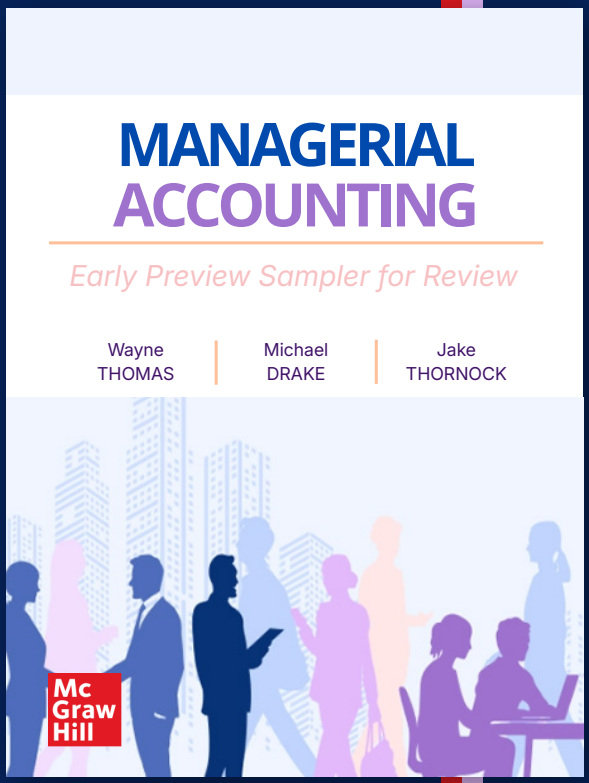
Managerial Accounting

Wayne Thomas
Michael Drake
Jake Thornock



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Dear Colleague,

Thank you for taking the time to consider our new book, *Managerial Accounting*. We take a fresh approach to the subject, with a text that is intentionally student-friendly, featuring streamlined explanations, bulleted key points, clear visuals, straightforward illustrations, and real-world perspectives that help today's students see the "big picture" and understand why managerial accounting matters.

Across all 12 chapters, students learn not only how to compute product and service costs, prepare budgets, and calculate variances, but more importantly, how managers use accounting information. The text emphasizes the importance for managers of understanding cost behavior, setting prices, comparing business alternatives, making constrained-resource decisions, and evaluating performance. Examples and decisions from both manufacturing and service environments are integrated throughout to give students a broad and modern view of managerial accounting.

In developing the text, assignments, and supplemental materials, we focused on what matters most for preparing students for their careers:

- developing real-world perspectives from a manager's point of view.
- fostering decision-making and analytical skills.
- helping students focus on critical concepts.
- using technology to enhance learning.

For example, in **Job Order Costing (Chapter 2)**, we emphasize the importance of understanding and assigning costs by showing how production costs flow in modern manufacturing and service environments. The mechanics are explicitly connected to operational decisions that managers actually make, and the chapter provides instructors with the flexibility to choose whether or not to emphasize debits and credits.

In **Cost-Volume-Profit Analysis (Chapter 5)**, we present CVP as a practical planning and decision-making tool. Students learn how managers use CVP relationships to assess profitability, evaluate strategic trade-offs, and conduct scenario analysis. This approach helps students see CVP not as a collection of formulas, but as a flexible framework for managerial planning and decision support.

In **Decision Analysis (Chapter 9**), we organize the chapter around five core managerial decisions common to both manufacturing and service companies. We integrate quantitative analysis with explicit discussion of qualitative factors that influence these decisions. Each major decision concludes with a Let's Review problem to reinforce application and professional judgment.

We are grateful for the opportunity to share our work. We hope these chapters give you a clear sense of our approach and why we believe this book offers a fresh, practice-oriented option for teaching managerial accounting. We welcome the opportunity to discuss the book further and invite you to contact any of us with questions or feedback.

Sincerely,

Wayne Thomas

Mike Drake

Jake Thornock

Watch a Video from the Authors

Wayne Thomas, Michael Drake and Jake Thornock

Managerial Accounting

2027 FIRST RELEASE

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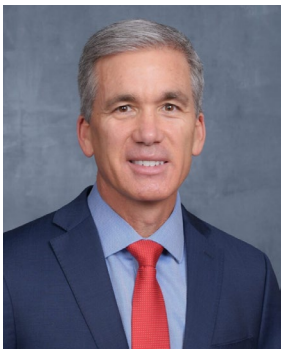
About the Authors

WAYNE THOMAS



Wayne Thomas is the David C. Steed Chair of Accounting at the University of Oklahoma, where he teaches introductory financial accounting, intermediate accounting, and MBAs. He received his bachelor's degree in accounting from Southwestern Oklahoma State University and his master's and PhD in accounting from Oklahoma State University.

Wayne has won numerous teaching awards at the department, college, university, state, and national levels, including being named the Outstanding Accounting Educator by the OSCPA and receiving the Cook Prize from the American Accounting Association for undergraduate teaching excellence. Along with Michael Drake and Jake Thornock, he is the co-author of McGraw Hill's *Financial Accounting for Managers*. He also co-authors McGraw Hill's best-selling *Intermediate Accounting*, with David Spiceland, Mark Nelson, and Jennifer Winchel, and *Financial Accounting*, with David Spiceland and Don Herrmann.

His primary research interests include accounting information in capital markets, techniques used by managers to manipulate earnings, the importance of financial disclosures, and financial statement analysis. He previously served as an editor of *The Accounting Review* and has published articles in a variety of journals, including *The Accounting Review*; *Journal of Accounting and Economics*; *Journal of Accounting Research*; *Review of Accounting Studies*; *Contemporary Accounting Research*; and *Accounting, Organizations and Society*. He has won several research awards, including the American Accounting Association's Competitive Manuscript Award and the University of Oklahoma's highest research award, being named a George Lynn Cross Research Professor.

Wayne is married to Julee, and they have four children and three grandchildren. He enjoys tennis, golf, biking, the outdoors, volunteer activities, and, most of all, spending time with his family.

MICHAEL DRAKE

Michael Drake is the K. Fred Skousen Professor of Accounting in the BYU Marriott School of Business at Brigham Young University. Before joining BYU, he was on faculty in the Fisher College of Business at The Ohio State University and a doctoral student in the Mays Business School at Texas A&M University, where he was a Deloitte Foundation Doctoral Fellow. Prior to his graduate work, he worked in public accounting at Arthur Andersen and Ernst & Young.

Michael teaches financial accounting and financial statement analysis at the undergraduate, graduate, and executive levels and has won several teaching awards, including the MBA Core Professor of the Year award in several consecutive years and the BYU Marriott School Teaching Excellence Award. Along with Wayne Thomas and Jake Thornock, he is the co-author of McGraw Hill's *Financial Accounting for Managers*.

Michael's primary research interest is in capital markets with a specific focus on the intermediaries and technologies that facilitate price formation. His research has been published in top academic journals, including the *Journal of Accounting and Economics*, *Journal of Accounting Research*, *The Accounting Review*, *Contemporary Accounting Research*, *Review of Accounting Studies*, and *Management Science*. He has won several awards at the academy, university, and college levels for his research, including multiple best paper awards and the BYU Young Scholar award. Michael currently serves on the editorial boards of *The Accounting Review*, *Contemporary Accounting Research*, and *Review of Accounting Studies*.

Michael is married to McKenzie, and they have five children, Gavin, Abbie, Quentin, Maxwell, and Hannah. He enjoys playing, coaching, and watching all sports.

JAKE THORNOCK

Jake Thornock is a professor of accounting in the BYU Marriott School of Business at Brigham Young University and holds the John and Nancy Hardy Chaired Professorship. He joined BYU from the University of Washington, where he was a tenured associate professor of accounting and the PwC Faculty Fellow. Jake completed his doctoral studies at Kenan-Flagler Business School at the University of North Carolina, where he was awarded the William Delozier Fellowship for Outstanding Doctoral Student. He earned his undergraduate and master's degrees in accounting at BYU.

Jake has diverse research interests, including interest in taxation, tax havens, earnings information content, and information technologies. His research has been accepted for publication at the *Journal of Accounting and Economics*, *Journal of Accounting Research*, *The Accounting Review*, *Contemporary Accounting Research*, *Review of Accounting Studies*, *Journal of Finance*, *Journal of Financial Economics*, and *Management Science*. Jake's research has been cited or featured in the *Wall Street Journal*, *New York Times*, *Bloomberg Businessweek*, *Fox News*, and *NPR*, and has been presented at the IRS, the SEC, and a congressional subcommittee. Jake currently serves as an editor at *Contemporary Accounting Research* and is on the editorial boards of *The Accounting Review* and *Journal of Accounting and Economics*. Along with Wayne Thomas and Jake Thornock, he is the co-author of McGraw Hill's *Financial Accounting for Managers*.

Jake has taught accounting at undergraduate and graduate levels. He has won several awards for teaching, mentoring, research, and innovation in the classroom. He also co-founded Accounting Coding Camp with Mike Drake and Josh Lee, which provides coding education to graduate students in accounting and finance.

Jake is married to Kerrie, and they have four children, Allie, Luke, Mia, and Josie. He enjoys audiobooks and college sports and is an ardent fly fisherman.

Focused on Student Success

THE THOMAS/SPICELAND ACCOUNTING SERIES

The Thomas/Spiceland Accounting Series includes

- *Financial Accounting*
- *Financial Accounting for Managers*
- *Intermediate Accounting*
- *Managerial Accounting* (Available Fall 2026)
- *Financial and Managerial Accounting for Managers* (Available in 2027)

Financial Accounting, *Financial Accounting for Managers*, and *Intermediate Accounting* are market leaders, with a proven record of engaging students with real-world perspectives, providing a wide array of resources for mastering accounting concepts, incorporating the latest technology, and equipping instructors with the variety of tools they need to design their unique courses.

Managerial Accounting, authored by award-winning educators Wayne Thomas, Mike Drake, and Jake Thornock, is an exciting addition to the Thomas/Spiceland *Accounting Series*. Building on the series' proven approach, it offers instructors flexible, real-world, technology-driven content to meet the needs of today's business students. The text engages students with contemporary companies, real-world perspectives, and robust analytical tools to help students connect accounting topics to managerial decisions.

Students will not only learn to compute product and service costs, prepare budgets, and calculate variances, but, more importantly, they will see how managers use accounting information to understand cost behavior, set prices, compare alternatives, make constrained-resource decisions, and evaluate performance for both manufacturing and service companies.

The Thomas/Spiceland Accounting Series is fully integrated with McGraw Hill Connect™, an educational platform that seamlessly combines superior content with enhanced digital resources in the way students learn best. By engaging with the text and supplemental resources, students will come to view managerial accounting as a vital information tool for making better business decisions, regardless of their major or intended career path.

A Flexible Approach

We recognize instructors have a wide variety of choices for topical coverage depending on their own preferences, course objectives, student mix, and length of the course. Because of this, instructors need flexibility in how much material to include in the course. *Managerial Accounting* by Thomas, Drake, and Thornock has been designed to provide this flexibility. For example:

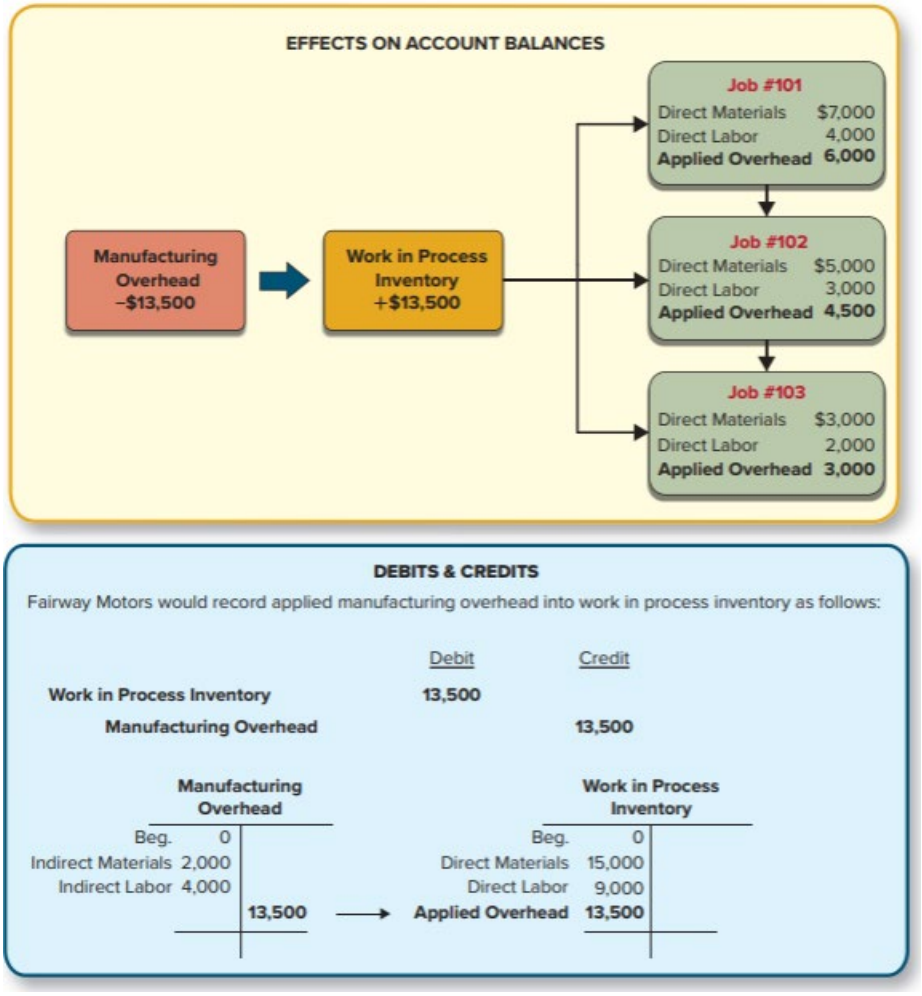
- Each chapter is designed to include fundamental topics in Parts A and B.
- For those instructors desiring expanded coverage of certain topics, some chapters contain Part C or Appendices.
- All end-of-chapter assignments are organized by Parts to simplify course development.
- All 12 chapters emphasize how managerial accounting supports managers' decision making across a wide range of companies, including manufacturing, retail, and service organizations. Real-World Perspective boxes and discussions are integrated throughout to engage students and highlight the practical importance of these concepts in today's business environment.
- All chapters include a variety of assignments and Real-World Perspectives Cases to meet different course needs.

Chapter	Fundamental Parts	Expanded Parts
1. A Framework for Managerial Accounting	A, B	C, App
2. Job Order Costing	A, B	C
3. Process Costing	A, B	App
4. Activity-Based Costing	A, B	App
5. Cost-Volume-Profit (CVP) Analysis	A, B	C, App
6. The Budgeting Process	A, B	C
7. Flexible Budgets and Performance Analysis	A, B	C, App
8. Standard Costing and Variance Analysis	A, B	App
9. Decision Analysis	A, B	C
10. Capital Investment Analysis	A, B	App
11. Statement of Cash Flows	A, B	App
12. Financial Statement Analysis	A, B	C, App

DEBITS AND CREDITS?

Instructors also differ in whether to emphasize or de-emphasize debits and credits in the course. The entire book and its assignment material have been written to accommodate both approaches.

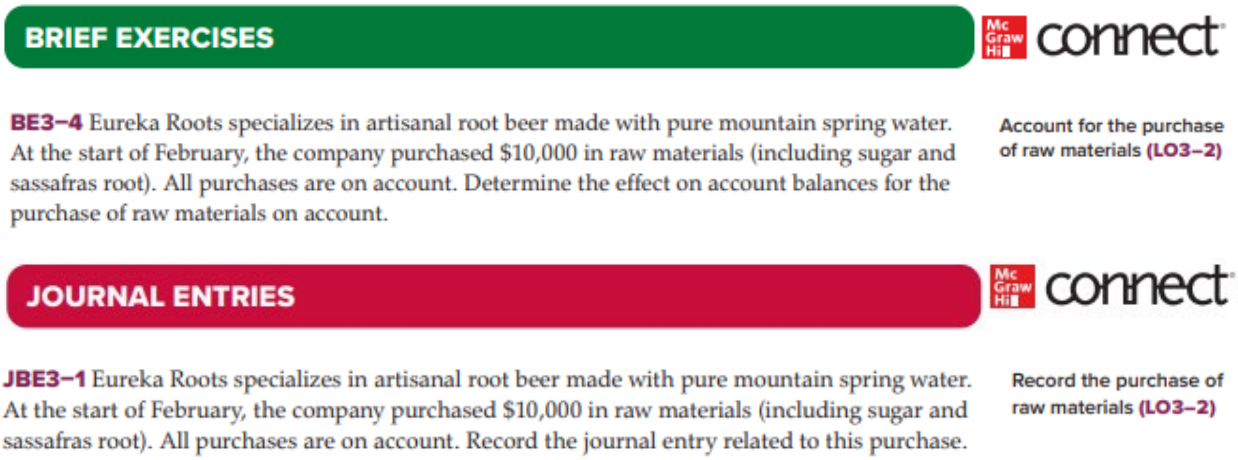
All transactions are first presented in the book showing their financial statement effects. Then, a separate call-out box, titled "DEBITS & CREDITS," shows related journal entries and T-accounts.



- Instructors **not covering** debits and credits can skip these call-out boxes.
- Instructors **covering** debits and credits can utilize these call-out boxes.

Additionally, all end-of-chapter assignment materials are available for both approaches by separating versions that use journal entries from those that do not. Assignments within the Brief Exercises, Exercises, and Problems ask students to **determine the financial**

statement effects, while corresponding Journal Entries sections ask students to **record the transactions** using debits and credits. These corresponding assignments are cross referenced to make them easy to find.



BRIEF EXERCISES connect

BE3–4 Eureka Roots specializes in artisanal root beer made with pure mountain spring water. At the start of February, the company purchased $10,000 in raw materials (including sugar and sassafras root). All purchases are on account. Determine the effect on account balances for the purchase of raw materials on account.

Account for the purchase of raw materials **(LO3–2)**

JOURNAL ENTRIES connect

JBE3–1 Eureka Roots specializes in artisanal root beer made with pure mountain spring water. At the start of February, the company purchased $10,000 in raw materials (including sugar and sassafras root). All purchases are on account. Record the journal entry related to this purchase.

Record the purchase of raw materials **(LO3–2)**

CASE-BASED INSTRUCTION

Managerial Accounting offers a robust array of Brief Exercises, Exercises, and Problems to cover each chapter's topics. In addition, many instructors want to add cases, offering important real-world applications, to their in-class curriculum or take-home activities. *Managerial Accounting* offers cases in its "Real-World Perspectives Cases" sections and dozens of Excel and Data Analytics assignments online, with each one auto-gradable in Connect, allowing additional decision-making practice for students and ease of grading for instructors. Our goal is to provide instructors with flexibility in the coursework they choose for their classes, ranging from knowledge-building assignments to real-world perspectives cases.

Case Type	Case Description
Decision Analysis	Use cost data to compare alternatives and recommend an action.
Conceptual Understanding	Build core concepts by emphasizing intuition and avoiding common pitfalls.
Interpreting Management Reports	Learn how to read and prepare internal reports to guide managers' next steps.
Ethical Dilemma	Address ethical issues that managers face in their decisions.
Great Adventures	Follow a single company through all chapters, adding topics as the story unfolds.
Integrated Excel (Connect-only)	Learn the topical content while also developing Excel skills.
AI and Data Analytics (Connect-only)	Connect the chapter's content with AI and data analytics tools, including visualization and dashboards.

Creating Future Business Leaders

Managerial Accounting combines years of author experience talking with business leaders, managers, and fellow accounting instructors across the country to ensure the book and its supplemental materials are consistent with what's being practiced in the business world and presented in such a way to help students be ready for business success. In keeping with this feedback, the authors have focused their approach on four key areas:

- Developing real-world perspectives and career-ready students.
- Fostering decision-making and analysis skills.
- Helping students focus on critical concepts.
- Using technology to enhance learning.

Developing Real-World Perspectives & Career-Ready Students

The authors know that students are most engaged when they see real-world examples that are applicable to their lives and future careers. Each chapter is introduced using real companies in the chapter's opening **Feature Story**. Throughout the chapter, students are exposed to a variety of real-world companies and how they approach the accounting issue at hand. Instructors can assign **Real-World Perspectives Cases** related to **Decision Analysis, Conceptual Understanding, Interpreting Management Reports, Ethical Dilemmas,** and the **Great Adventures Trail Mix Continuing Problem**. *Managerial Accounting* offers auto-graded cases in Connect, allowing additional decision-making practice for students and ease of grading for instructors.

Fostering Decision-Making and Analysis Skills

Companies today cite decision-making and analysis skills as top desired skills among recent graduates. Students are given opportunities to see real business decision-making practices in each chapter. Instructors can help students build their Excel and data visualization skills using a wide variety of **Data Analytics** and **Integrated Excel** assignments that are auto-gradable in Connect. Finally, the **Great Adventures Trail Mix Continuing Problem** progresses from chapter to chapter, encompassing the accounting issues of each new chapter as the story unfolds.

Helping Students Focus on Critical Concepts

Students check their understanding along the way by using **Key Points** within each Learning Objective and in-chapter **Let's Review** problems of the chapter's primary topics. These items prepare students to successfully complete the assigned end-of-chapter materials. Many Let's Review problems are complemented by videos. The **Common Mistakes** feature is a student favorite, helping them avoid mistakes that regularly trip up both learners and professionals.

Using Technology to Enhance Learning

Today's students are comfortable online and seek out videos to aid their learning. *Managerial Accounting* reinforces students' conceptual understanding with videos such as **Let's Review**, **Interactive Illustrations**, **Concept Overview**, and **Applying Excel**. Select end-of-chapter exercises are supplemented with **Guided Example Hint videos** and additional online resources like adaptive-learning **SmartBook with AI Reader** and **Application-Based Activities**.

Helping Students Focus on Critical Concepts

Critical Concepts—Chapter 1 introduces the primary functions of managerial accounting and the importance of tracking and classifying costs. Chapters 2 and 3 build on this foundation by explaining job order costing and process costing systems. Chapter 4 extends the discussion of overhead by introducing departmental and activity-based overhead approaches. With a solid understanding of cost measurement, Chapter 5 introduces cost-volume-profit analysis, showing students how profits respond to changes in volume and sales mix and highlighting the need for effective planning. Chapter 6 then formalizes the plans through the development of budgets, and Chapters 7 and 8 use flexible budgets and variance analysis to compare actual results to expectations and explain performance gaps. Equipped with these tools, in Chapters 9 and 10 students move on to managerial decision making related to short-term operations, long-term business strategies, and methods of analyzing capital investments. The text concludes by linking internal decision making to external reporting in Chapter 11, which covers the statement of cash flows, and financial statement analysis in Chapter 12.

Let's Review sections within each chapter test students' comprehension of key concepts. These short review exercises, with solutions, are intended to reinforce understanding of specific chapter material and allow students to apply concepts and procedures learned in the chapter prior to attempting their homework assignment. **Let's Review Videos** show students how to solve select exercises and model that approach for related homework.

Let's Review

The Roasting Department at Cascade Coffee Co. began the month of April with 800 units in beginning Work in Process (WIP) inventory. During the month, the department started production on 12,200 additional units. By the end of April, 11,500 units were completed and transferred to the Packaging Department. The remaining units in ending WIP inventory were estimated to be 100% complete with respect to direct materials and 40% complete with respect to conversion costs.

Common Mistakes made by students and professionals are highlighted throughout each of the chapters. With greater awareness of the potential pitfalls, students can avoid making the same mistakes and gain a deeper understanding of the chapter material.

COMMON MISTAKE

A common mistake when preparing the cost schedule is to omit the costs in beginning inventory and include only the costs added during the current period. This leads to an understated total cost of production and throws off the cost per equivalent unit in Step 4.

Key Points provide quick synopses of the critical pieces of information presented throughout each chapter.

KEY POINT

The total fixed overhead cost variance can be separated into its budget and volume components. A fixed overhead *budget* variance occurs when actual fixed overhead costs differ from the budgeted fixed overhead costs. A fixed overhead *volume* variance occurs when the budgeted fixed overhead costs differ from total fixed cost applied during production.

Alternative Names provide students with a set of synonyms for common terms used in accounting.

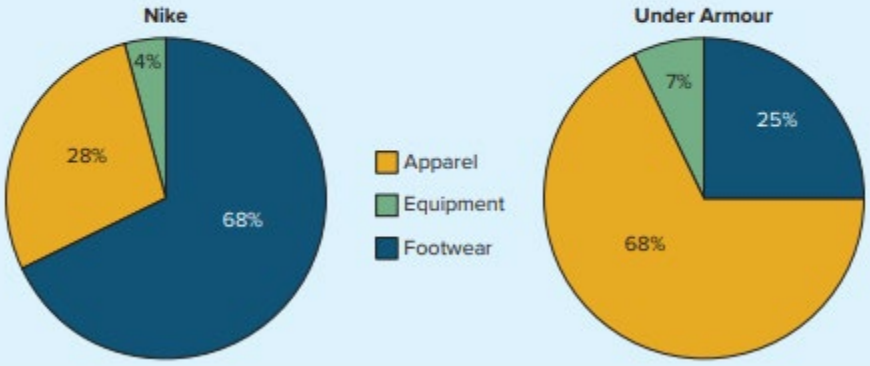
Developing Real-World Perspectives & Career-Ready Students

Students retain more information when they see how concepts are applied in the real world. Each chapter begins with a **Feature Story** that highlights real companies and offers business insights related to the material in the chapter. As the chapter's topics are being presented, references to the companies in the Feature Story and other related companies help keep topics relevant. The authors understand that students are best engaged when the discussion involves companies that students find interesting and whose products or services are familiar, such as **The Hershey Company, FedEx, Rivian, Goodyear, and Vail Resorts**. In Chapter 12, full financial statement analysis is provided for **Nike** and **Deckers Outdoor**.

Real-World Perspectives illustrations are used throughout each chapter. These illustrations offer engaging insights into chapter topics. The intent is to continually reinforce to students that the topics they are studying relate to real companies and real decisions. These illustrations include real-world discussion such as differences in contribution margin across real companies, the balanced scorecard approach at **Apple**, executive compensation at **Vail Resorts**, efforts to reduce variable costs at **Amazon**, sales mix for **Netflix**, and many other real-company comparisons, analyses, and perspectives.

Real-World Perspectives

Nike and **Under Armour** are competitors but have very different sales mixes, as disclosed in their annual reports. Nike focuses more on footwear, while Under Armour focuses more on apparel.



Real-World Perspectives

Netflix is a prime example of a company that has successfully re-prioritized its mix of products and services over time. Initially launched as a DVD rental service by mail in 1998, Netflix shipped its first DVD, *Beetlejuice*, on March 10, 1998, and went on to ship over 5.2 billion DVDs. Recognizing the potential of online streaming, Netflix introduced streaming as a second product in 2007. After that, the company began to slowly phase out its DVD service. The final DVD was shipped on September 29, 2023.

To further enhance its offerings, Netflix began developing its own original content in 2011, starting with *House of Cards*, *Orange Is the New Black*, and a new season of *Arrested Development*. This strategic shift not only diversified its content library but also allowed Netflix to differentiate itself from competitors, creating a unique value proposition that has significantly contributed to its success in the highly competitive entertainment industry.

https://about.netflix.com/en/news/netflix-dvd-the-final-season

The **Real-World Perspectives** problems at the end of each chapter offer cases and activities that ask students to apply the knowledge and skills they've learned to actual, real-world situations. Students are placed in the role of decision maker, presented with a set of information, and asked to draw conclusions that test their understanding of the issues discussed in the chapters. All cases and activities are auto-gradable, meaning that McGraw Hill Connect will automatically grade each case. Chapters contain: Decision Analysis, Conceptual Understanding, Interpreting Management Reports, Ethical Dilemma, and Great Adventures Trail Mix Continuing cases, as well as Integrated Excel and Data Analytics cases that are available online.

REAL-WORLD PERSPECTIVES

LO4–1, LO4–2, LO4–3

Decision Analysis

RWP4–1 Lumina33 manufactures high-end hair tools with interchangeable attachments for drying, curling, smoothing, and volumizing hair. The company has two primary product lines: VoluWave Pro and SmoothLite Ultra. The company is evaluating how three different overhead allocation methods—company-wide, departmental, and activity-based—affect product costs. Lumina33 estimates it will have $600,000 in total overhead costs and produce 4,000 total tools during the first quarter of the year.

The company operates two primary manufacturing departments:

Department	Estimated Overhead	Cost Driver	Estimated Cost Driver Units
Component Molding	$360,000	Machine hours (MH)	6,000 MH
Final Assembly	240,000	Direct labor hours (DLH)	2,000 DLH
	$600,000		

Fostering Decision-Making and Analysis Skills

Data Analytics assignments are provided with each chapter. Instructors can visit Connect to find a variety of auto-graded Data Analytics questions that introduce students to seeing data presented in the types of visual formats they'll see in today's business environments. These exercises have been thoughtfully developed and scaffolded to build data analytics exposure and skills. Assignable, auto-gradable materials include:

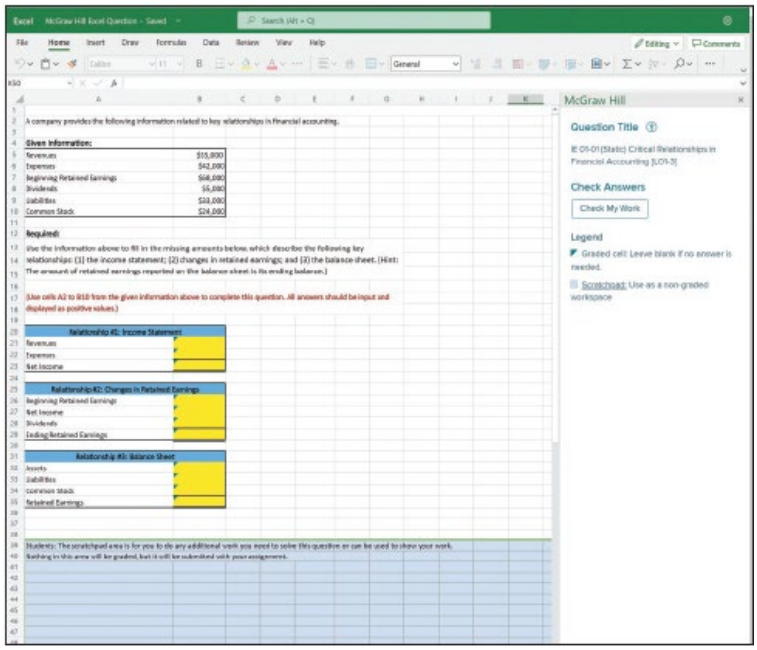
- **Data Visualizations**—Familiarize students with data visualizations. Students interpret data in a static visual to answer accounting questions.
- **Tableau Dashboard Activities**—Easily introduce students to Tableau. Students learn to gather the information they need from a live embedded Tableau dashboard—no prior knowledge of Tableau needed.
- **Applying Tableau and Applying Power BI Cases**—Build students' data analytics skills. Students download an Excel file and build a Tableau dashboard or a Power BI visualization with video tutorial guidance. Once they've completed their work in Tableau or Power BI, they'll use it to answer auto-graded questions in Connect.

AI Cases are auto-gradable Connect assignments that focus on using AI as an additional accounting tool to help instructors reinforce topics. These assignments promote critical thinking and analysis of AI output.

The Great Adventures Trail Mix Continuing Problem progresses from chapter to chapter, encompassing the accounting issues of each new chapter as the story unfolds. These problems allow students to see how each chapter's topics can be integrated into the operations of a single company. Great Adventures Trail Mix problems are also available in McGraw Hill Connect.

Excel activities and exercises foster career readiness by offering students hands-on training in multiple ways:

- **Integrated Excel** assignments pair the power of Microsoft Excel with the power of Connect. A seamless integration of Excel within Connect, Integrated Excel questions allow students to work in live, auto-graded Excel spreadsheets— no additional logins, no need to upload or download files. Instructors can choose to grade by formula or solution value, and students receive instant cell-level feedback via integrated Check My Work functionality.
- **Applying Excel** features in each chapter help build students' Excel skills, showing them how Excel can be used to make efficient calculations and analysis. Applying Excel video solutions housed in Connect complement the feature, allowing students to view the power of Excel to analyze business scenarios.



Microsoft Corporation

Using Technology to Enhance Learning

Connect and *Managerial Accounting* are tightly integrated to continue honing students' conceptual understanding, problem-solving, decision-making, and analysis skills.

All end-of-chapter items in the textbook are built in the Connect platform. These items include feedback and explanations and many with **Hints/Guided Example Videos** to help students work through their homework in an effective manner. In addition, **SmartBook with AI Reader** promotes active reading and helps students better understand course material. Aligned with your course content, Al Reader enables students to highlight words or sections and view simplified explanations and quiz themselves.

ASSESSMENT & PRACTICE: END-OF-CHAPTER AND TEST BANK

Algorithmic Content & End-of-Chapter Assignments

A large set of algorithmic problems have been included, allowing more opportunities for students to demonstrate their understanding.

Extensive end-of-chapter assignments are available in the text and Connect: A large set of algorithmic problems have been included, allowing more opportunities for students to demonstrate their understanding.

Extensive end-of-chapter assignments are available in the text and Connect:

- Real-World Perspectives
    - Decision Analysis cases
    - Conceptual Understanding cases
    - Ethical Dilemma cases
    - Great Adventures Trail Mix continuing cases
- Brief Exercises
- Exercises
- Problems

- AI, Data Analytics, and Excel cases (available online)

Concept Overview Videos

Concept Overview Videos provide engaging narratives of chapter learning objectives in an assignable, interactive online format. These videos follow the structure of the text and match specific learning objectives within each chapter of *Managerial Accounting*. Concept Overview Videos provide additional explanation and enhancement of material from the text chapter, allowing students to learn, study, and practice at their own pace. Assignable assessment questions paired with the videos help students test their knowledge, ensuring that they are retaining concepts.

Hints/Guided Example Videos

Hint/Guided Example videos are narrated, animated, and step-by-step walkthroughs of algorithmic versions of select exercises in Connect. Presented to the student as hints, Guided Examples provide just-in-time feedback, focused on the areas where students need the most guidance.

Interactive Illustration Videos

Interactive Illustrations provide video-based explanations of key illustrations in the chapter. These videos transform a static illustration in the text into a dynamic, step-by-step walk-through of the illustration, deepening students' understanding of the concepts or the calculations shown.

Let's Review Videos

Let's Review videos relate to the Let's Review sections in the text, showing students how to solve certain exercises. In walking students through a particular scenario or question, these videos model how students can approach problem solving.

Test Builder in Connect

Available within McGraw Hill Connect®, Test Builder is a cloud-based tool that enables instructors to format tests that can be printed or administered within a Learning Management System, or exported as a Word document. Test Builder offers a modern, streamlined interface for easy content configuration that matches course needs, without requiring a download.

Test Builder allows you to:

- Access all test bank content from a particular title.
- Easily pinpoint the most relevant content through robust filtering options.
- Manipulate the order of questions or scramble questions and/or answers.
- Pin questions to a specific location within a test.
- Determine your preferred treatment of algorithmic questions.
- Choose the layout and spacing.
- Add instructions and configure default settings.

Test Builder provides a secure interface for better protection of content and allows for just-in-time updates to flow directly into assessments.

Remote Proctoring & Browser-Locking Capabilities

Remote proctoring and browser-locking capabilities, hosted by Proctorio within Connect, provide control of the assessment environment by enabling security options and verifying the identity of the student.

Seamlessly integrated within Connect, these services allow instructors to control students' assessment experience by verifying identification, restricting browser activity, and monitoring student actions.

Instant and detailed reporting gives instructors an at-a-glance view of potential academic integrity concerns, thereby avoiding personal bias and supporting evidence-based claims.

ReadAnywhere® App

Read or study when it's convenient with McGraw Hill's free ReadAnywhere® app. Available for iOS and Android smartphones or tablets, it gives users access to McGraw Hill tools including the eBook and SmartBook® or Adaptive Learning Assignments in McGraw Hill Connect®. Students can take notes, highlight, and complete assignments offline—all their work will sync when connected to Wi-Fi. Students log in with their Connect username and password to start learning—anytime, anywhere!

Evergreen

Content and technology are ever-changing, and it is important that you can keep your course up to date with the latest information and assessments. That's why we want to deliver the most current and relevant content for your course, hassle-free.

Managerial Accounting uses an Evergreen delivery model, which means it has content, tools, and technology that is updated and relevant, with updates delivered directly to your existing McGraw Hill Connect® course. Engage students and freshen up assignments with up-to-date coverage of select topics and assessments, all without having to switch editions or build a new course.

Brief Table of Contents

CHAPTER TWO

2 Job Order Costing

Learning Objectives

PART A: JOB ORDER COSTING IN A MANUFACTURING COMPANY

- **LO2–1** Define the basic principles of job order costing.
- **LO2–2** Account for direct and indirect raw materials.
- **LO2–3** Account for direct and indirect labor.
- **LO2–4** Account for actual and applied manufacturing overhead.
- **LO2–5** Calculate the cost of finished goods and cost of goods sold.

PART B: FINANCIAL REPORTING OF JOB ORDER COSTS

- **LO2–6** Determine the impact of underapplied and overapplied manufacturing overhead on cost of goods sold.
- **LO2–7** Analyze the financial reporting of job order costs.

PART C: JOB ORDER COSTING IN A SERVICE COMPANY

- **LO2–8** Understand job order costing for a service company.

Self-Study Materials

Edwin Tan/E+/Getty Images

Feature Story

Club Car, LLC

Founded in 1958, Club Car has been a cornerstone of American manufacturing for over six decades. The company has grown from a niche golf cart producer into a leader in the market for small-wheel electric and gas-powered vehicles. Located in the iconic city of Augusta, Georgia—home of the Masters golf tournament—the company built its reputation on a foundation of quality and innovation.

Club Car's dedication to quality and performance is reflected in its meticulous design, fabrication, and assembly processes. This commitment to excellence has earned the company recognition as one of America's Safest Companies by *EHS Today*. Enthusiasts also collect some of the early models, with some Club Car golf carts remaining in service decades later—a testament to their enduring manufacturing quality.

The company's commitment to innovation has led to multiple innovative strategic choices. In the 1980s, the company introduced the durable, easy-to-maintain, and highly popular Club Car DS, which quickly became the flagship vehicle, making Club Car an internationally recognized name. Beyond its core market in golf carts, Club Car also recognized a burgeoning trend: the demand for utility vehicles to support personal and commercial transportation. In the 2000s, the company identified a growing demand for street-legal, low-speed vehicles, which expanded its market beyond golf courses. Most recently, the company has been at the forefront of the environmental movement, making a strategic shift towards electric vehicle technology.

Throughout its history, Club Car has remained committed to manufacturing quality one job at a time, with high-quality raw materials, fabrication and assembly, and reliability long after the cart is sold. Club Car is poised to navigate the course forward, ensuring a smooth ride for generations to come.

Sources: https://www.clubcar.com/en-us/our-company/history
https://www.clubcar.com/en-us/our-company/about-us

JOB ORDER COSTING IN A MANUFACTURING COMPANY

PART A

One of the best ways to improve profitability is to manage costs. For a manufacturing company, those costs are best understood by tracking them throughout the manufacturing process. The concept of tracking costs throughout the manufacturing process using inventory accounts was introduced in Chapter 1. By understanding and managing costs, managers can benefit their company in many ways, as summarized in Illustration 2–1.

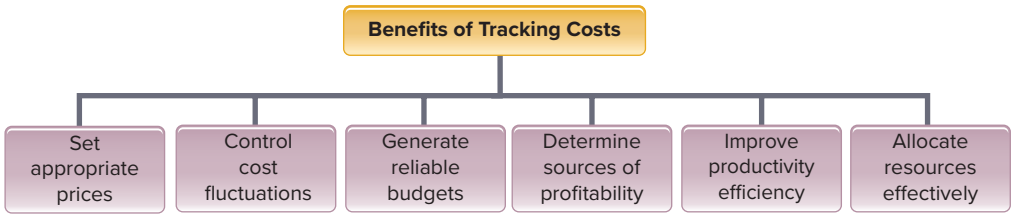


ILLUSTRATION 2–1
Benefits of Tracking Costs

So how do we track costs? We use a system.

A **product costing system** (also known as a *cost accounting system*) is used to account for an organization's product costs and to provide timely and accurate unit cost information for pricing, cost planning and control, inventory valuation, and financial statement preparation. A product costing system

- Enables managers to measure and recognize costs throughout the manufacturing process and
- Provides a measurement and recognition structure for matching costs to their related revenues from sales of products or services.

● **LO2–1**
Define the basic principles of job order costing.

Job Order Costing

A **job order costing system** is a cost accounting system used to track costs *by individual jobs.* This system is particularly useful for companies that make unique or special-order products, such as custom designer dresses, tailored network systems, or custom construction projects. For example, **Ringbrothers** https://www.ringbrothers.com/ makes some of the most iconic custom cars, including customized vintage Mustangs and Chevelles. The company can use a job order costing system to track the costs of each custom car (a "job"), from start to finish. By tracking orders on a job-by-job basis, a job order costing system can provide all of the benefits listed in Illustration 2–1 above.

Image Source Limited/Alamy Images

We'll refer to a custom job or batch of products as a **job order**. A job order contains a specific number of specially designed, made-to-order products.

A job order costing system would not likely be used for companies that process large quantities of similar products on a continuous basis. For example, **Kimberly-Clark** needs to track costs for its hygiene products like Kleenex tissues, which are designed for large-scale, continuous production. Costs for these types of standardized products are typically tracked using a **process costing system**, which is discussed in Chapter 3.

Illustration 2–2 summarizes the general characteristics of job order costing.

Radomir Rezny/Alamy Images

ILLUSTRATION 2–2
Characteristics of Job Order Costing System

	Job Order Costing System
Product type	• Unique products
Manufacturing process	• Custom-ordered
Order quantity	• Lower volume
Cost tracking	• By job

KEY POINT

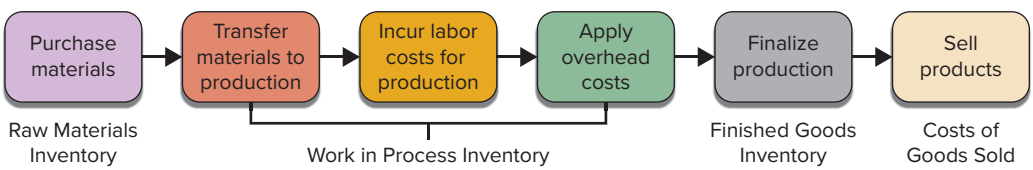
A job order costing system is a management accounting system used to track manufacturing costs *by individual jobs*. This system is particularly useful for companies that make unique or special-order products.

Manufacturing Process and Cost Tracking

The fundamental objectives of a job order costing system are to measure and to communicate manufacturing costs to managers and other key decision makers. We'll focus on a job order costing system for a manufacturing company for now, but we'll discuss cost tracking for service companies later in the chapter.

A job order costing system tracks costs for the entire manufacturing process, beginning to end. This means that the system tracks costs from the very beginning, when materials are purchased, to the very end, when shiny new products are completed and sold. Illustration 2–3 summarizes the steps of the manufacturing process and the accounts used to track costs.

ILLUSTRATION 2–3
Manufacturing Process and Cost Tracking



Notice that we start production with the purchase of raw materials inventory. We then transfer those materials into production. These materials, along with labor and overhead needed for production, are tracked as work in process inventory. Once production is complete, the products are transferred to finished goods inventory and then ultimately sold to customers. The inventory accounts used to track costs through production are summarized:

- **Raw Materials Inventory** includes the cost of unused materials that have been purchased but not yet placed in the manufacturing process.
- **Work in Process Inventory** includes the costs that have been assigned to partially completed products. These include costs of direct materials, direct labor, and applied overhead (which covers indirect materials, indirect labor, and other related costs).
- **Finished Goods Inventory** includes the costs assigned to completed products that have not been sold.
- **Cost of Goods Sold** includes the costs of finished products that were sold during the period.

Job Cost Sheet

In a job order costing system, each job in production needs to be tracked. We track the costs associated with each job using a job cost sheet. A **job cost sheet** is a record of all production costs for a particular job order—a completed unit. While the term "sheet" might imply the system is paper-based, in today's digital business environment, these records are nearly always kept electronically.

A manufacturer's job cost sheet tracks the cost of manufacturing by including the following information:

- Job number (or other identification)
- Start and completion dates
- Costs of direct materials
- Costs of direct labor
- Applied overhead costs
- Total job costs

The job cost sheet may include additional information needed for tracking costs, including relevant dates, customer information, special requirements for the job, or other important notes about the job production. The job cost sheet is filled out as the job makes its way through the manufacturing process.

As an example, let's examine a job cost sheet in Illustration 2–4 for GT Guitars, a hypothetical company that makes custom electric guitars in Eureka, California. The typical job cost sheet includes customer information, job information, and cost information.

ILLUSTRATION 2–4
Job Cost Sheet

Job cost sheet
GT Guitars

Customer Information	
Name:	Stevie Ray
Address:	Austin, TX
Phone:	555-555-5555

Job Information	
Job:	#G421
Date:	April 1

Cost description:	Amount:
Direct materials	
Direct labor	
Applied overhead	
Total manufacturing cost	
Units	
Cost per unit	

KEY POINT

In a job order costing system, we track the cost of direct materials, direct labor, and overhead through the various stages of production through to the sale to customers. To do this, we use the following accounts: Raw Materials Inventory, Work in Process Inventory, Finished Goods Inventory, and Cost of Goods Sold. Costs are tracked for each job using a job cost sheet.

Real-World Perspective

Kimberly Clark discusses how it uses cost management to improve profits in a recent annual report:

Although input costs remain high, in 2023, we will remain committed to sustaining margin improvements through a combination of top line growth and cost discipline.

We continue to drive cost optimization through our FORCE (Focused On Reducing Costs Everywhere) program, which achieved savings of $290 million in 2022 through strategic procurement and operational efficiency.

COMMON MISTAKE

A frequent mistake students make in job order costing is failing to track and allocate all relevant costs to the correct jobs. This often involves overlooking indirect costs, such as overhead, or misallocating expenses to the wrong job. Such errors can lead to inaccurate job cost sheets and potentially lead to distorted profits.

Direct and Indirect Raw Materials

● LO2–2
Account for direct and indirect raw materials.

Let's use an example to understand a job order costing system and how costs are tracked throughout production. We'll examine the steps in job order costing for Fairway Motors, a hypothetical company similar to **Club Car**, which builds both customized and general-purpose golf carts.

For the current period, suppose Fairway Motors had the following beginning balances in each inventory account:

- Raw Materials Inventory: $4,000
- Work in Process Inventory: $0
- Finished Goods Inventory: $0

During the period, the company custom designed three golf carts. Each cart includes a variety of alternative options from frame size, seat material, motor power, electronics, and paint style. The Model XLE offers the most customized features and is the most expensive, the Model XL is the option with standard features and price, while the Model X is the simplest and least expensive.

Job #101: Model XLE golf cart

Job #102: Model XL golf cart

Job #103: Model X golf cart

Transactions during the manufacturing process related to the production of these carts are listed in Illustration 2–5.

The production process begins with a request for raw materials that are needed for production. If these materials are not currently on hand, they must be purchased from an outside vendor. When the new materials arrive, the materials are placed in the raw materials storage area and recorded as part of the Raw Materials Inventory account. For tracking costs, we distinguish between two types of raw materials:

- **Direct materials** include the costs of materials that can be easily traced to a specific job (such as cart frames, wheels, seats, windshields, motors, and rechargeable batteries). As direct materials are assigned to jobs, their costs are included in the Work in Process Inventory account.
- **Indirect materials** include the costs of materials needed for production, but those costs are not easily traceable to specific jobs. As indirect materials costs are assigned to production, they are included in the Manufacturing Overhead account.

Transaction	Description
1. Purchase raw materials	Purchase materials for $18,000 on account. The purchase includes direct materials for $14,000 (such as frames, wheels, and windshields) and indirect materials for $4,000 (such as paint, silicone, machine lubricant, and screws).
2. Transfer materials to production	Transfer $15,000 of direct materials and $2,000 of indirect materials to production.
3. Incur labor costs for production	Incur $9,000 of direct labor and $4,000 of indirect labor for production.
4. Account for overhead costs	(a) Apply overhead of $13,500 to production. This amount equals an applied rate of 150% of direct labor costs.
	(b) Record actual overhead costs for depreciation ($4,000), utilities ($2,500), and insurance coverage ($1,500).
5. Finalize production	Job #102 and Job #103 are completed. The completed carts are transferred to the finished goods storage area.
6. Sell products	The golf cart completed in Job #103 is sold to a customer for $12,000 on account.

ILLUSTRATION 2–5

Manufacturing Process Related to Job #101, Job #102, and Job #103.

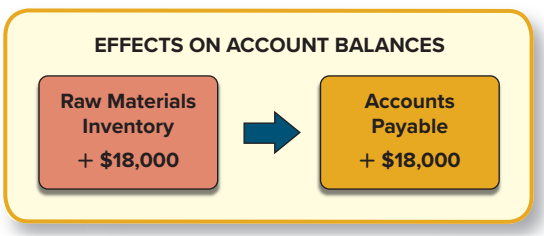
TRANSACTION (1): PURCHASE MATERIALS

Suppose Fairway Motors purchases materials for $18,000 on account. A purchase invoice indicates that the purchase included direct materials for $14,000 (such as frames, wheels, and windshields) and indirect materials for $4,000 (such as paint, silicone, and machine lubricant). As indicated in Illustration 2–6 for transaction (1):

- The costs of both direct and indirect materials are initially assigned to the Raw Materials Inventory account.
- We also record Accounts Payable because the purchase was on account (otherwise, we record cash paid).

ILLUSTRATION 2–6

Transaction (1): Purchase Direct and Indirect Materials.



DEBITS & CREDITS

Fairway Motors would record the purchase of direct and indirect materials on account as follows:

	Debit	Credit
Raw Materials Inventory	**18,000**	
Acccounts Payable		**18,000**

Raw Materials Inventory		Accounts Payable	
Beg. 4,000			0
18,000			**18,000**
End. 22,000			

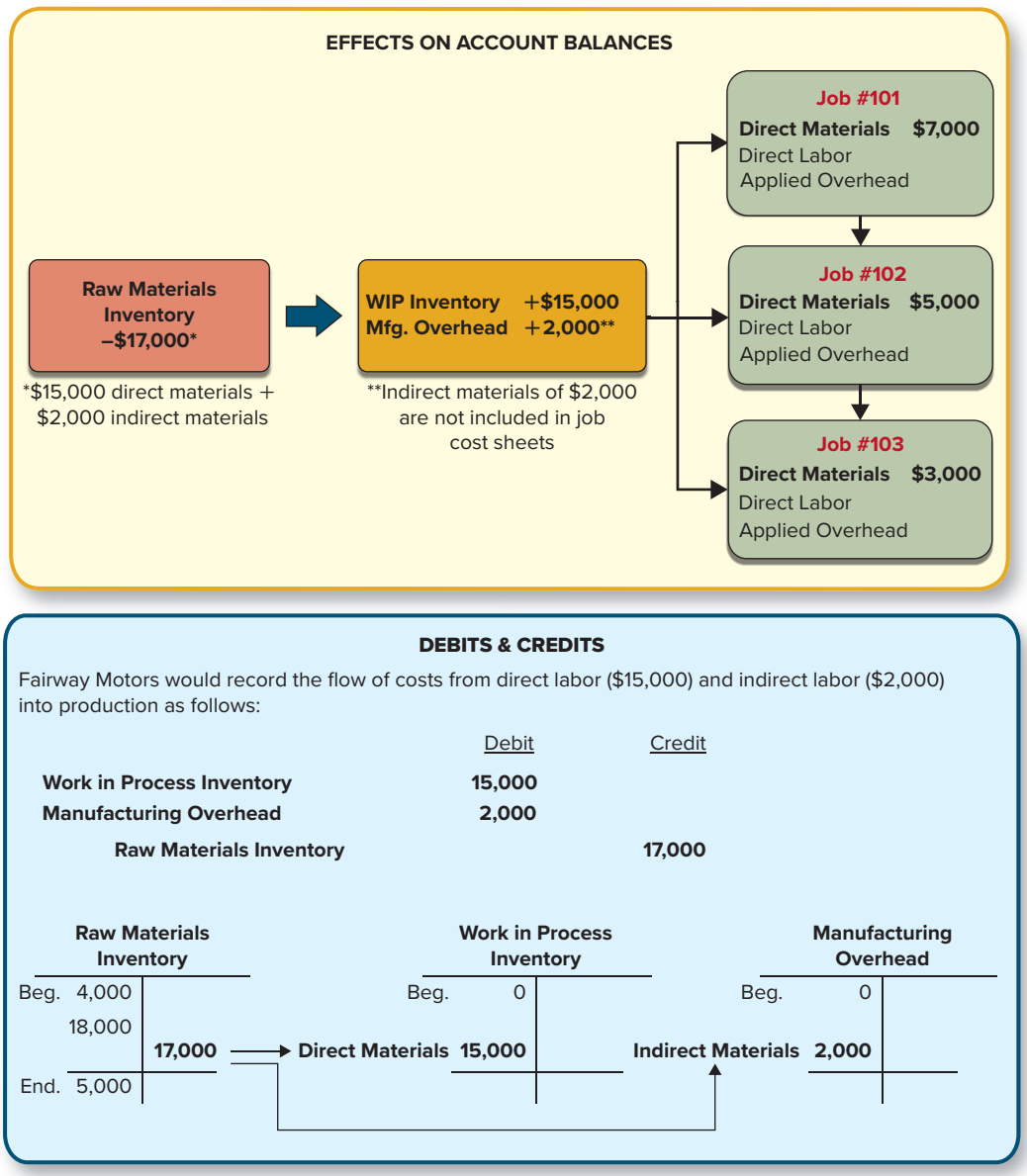
TRANSACTION (2): TRANSFER MATERIALS INTO PRODUCTION

Once the raw materials are in place, production can begin. At that point, raw materials are requisitioned from the raw materials storage area to the manufacturing area. To provide cost management, we need to track the transfer of these raw materials.

Suppose Fairway Motors transfers $15,000 of direct materials and $2,000 of indirect materials to production. As indicated in Illustration 2–7 for transaction (2):

- *Direct materials* costs are transferred from the Raw Materials Inventory account to the Work in Process Inventory account.
  - We also allocate the cost of direct materials to each job in the job cost sheet. Direct materials included $7,000 for Job #101, $5,000 for Job #102, and $3,000 for Job #103.
- *Indirect materials* costs are transferred from the Raw Materials Inventory account to the Manufacturing Overhead account.
  - The cost of indirect materials is not allocated to each job.

ILLUSTRATION 2–7
Transaction (2): Transfer Direct and Indirect Materials Costs to Production.



The Work in Process Inventory account functions as a central record for all direct production costs *across all jobs.* Direct material costs for specific jobs are detailed in individual job cost sheets, as demonstrated in light green boxes in Illustration 2–7. Indirect material costs, however, are recorded in the Manufacturing Overhead account. The advantage of this job costing system is that it allows for a single Work in Process account for financial reporting, while providing detailed tracking of individual job costs through supporting job cost sheets.

KEY POINT

Purchases of raw materials are recorded in the Raw Materials Inventory account. As *direct materials* costs are used in production and assigned to jobs, they are removed from the Raw Materials Inventory account and included in the Work in Process Inventory account. *Indirect materials* costs used in production are removed from the Raw Materials Inventory account and included in the Manufacturing Overhead account.

Direct and Indirect Labor

● LO2–3
Account for direct and indirect labor.

During the production process, both direct labor and indirect labor are needed to manufacture the products.

- **Direct labor** includes wages and salaries for the workers who are directly involved in producing goods or providing services. Direct labor costs are traced and charged directly to each job. As labor costs are assigned to jobs, they are included in the Work in Process Inventory account.
- **Indirect labor** includes wages and salaries for the workers who support the company's operations but who do not work directly on the products or services provided. They include supervisors, maintenance staff, and other factory support personnel. As indirect labor costs are assigned to production, they are included in the Manufacturing Overhead account.

TRANSACTION (3): INCUR LABOR COST FOR PRODUCTION

To assemble the golf carts, assume Fairway Motors has direct labor costs of $9,000 and indirect labor costs of $4,000. These labor costs will be paid to the employees as part of their upcoming paycheck. As indicated in Illustration 2–8 for transaction (3):

- *Direct labor* costs include the cost of salaries (recorded as Manufacturing Salaries Payable) and are assigned to the Work in Process Inventory account.
  - We allocate the cost of direct labor to each job in the job cost sheet. Direct labor includes $4,000 for Job #101, $3,000 for Job #102, and $2,000 for Job #103.
- *Indirect labor* costs are assigned to the Manufacturing Overhead account.
  - They are not allocated to individual jobs.

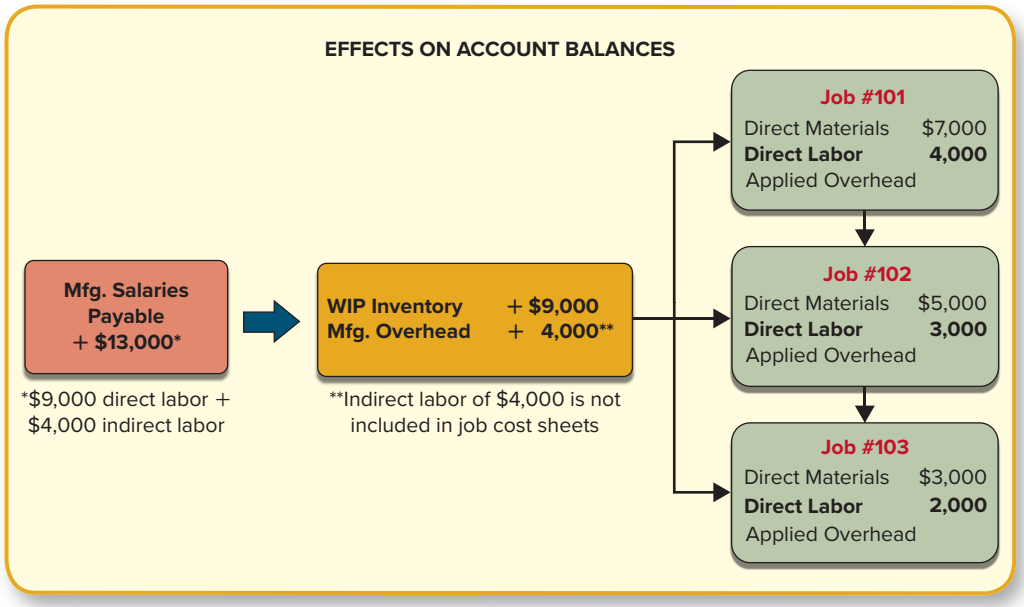
The Work in Process Inventory account captures all direct production costs, including direct labor, for all jobs. Direct labor costs for specific jobs are detailed in individual job cost sheets, as demonstrated in light green boxes in Illustration 2–8. Indirect labor costs, however, are recorded in the Manufacturing Overhead account.

KEY POINT

As *direct labor* costs are used in production and assigned to jobs, they are included in the Work in Process Inventory account. *Indirect labor* costs used in production are included in the Manufacturing Overhead account.

ILLUSTRATION 2–8

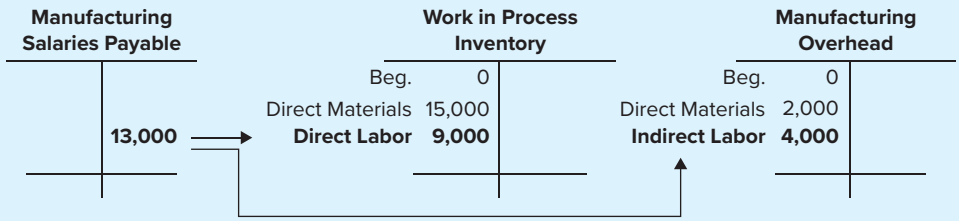
Transaction (3): Incur Direct and Indirect Labor Costs for Production.



DEBITS & CREDITS

Fairway Motors would record the flow of costs from direct materials ($9,000) and indirect materials ($4,000) into production as follows:

	Debit	Credit
Work in Process Inventory	**9,000**	
Manufacturing Overhead	**4,000**	
Manufacturing Salaries Payable		**13,000**



Let's Review

Direct Materials and Direct Labor

During the year, Hermana Company had the following production activities. Determine the effect of each activity on the balance of Raw Materials Inventory, Work in Process Inventory, and Manufacturing Overhead. Raw Materials Inventory had a beginning balance of $40,000. Work in Process Inventory had a beginning balance of $60,000.

Activities:

Materials purchased	$150,000	Direct labor costs	$240,000
Direct materials used	160,000	Indirect labor costs	100,000
Indirect materials used	20,000		

Solution:

Production Activities:	Raw Materials Inventory	Work in Process Inventory	Manufacturing Overhead
Beginning balances (given)	$ 40,000	$ 60,000	$ 0
Materials purchased[a]	+$150,000		
Direct materials used	−$160,000	+$160,000	
Indirect materials used	−$ 20,000		+$ 20,000
Direct labor costs[b]		+$240,000	
Indirect labor costs[b]			+$110,000

[a] The purchase would also decrease Cash if paid or increase Accounts Payable if not yet paid.
[b] The labor cost would also decrease Cash if paid or increase Manufacturing Salaries Payable if not yet paid.

Applied and Actual Manufacturing Overhead

● LO2–4
Account for applied and actual manufacturing overhead.

Manufacturing overhead includes a wide range of costs, all of which are part of the manufacturing process but are not tied directly to any specific job. These costs can include indirect materials, indirect labor, and other indirect costs needed for production, such as utilities, rent, insurance, and property taxes that are not directly tied to specific jobs.

For job order costing, there are two concepts of overhead to keep in mind:

1. **Applied overhead** —The estimated amount of overhead assigned to each job using a predetermined rate, which is calculated at the beginning of the period.
2. **Actual overhead** —The actual cost of overhead that occurs throughout the period.

Notice the difference in nature and timing of these two amounts. Applied overhead is tracked using an *estimated* rate calculated at the *beginning* of the period, with the same rate being applied to all jobs during the production period. In contrast, actual overhead is tracked for its *actual* amount and recorded *whenever* the cost occurs.

As you might imagine, applied overhead will almost always differ from actual overhead by the end of the period. So, why do managers apply overhead to each job if it will not equal actual overhead by the end of the period? Managers use applied overhead to plan operations at the beginning of the period and to make important decisions related to product costing, performance measurement, and sales pricing during the period. Applying overhead as production occurs gives managers a real-time estimate of each job's cost.

Actual overhead costs often are *lumpy,* occurring in large amounts at specific times rather than being spread out over the production cycle. Actual costs are also often *lagged,* coming after products are completed and decisions need to be made. For example, the property taxes on a manufacturing facility are assessed all at once (lumpy) and usually well after the year ends (lagged). Illustration 2–9 summarizes how applied overhead costs differ from actual overhead costs.

Illustration 2–10 further explains the differences in the timing and tracking of applied versus actual overhead. We'll discuss later how to close the difference between applied and actual overhead to the Cost of Goods Sold account.

Companies use a **predetermined overhead rate** to apply estimated overhead costs to each particular job. This rate is determined using an estimate of total overhead costs for the period divided by total estimated cost driver activity.

$$\text{Predetermined overhead rate} = \frac{\text{Estimated overhead costs}}{\text{Estimated cost driver activity}}$$

A **cost driver** is an activity that is expected to relate directly to the overhead cost that occurs during the period. For example, a cost driver might be any of the following:

- Direct labor costs: wages paid to workers assigned to a specific job.
- Direct labor hours: number of hours worked on a specific job.

ILLUSTRATION 2–9
Applied versus Actual Overhead

	Applied (estimated) Overhead	Actual Overhead
Timing	• As production occurs	• As costs actually occur
Purpose	• Used for planning, product costing, and current pricing	• Used for analyzing past performance and variances
Accuracy	• Based on beginning estimated cost driver activity	• Based on actual transactions through the end of the period
Adjustment	• Revised each period as more information arrives	• Does not require adjustment

ILLUSTRATION 2–10
Timing and Tracking of Applied versus Actual Overhead Costs.

Beginning of the Period
Plan the estimated overhead rate.

$$= \frac{\text{Estimated overhead costs}}{\text{Estimated cost driver activity}}$$

Throughout the Period
Apply the estimated overhead rate to units produced and track using the WIP account.

Track actual overhead costs as they occur using the MOH account.

End of the Period
Close the difference between applied versus actual overhead.

Close the difference to the COGS account.

- Machine hours: number of hours machinery is used for a specific job.
- Setup hours: time spent preparing machines or workstations for a specific job.
- Deliveries: volume of shipments related to a specific job.
- Units produced: total output generated for a specific job.

A cost driver can be any activity that has a cause-and-effect relationship with overhead costs.

By dividing an estimate of total overhead costs for the period by an estimate of cost driver activity for the period, we calculate a rate to apply overhead to each job as actual cost driver activity occurs.

$$\textbf{Applied overhead} = \textbf{Predetermined overhead rate} \times \textbf{Actual cost driver activity}$$

COMMON MISTAKE

A mistake that students sometimes make is confusing applied overhead with actual overhead for tracking job costs. Specifically, students often believe that the overhead cost allocated to jobs during the period is the actual overhead when, in reality, the amount applied during the period is only estimated overhead.

TRANSACTION (4A): APPLY OVERHEAD COSTS

Suppose Fairway Motors uses direct labor costs as its cost driver. At the beginning of the year, assume the company estimated total overhead costs for the year to be $300,000 and total direct labor costs to be $200,000. Fairway Motors would calculate a predetermined overhead rate of 150% of direct labor costs.

$$\textbf{Predetermined overhead rate} = \frac{\textbf{\$300,000 estimated overhead}}{\textbf{\$200,000 estimated direct labor}} = \textbf{150\% of direct laborcosts}$$

For applying overhead to each of its three jobs, Fairway Motors multiplies actual direct labor costs by 150%.

	Actual Direct Labor Costs	×	Predetermined Overhead Rate	=	Applied Overhead
Job #101	$4,000		150%		$ 6,000
Job #102	3,000		150%		4,500
Job #103	2,000		150%		3,000
					$13,500

As indicated in Illustration 2–11 for transaction (4a):

- *Applied overhead* costs of $13,500 are transferred from the Manufacturing Overhead account to the Work in Process Inventory account. We allocate the cost of applied overhead to each job.

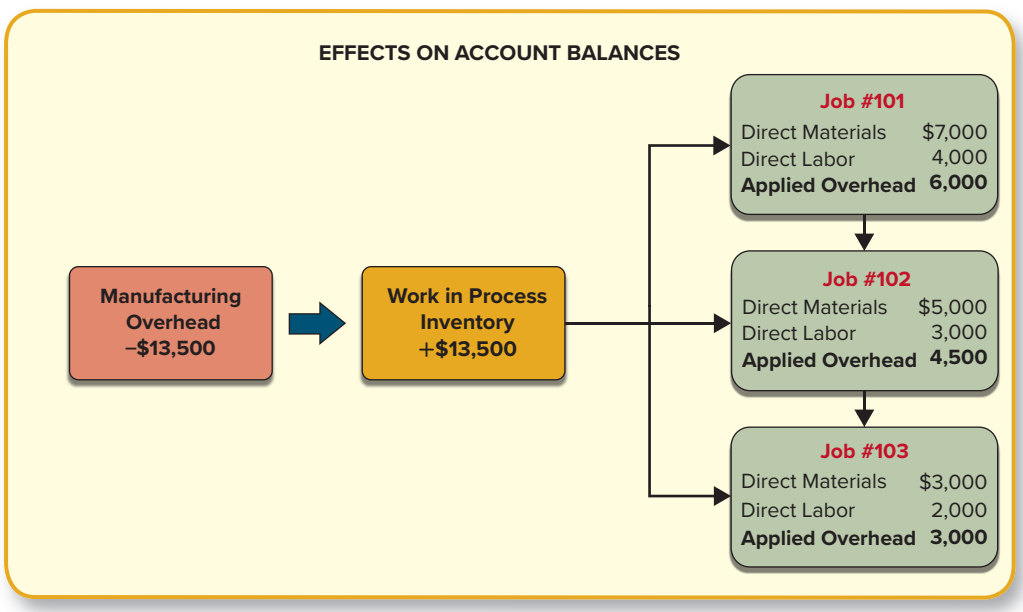


ILLUSTRATION 2–11
Transaction (4a): Apply Estimated Overhead to Production.

DEBITS & CREDITS

Fairway Motors would record applied manufacturing overhead into work in process inventory as follows:

	Debit	Credit
Work in Process Inventory	**13,500**	
Manufacturing Overhead		**13,500**

Manufacturing Overhead			Work in Process Inventory		
Beg.	0		Beg.	0	
Indirect Materials	2,000		Direct Materials	15,000	
Indirect Labor	4,000		Direct Labor	9,000	
		13,500 →	**Applied Overhead**		**13,500**

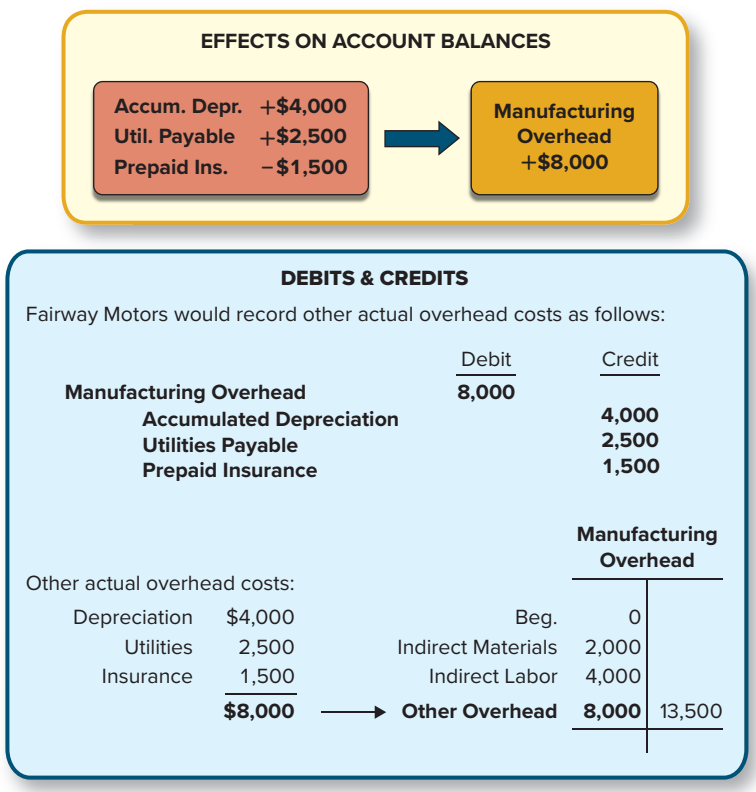
We use the Manufacturing Overhead account as a control account that summarizes all actual and applied overhead costs for all jobs. However, each individual job's applied overhead cost also is recorded on its respective job cost sheet.

TRANSACTION (4B): RECORD ACTUAL OVERHEAD COSTS

Thus far, we've accounted for the costs of indirect materials and indirect labor by recording these costs into the Manufacturing Overhead account. Suppose Fairway Motors has other indirect costs for the production of golf carts during the period, including depreciation on the manufacturing facility and equipment ($4,000), utilities ($2,500), and insurance expired on the manufacturing facility ($1,500). These costs are typically difficult to relate to specific jobs so they are applied to all jobs during the production period. As indicated in Illustration 2–12 for transaction (4b):

- Actual indirect overhead costs are recorded in the Manufacturing Overhead account.
  - Actual overhead costs are not allocated to each job because we already have applied overhead to these jobs using a predetermined rate.
- Depreciation is recorded in the Accumulated Depreciation account.
- Utilities costs (not yet paid) are recorded in the Utilities Payable account.
- The cost of expired insurance reduces the Prepaid Insurance account.

ILLUSTRATION 2–12
Transaction (4b): Track Other Actual Overhead.



In our example, notice that *actual* overhead costs for indirect materials, indirect labor, and other overhead are $14,000 (= $2,000 + $4,000 + $8,000), while *applied* overhead costs are only $13,500. This means that Fairway Motors's actual overhead costs for the period were $500 more than the amount applied (= $14,000 actual − $13,500 applied).

Companies will normally have applied overhead that differs from actual overhead by the end of the period.

- **Overapplied overhead costs** occur when overhead costs applied to production during the period are *greater* than the actual overhead costs.
- **Underapplied overhead costs** occur when overhead costs applied to production during the period are *less* than the actual overhead costs.

We'll discuss later in our example how this difference of $500 (underapplied overhead) is removed from the Manufacturing Overhead account at the end of the period.

KEY POINT

As production occurs, overhead costs are applied to jobs at a predetermined rate. These overhead costs are included in the Work in Process Inventory account. Actual overhead costs are included in the Manufacturing Overhead account. The difference between applied overhead and actual overhead equals the amount of overapplied or underapplied overhead.

Applied Overhead

Let's Review

1. Compute the predetermined overhead rate for El Tio Company if its estimated overhead costs for the coming year will be $150,000 and 5,000 direct labor hours will be worked.
2. Calculate the amount of overhead costs applied by El Tio Company to one of its jobs if the job required 10 direct labor hours to complete.
3. Compute the total cost of the job if direct materials costs are $200 and direct labor costs are $400.

Solution:

1. Predetermined overhead rate:
   = Estimated overhead costs/Estimated direct labor hours (DLH)
   = $150,000/5,000 DLH = **$30 per DLH**
2. Applied overhead costs of the job:
   = Predetermined overhead rate × Actual hours worked
   = $30 per DLH × 10 Actual direct labor hours worked = **$300**
3. Total cost of the job:
   = Direct materials +Direct labor +Applied overhead
   = $200 + $400 + $300 = **$900**

Finished Goods

When jobs are completed, the products are physically moved from the manufacturing area to the finished goods storage area. These products are ready for sale.

● **LO2–5**
Calculate the cost of finished goods and cost of goods sold.

TRANSACTION (5): FINALIZE PRODUCTION

In our example, Job #102 and Job #103 are completed during the period, while Job #101 remains unfinished. The total cost of direct materials, direct labor, and applied overhead for Job #102 ($12,500) and Job #103 ($8,000) is $20,500. As indicated in Illustration 2–13 for transaction (5):

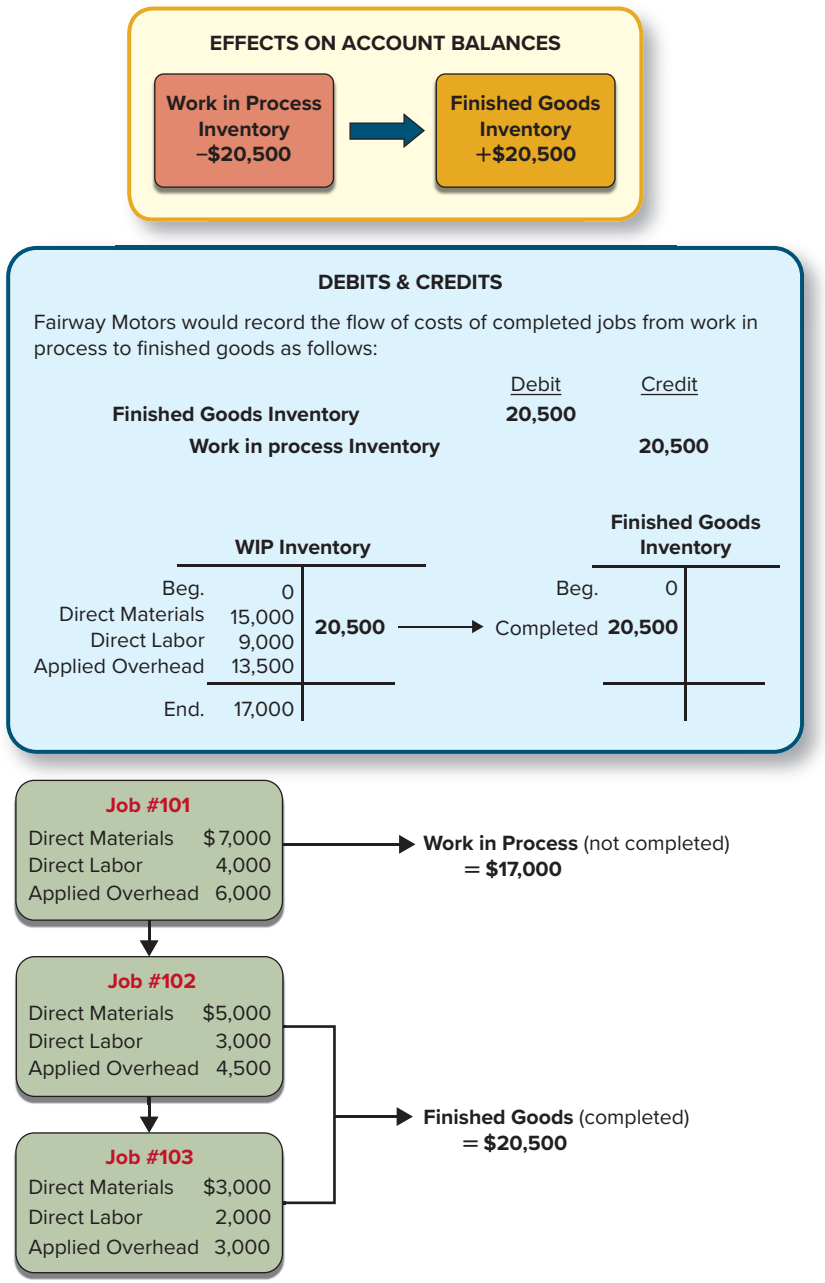
- We transfer the costs of completed jobs from the Work in Process Inventory account to the Finished Goods Inventory account.
- Because Job #101 is not yet complete, its total cost to date remains in the balance of the Work in Process Inventory account.

KEY POINT

The costs of products that have completed the production process are removed from the Work in Process Inventory account and included in the Finished Goods Inventory account.

ILLUSTRATION 2–13

Transaction (5): Transfer Product Costs to Finished Goods Inventory.



Product Sales

Once products are finished, they are ready for sale. If those goods have previously been ordered by customers, they can be shipped to the customers. Otherwise, the finished goods remain in inventory until they are later sold to a customer.

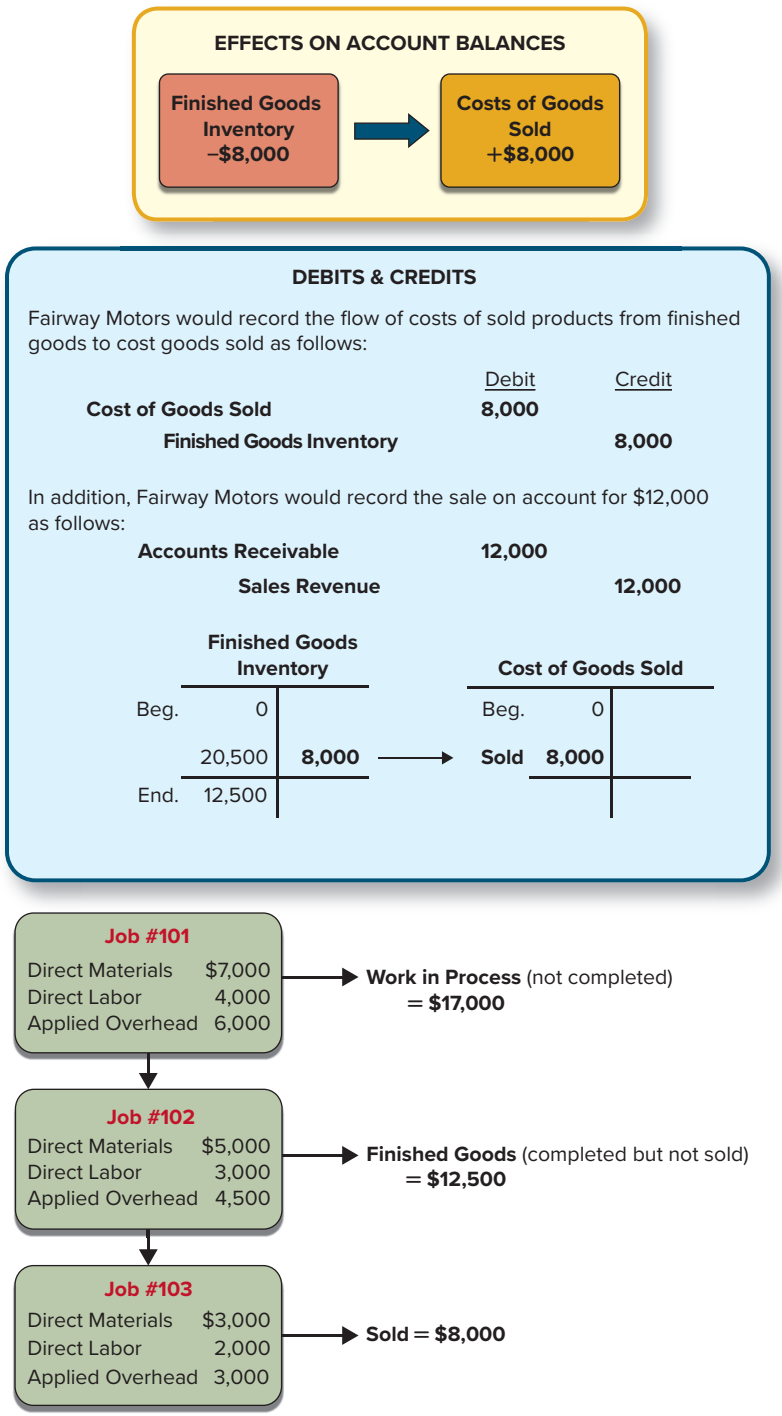
TRANSACTION (6): SELL PRODUCTS

Suppose Fairway Motors sold the custom golf cart manufactured in Job #103 by the end of the period, while Job #102 remains unsold. The sales price of Job #103 to the customer is $12,000 on account. Because we've tracked the cost of Job #103 throughout the production process, we know its cost is $8,000. This means we know our profit on the sale is the difference of $4,000 (= $12,000 sales price − $8,000 cost of production). As indicated in Illustration 2–14 for transaction (6):

- We transfer the cost of $8,000 for Job #103 from the Finished Goods Inventory account to the Cost of Goods Sold account.

ILLUSTRATION 2–14

Transaction (6): Transfer Finished Goods Inventory to Cost of Goods Sold.



- We record the $12,000 sale on account in the Accounts Receivable account and Sales Revenue account.
- By recording Sales Revenue at the same time as Cost of Goods Sold (an expense), we match revenues with their related expenses.
- Because Job #102 is finished but not yet sold, its total cost of $12,500 remains in the balance of the Finished Goods Inventory account.

KEY POINT

The costs of products sold are removed from the Finished Goods Inventory account and included in the Cost of Goods Sold account.

Let's Review

Inventory Balances

Partial operating data for Hermana Company follows. The company's management has set the predetermined overhead rate for the current year at 60% of direct labor costs. Compute the unknown values.

Beginning Materials Inventory	$ 40,000	Applied overhead (OH)	$ (b)
Beginning Work in Process Inventory	60,000	Cost of units completed	(c)
Beginning Finished Goods Inventory	20,000	Cost of Goods Sold (COGS)	500,000
Direct materials (DM) used	160,000	Ending Materials Inventory	10,000
Indirect materials used	20,000	Ending Work in Process Inventory	100,000
Raw materials purchased	(a)	Ending Finished Goods Inventory	(d)
Direct labor (DL) costs	240,000		

Solution:

Raw Materials Inventory:
Beginning + Purchased − Used = Ending
$40,000 + **(a)** − ($160,000 + $20,000) = $10,000
(a) = $150,000

Raw Materials Inventory			
Beg.	40,000		
+ Purch.	(a)	−180,000	Used
= End	10,000		

Applied Overhead:
(b) $240,000 × 60% = **$144,000**
Work in Process Inventory:
Beg. + DM used + DL costs + Applied OH − Completed = Ending
$60,000 + $160,000 + $240,000 + $144,000 − **(c)** = $100,000
(c) = $504,000

Work in Process Inventory			
Beg.	60,000		
+ DM used	160,000		
+ DL costs	240,000		
+ Applied OH	144,000	− (c)	Completed
= End	100,000		

Finished Goods Inventory:
Beginning + Completed − COGS = Ending
$20,000 + $504,000 − $500,000 = **(d)**
(d) = $24,000

Finished Goods Inventory			
Beg.	20,000		
+ Completed (c)	504,000	−500,000	COGS
= End	(d)		

PART B

FINANCIAL REPORTING FOR JOB ORDER COSTING

Underapplied or Overapplied Manufacturing Overhead

● **LO2–6**
Determine the impact of underapplied and overapplied manufacturing overhead on cost of goods sold.

As discussed in Part A of this chapter, we apply *estimated* overhead costs as production occurs throughout the period. We also record *actual* overhead costs as they occur during the accounting period.

Normally, there will be a difference between the amount of overhead *applied* during the period and the *actual* overhead that occurs by the end of the period. The difference between applied and actual overhead is reflected in the ending balance of the Manufacturing Overhead account. The Manufacturing Overhead account has a temporary balance that is closed to Cost of Goods Sold, as demonstrated in the next section.

CLOSE THE MANUFACTURING OVERHEAD ACCOUNT

All actual manufacturing costs (including overhead) ultimately end up in the Cost of Goods Sold account. For this to occur accurately, we need to close any remaining balance in the Manufacturing Overhead account and transfer that balance to the Cost of Goods Sold account.

- To close **underapplied overhead**, the Cost of Goods Sold account is increased and the Manufacturing Overhead account is decreased by the difference.
- To close **overapplied overhead**, the Cost of Goods Sold account is decreased and the Manufacturing Overhead account is increased by the difference.

COMMON MISTAKE

At the end of the period, the actual overhead that occurred is often different from the overhead applied to jobs. This leads to either underapplied or overapplied overhead. Failing to close this difference is a frequent error made by students, which can result in misstated job costs and inaccurate profits.

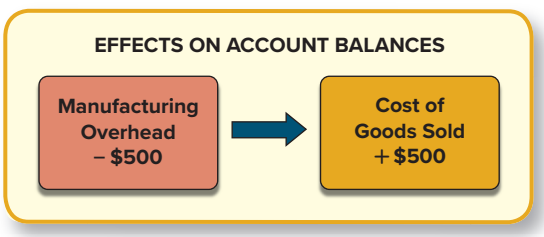
Underapplied Overhead for Fairway Motors. Returning to our Fairway Motors example, by the end of the period, let's assume all *actual* overhead costs have been recorded in the Manufacturing Overhead account. We did this previously for indirect materials costs of $2,000 (Transaction 2), indirect labor costs of $4,000 (Transaction 3), and other actual overhead costs of $8,000 [Transaction 4(b)]. In total, *actual* overhead costs are $14,000 (listed in Illustration 2–12).

On the other hand, we *applied* overhead costs during the production process of only $13,500 using a predetermined rate of 150% of direct labor costs [Transaction 4(a)].

At the end of the period, we compare the actual overhead costs of $14,000 to the applied overhead costs of $13,500 and find that overhead has been underapplied by $500. We need to transfer this difference to Cost of Goods Sold and close the Manufacturing Overhead account. This process is demonstrated in Illustration 2–15.

- For *underapplied* overhead (in our example), we move the excess actual overhead from the Manufacturing Overhead account to the Cost of Goods Sold account. This transfer closes the Manufacturing Overhead account and increases Cost of Goods Sold.

ILLUSTRATION 2–15
Close Manufacturing Overhead to Cost of Goods Sold.



DEBITS & CREDITS

Fairway Motors would close the Manufacturing Overhead account as follows:

	Debit	Credit
Cost of Goods Sold	**500**	
Manufacturing Overhead		**500**

Manufacturing Overhead

Beg.	0		
Indirect Materials	2,000	13,500	Applied Overhead
Indirect Labor	4,000		
Other Overhead	8,000	**500**	**Close Overhead** →
End.	0		

Cost of Goods Sold

Beg.	0	
Sold	8,000	
	500	
End	8,500	

- If overhead had been *overapplied,* we would have decreased the Cost of Goods Sold account for the difference to close the Manufacturing Overhead account.
- Notice that closing the Manufacturing Overhead account has no effect on the costs allocated to each job.

KEY POINT

At the end of the period, overhead costs applied to production will likely differ from overhead costs that actually occur. This difference is removed from the Manufacturing Overhead account and included in the Cost of Goods Sold account. If overhead has been *underapplied,* the balance of Cost of Goods Sold increases. If overhead has been *overapplied,* the balance of Cost of Goods Sold decreases.

Let's Review

Closing the Manufacturing Overhead Account

1. Compute the predetermined overhead rate for El Tio Company if its estimated overhead costs for the coming year will be $150,000 and 5,000 direct labor hours will be worked.
2. Using the overhead rate computed in Requirement 1, determine the total amount of overhead applied to operations during the year if El Tio Company has a total of 4,900 labor hours worked.
3. If El Tio Company's actual overhead costs for the year are $148,000, compute the amount of under- or overapplied overhead for the year. Will the Cost of Goods Sold account be increased or decreased to correct the under- or overapplied overhead?

Solution:

1. Predetermined overhead rate:
   = Estimated overhead costs/ Estimated direct labor hours (DLH)
   = $150,000/5,000 DLH = **$30 per DLH**
2. Applied overhead costs:
   = Predetermined overhead rate × Actual hours worked
   = $30 per DLH × 4,900 Actual direct labor hours worked = **$147,000**
3. Overhead costs applied $147,000
   Actual overhead costs 148,000
   Underapplied overhead **$ (1,000)**

   Underapplied overhead will **increase** the balance of Cost of Goods Sold to correct the underapplied overhead.

Financial Statement Effects

● **LO2–7**
Analyze the financial reporting of job order costs.

Illustration 2–16 provides a general description of how inventory costs are reported in the balance sheet and income statement under a job order costing system.

- Materials purchased (but not yet used in production) are initially reported as Raw Materials Inventory (an asset).
- Costs of direct materials used in production are transferred from Raw Materials Inventory to Work in Process Inventory (an asset).
- Costs of direct labor and applied overhead are added to Work in Process Inventory.
- Once the units are complete, costs are transferred from Work in Process Inventory to Finished Goods Inventory (an asset).
- Once the units are sold, costs are transferred from Finished Goods Inventory to Cost of Goods Sold (an expense).

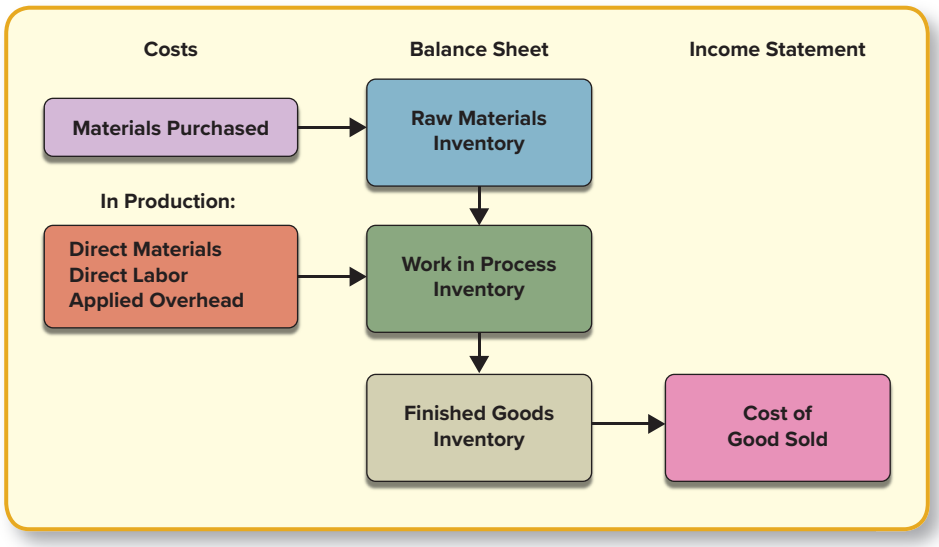


ILLUSTRATION 2–16
Cost Flows for Balance Sheet and Income Statement Accounts.

Illustration 2–17 summarizes the transactions in our Fairway Motors example. Notice the following key points:

- Transferring manufacturing costs from one inventory account to another inventory account during production has no effect on total assets or total expenses.

ILLUSTRATION 2–17 Financial Statement Effects of Transactions Associated with the Manufacturing Process.

	Balance Sheet			Income Statement		
	Assets	= Liabilities	+ Equity	Revenues	− Expenses	= Net Income
Purchase materials	Raw Materials Inv. +18,000	Accounts Payable +18,000				
Tansfer materials to production	Raw Materials Inv. −17,000 Work in Process Inv. +15,000 Mfg. Overhead +2,000					
Incur labor cost for production	Work in Process Inv. +9,000 Mfg. Overhead +4,000	Mfg. Salaries Payable +13,000				
Apply overhead costs	Mfg. Overhead −13,500 Work in Process Inv. +13,500					
Finalize production	Work in Process Inv. −20,500 Finished Goods Inv. +20,500					
Sell products	Finished Goods Inv. −8,000 Accounts Receivable +12,000		+4,000	Sales Revenue +12,000	Cost of Goods Sold +8,000	+4,000

- Only when inventory is sold do costs of inventory move from being reported as an asset (finished goods inventory) to being reported as an expense (cost of goods sold).
- By tracking costs of each job, we better match revenues with their related expenses.

KEY POINT

Transferring manufacturing costs from one inventory account to another inventory account (Raw Materials Inventory, Work in Process Inventory, or Finished Goods Inventory) has no effect on total assets or total expenses. Only when inventory is sold do costs of inventory move from being reported as an asset (Finished Goods Inventory) to being reported as an expense (Cost of Goods Sold).

Schedule of Cost of Goods Manufactured

A **schedule of cost of goods manufactured** summarizes the flow of all manufacturing costs during the period for inventory completed and transferred out of work in process. This schedule is useful in managing inventory by (1) detailing the full set of manufacturing costs for the period and (2) reconciling those costs to changes in inventory balances.

The schedule of cost of goods manufactured is constructed in three steps:

Step 1. Reconcile raw materials inventory balances with the **cost of direct materials used** during the period.

Step 2. Compute **total manufacturing costs** for the period.

Step 3. Reconcile total manufacturing costs with the **cost of goods manufactured** during the period.

Let's examine each of these steps.

Step 1. Reconcile raw materials inventory balances with the cost of direct materials used during the period as follows:

Beginning raw materials inventory + Raw materials purchased	Total cost of materials *available* to use
− Indirect materials used − Ending raw materials inventory	Less: Costs *not* used for *direct* materials this period
= Cost of direct materials used	

The **cost of direct materials used** is just that—the cost of the direct materials used to produce inventory during the current period. Most companies track the cost of direct materials used throughout the period for each job (as demonstrated in Illustrations 2-6 and 2-7). By the end of the period, we can verify this amount with the following actions:

- Add beginning inventory and raw materials purchased. This amount is the total cost of materials available to use.
- Subtract the cost of indirect materials and ending inventory to determine costs *not* used for *direct* materials for this period. *Indirect* materials do not represent the cost of *direct* materials, and ending inventory includes materials that were purchased but *not* used this period.

For companies that do not track costs throughout the period, the calculation in Step 1 is useful for determining the cost of direct materials used.

Step 2. Compute total manufacturing costs for the period as follows:

Cost of direct materials used (from Step 1)
+ Direct labor costs
+ Applied overhead costs
= Total manufacturing costs

Total manufacturing costs represent the complete costs of production during a given period. They include costs related to direct materials (from step 1), direct labor, and applied overhead. Each of these costs was tracked to Work in Process Inventory during the period.

Step 3. Managers typically want information on two different cost measures: (1) total manufacturing costs and (2) cost of goods manufactured. What's the difference?

- Total manufacturing costs (as described in step 2) tell you how much money was spent on manufacturing activities during a period, regardless of whether goods are completed or sold.
- **Cost of goods manufactured** tells you the cost of the goods that were actually completed and ready for sale during that period.

In step 3, we reconcile these two amounts as follows:

Total manufacturing costs (from Step 2)	Total cost of manufacturing during the period
+ Beginning work in process inventory − Ending work in process inventory	Adjust for cost of units *not* completed this period
= Cost of goods manufactured	

The reconciliation includes the following:

- Start with total manufacturing costs (from step 2), which represents the total cost of manufacturing activities during the period.
- Adjust for units *not* completed this period. This adjustment is done by adding the units that were partially completed at the beginning of the period (beginning work in process inventory) and subtracting units that remained unfinished at the end of the period (ending work in process inventory).

Let's go back to our hypothetical example for Fairway Motors and prepare a single schedule in Illustration 2–18 that combines the three steps above.

ILLUSTRATION 2–18
Schedule of Cost of Goods Manufactured

FAIRWAY MOTORS
Schedule of Cost of Goods Manufactured
For the current accounting period

Beginning raw materials inventory	$ 4,000
Plus: Raw materials purchased	18,000
Less: Indirect materials used	(2,000)
Less: Ending raw materials inventory	(5,000)
Cost of direct materials used	**$ 15,000**
Direct labor costs	9,000
Applied overhead costs	13,500
Total manufacturing costs	**$ 37,500**
Plus: Beginning work in process inventory	0
Less: Ending work in process inventory	(17,000)
Cost of goods manufactured	$ 20,500

COST OF GOODS SOLD

For a manufacturing company, the relationship between cost of goods manufactured and cost of goods sold is detailed below.

Beginning finished goods inventory		
+ **Cost of goods manufactured** (from step 3)		Total cost of goods available for sale
− Ending finished goods inventory		Cost of goods completed but *not* sold this period
= Unadjusted cost of goods sold		
+/− Underapplied/Overapplied overhead costs		
= **Cost of goods sold**		

Let's generate the income statement for Fairway Motors in Illustration 2–19 based on the following additional information:

- Recall that the custom golf cart manufactured in Job #103 was sold for $12,000 on account.
- Selling and Administrative Expense amounted to $2,200. These types of expenses typically include costs for advertising, sales commissions, shipping, and other costs that do not contribute to the manufacturing process.

ILLUSTRATION 2–19
Income Statement

FAIRWAY MOTORS
Income Statement
For the current accounting period

Sales revenue		$12,000
Less: Cost of goods sold		
Beginning finished goods inventory	0	
Plus: **Cost of goods manufactured**	**$20,500**	
Less: Ending finished goods inventory	(12,500)	
Unadjusted cost of goods sold	$ 8,000	
Plus: Underapplied overhead costs	500	
Cost of goods sold		**(8,500)**
Gross profit		3,500
Less: Selling and administrative expenses		(2,200)
Net operating income		$ 1,300

KEY POINT

A schedule of cost of goods manufactured summarizes the flow of all manufacturing costs during the period. This schedule is useful in managing inventory by (1) detailing the full set of manufacturing costs for the period and (2) reconciling inventory balances.

PART C

JOB ORDER COSTING IN A SERVICE COMPANY

Service Companies

● **LO2–8**
Understand job order costing for a service company.

The underlying principles we've learned about job order costing are equally applicable—and critically important—in a service-oriented business. These service companies can benefit from job order costing because they often provide unique services to individual clients, making it essential to track costs accurately for each job or project. Here are several examples of service companies that could benefit from the individualized job cost tracking offered by job order costing:

- Professional services—law firms, accounting firms, consulting firms
- Medical services—hospitals, doctor's offices, billing companies
- Creative services—advertising or marketing agencies, event planning companies
- Technology services—software development companies, web design firms

Each of these companies can use job order costing to understand the true cost of delivering a single project, engagement, or case, which can enable better decision making and planning.

The cost flow of services is similar to the cost flow of manufactured products:

- Identify jobs—each distinct service engagement is treated as a separate job.
- Track labor costs—the most important cost for a service organization is labor, which is typically tracked using the amount of time employees spend completing the service.
- Track materials costs (if any)—materials costs play a much smaller role for service organizations. Because most of their materials costs are indirect, they are included as part of overhead.
- Apply overhead costs—service organizations have indirect costs (overhead), such as rent, utilities, or administrative salaries, that need to be applied to each job.
- Account for the costs of labor and applied overhead in a Work in Process account.
- Compute total cost of services—once the service is complete and the customer is billed, costs are transferred from the Work in Process account to the Cost of Services account.

One distinction is that cost flows for a service company do not include a Finished Goods Inventory account, as would a manufacturing company. Instead, costs are transferred directly from the Work in Process account to the Cost of Services account. Illustration 2–20 demonstrates the flow of costs for service companies.

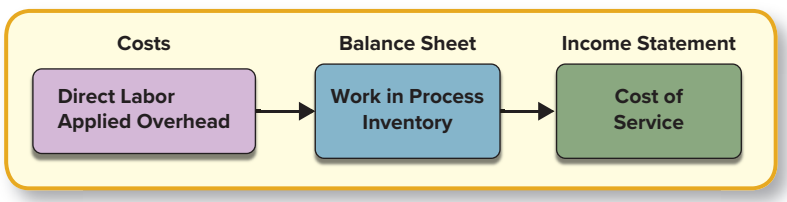


ILLUSTRATION 2–20
Cost Flows for Service Companies.

Example. Consider the advertising agency Connex Marketing, which has just landed a new client: North Shore Golf Clubs. North Shore wants to boost sales through a social media marketing campaign focusing on Instagram, Facebook, and TikTok. Because the agency needs to separately track costs for each engagement, this situation is a perfect candidate for job order costing. Connex Marketing assigns a unique job number—Job #301—to the North Shore campaign. All costs related to this advertising campaign are recorded under this job number.

- *Materials costs* in Illustration 2–21. Given the nature of the campaign, no direct materials costs are needed.
  - However, indirect materials costs amount to $1,000—these are recorded directly into the Service Overhead account as actual overhead costs.
  - Other actual overhead costs related to utilities payable amounted to $2,400 for the month. Actual overhead costs are not recorded in the job cost sheet.
- *Direct labor costs* in Illustration 2–22. The agency's creative director, social media manager, copywriter, and graphic designer will all work on this advertising campaign.
  - Suppose that at the end of the first month, these team members have logged 100 direct labor hours with a blended rate of $150 per hour.
  - The direct labor cost attributed to North Shore's campaign for the month is 100 hours × $150/hour = $15,000.
- *Applied overhead costs* in Illustration 2–23. The agency sets a predetermined overhead rate at the beginning of the year.
  - Assume the agency estimates total overhead of $300,000 for the year and anticipates logging 6,000 total billable hours across all clients.
  - The predetermined overhead rate would then be $300,000 ÷ 6,000 hours = $50/hour.
  - Applying this rate to Job #301 for the first month: 100 hours × $50/hour = $5,000 in applied overhead.

ILLUSTRATION 2–21

Indirect Materials Cost and Other Actual Overhead for a Service Company

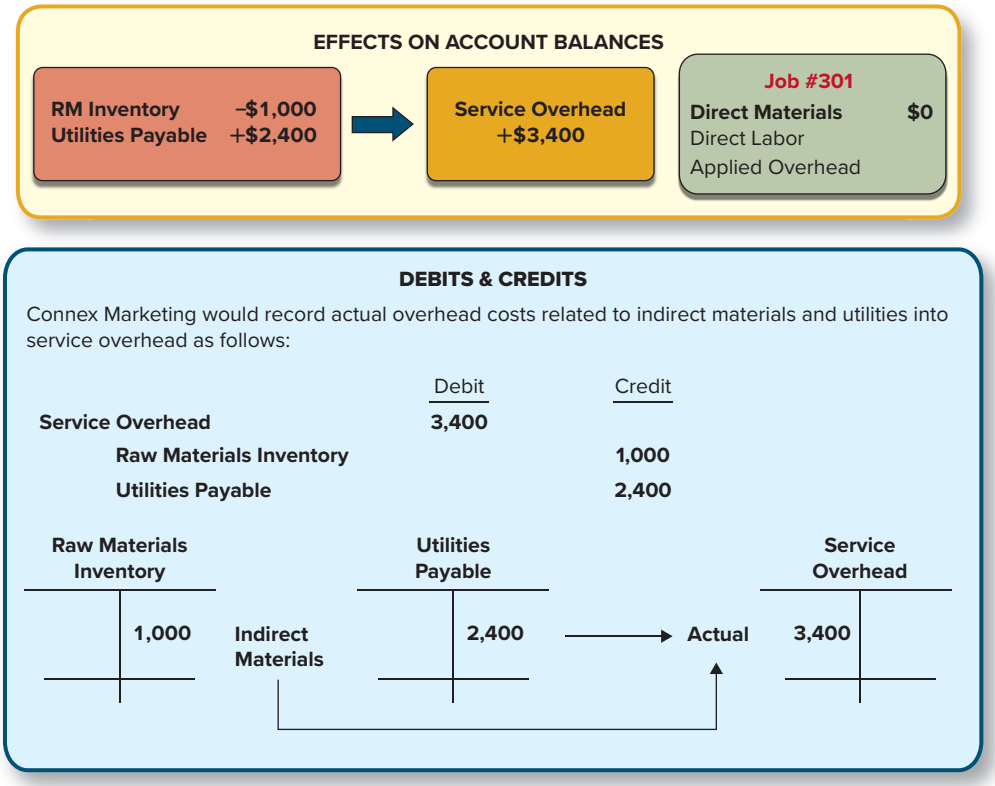
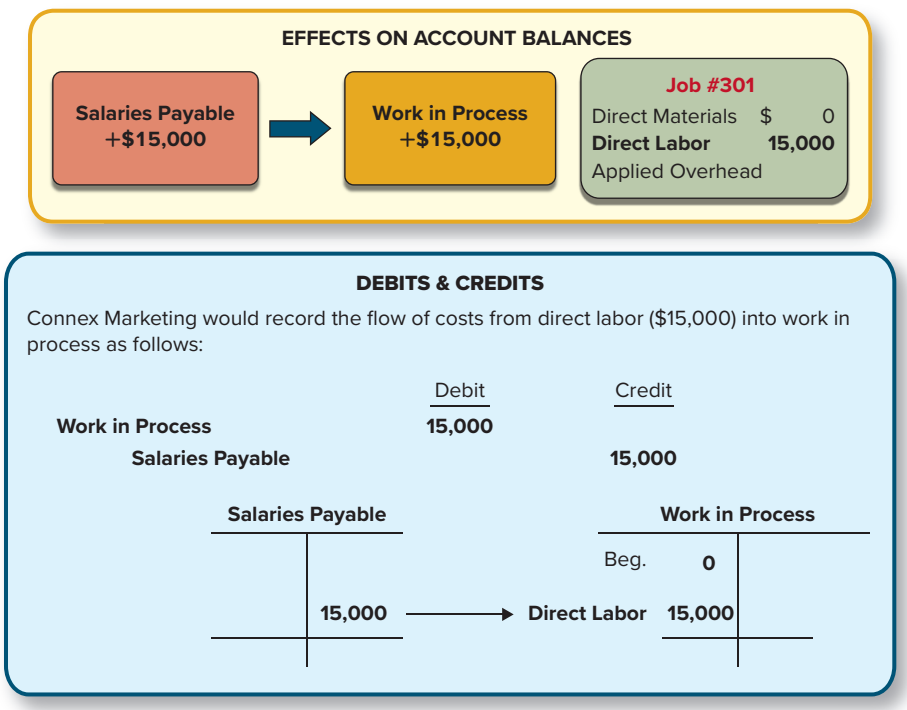


ILLUSTRATION 2–22

Direct Labor Costs for a Service Company



- *Service revenue* in Illustration 2–24. Suppose that Connex Marketing completed the services and billed North Shore $28,000. We need to record that revenue. We also need to transfer the cost of $20,000 from the Work in Process account to the Cost of Services acc ount.

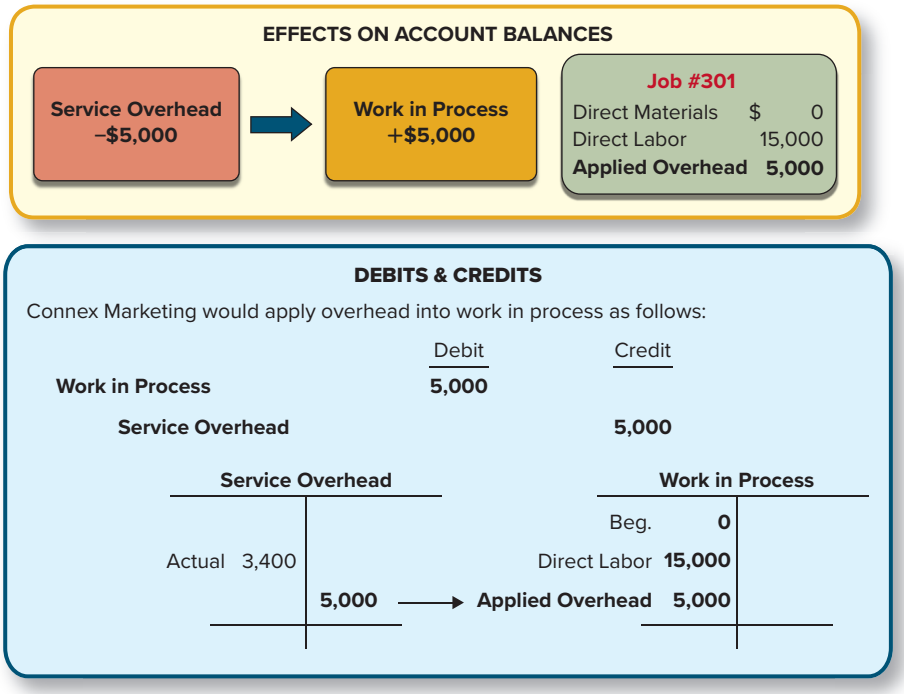


ILLUSTRATION 2–23

Applied Overhead Costs for a Service Company

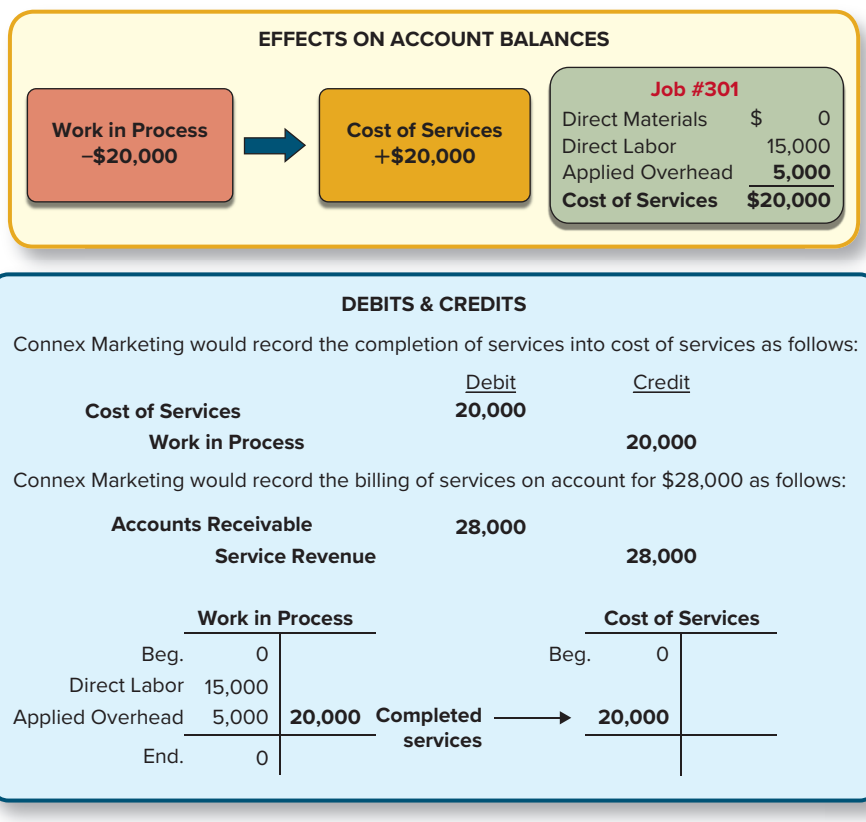


ILLUSTRATION 2–24

Completed Services for a Service Company

KEY POINT

Job order costing is just as valuable for service companies as it is for manufacturers. By tracking direct labor, applying overhead, and assigning costs to individual jobs, service companies can better understand the cost of each service provided.

THE BOTTOM LINE

LO2–1 Define the basic principles of job order costing.

A job order costing system is a management accounting system used to track manufacturing costs *by individual jobs.* This system is particularly useful for companies that make unique or special-order products.

In a job order costing system, we track the cost of direct materials, direct labor, and overhead through the various stages of production through to the sale to customers. To do this, we use the following accounts: Raw Materials Inventory, Work in Process Inventory, Finished Goods Inventory, and Cost of Goods Sold. Costs are tracked for each job using a job cost sheet.

LO2–2 Account for direct and indirect raw materials.

Purchases of raw materials are recorded in the Raw Materials Inventory account. As *direct materials* costs are used in production and assigned to jobs, they are removed from the Raw Materials Inventory account and included in the Work in Process Inventory account. *Indirect materials* costs used in production are removed from the Raw Materials Inventory account and included in the Manufacturing Overhead account.

LO2–3 Account for direct and indirect labor.

As *direct labor* costs are used in production and assigned to jobs, they are included in the Work in Process Inventory account. *Indirect labor* costs used in production are included in the Manufacturing Overhead account.

LO2–4 Account for actual and applied manufacturing overhead.

As production occurs, overhead costs are applied to jobs at a predetermined rate. These overhead costs are included in the Work in Process Inventory account. Actual overhead costs are included in the Manufacturing Overhead account. The difference between applied overhead and actual overhead equals the amount of overapplied or underapplied overhead.

LO2–5 Calculate the cost of finished goods and cost of goods sold.

The costs of products that have completed the production process are removed from the Work in Process Inventory account and included in the Finished Goods Inventory account.

The costs of products sold are removed from the Finished Goods Inventory account and included in the Cost of Goods Sold account.

LO2–6 Determine the impact of underapplied and overapplied manufacturing overhead on cost of goods sold.

At the end of the period, overhead costs applied to production will likely differ from overhead costs that actually occur. This difference is removed from the Manufacturing Overhead account and included in the Cost of Goods Sold account. If overhead has been *underapplied,* the balance of Cost of Goods Sold increases. If overhead has been *overapplied,* the balance of Cost of Goods Sold decreases.

LO2–7 Analyze the financial reporting of job order costs.

Transferring manufacturing costs from one inventory account to another inventory account (Raw Materials Inventory, Work in Process Inventory, or Finished Goods Inventory) has no effect on total assets or total expenses. Only when inventory is sold do costs of inventory move from being reported as an asset (Finished Goods Inventory) to being reported as an expense (Cost of Goods Sold).

A schedule of cost of goods manufactured summarizes the flow of all manufacturing costs during the period. This schedule is useful in managing inventory by (1) detailing the full set of manufacturing costs for the period and (2) reconciling inventory balances.

LO2–8 Understand job order costing for a service company.

Job order costing is just as valuable for service companies as it is for manufacturers. By tracking direct labor, applying overhead, and assigning costs to individual jobs, service companies can better understand the cost of each service provided.

GLOSSARY

Actual overhead: The actual cost of overhead that occurs throughout the period. **p. 49**

Applied overhead: The estimated amount of overhead assigned to each job using a predetermined rate, which is calculated at the beginning of the period. **p. 49**

Cost driver: An activity that is expected to relate directly to the overhead cost that occurs during the period. **p. 49**

Cost of direct materials used: The cost of the direct materials used to produce inventory during the current period. **p. 60**

Cost of goods manufactured: The cost of the inventory units that were actually completed during the period. **p. 61**

Cost of goods sold: Costs of finished products that were sold during the period. **p. 42**

Direct labor: Wages and salaries for the workers who are directly involved in producing goods or providing services. **p. 47**

Direct materials: Cost of materials that can be easily traced to a specific job. **p. 44**

Finished goods inventory: Costs assigned to completed products that have not been sold. **p. 42**

Indirect labor: Wages and salaries for the workers who support the company's operations but who do not work directly on the products or services provided. **p. 47**

Indirect materials: Cost of materials needed for production, but those costs are not easily traceable to specific jobs. **p. 44**

Job cost sheet: A record of all production costs for a particular job order. **p. 43**

Job order: A custom job or batch of products. **p. 41**

Job order costing system: A cost accounting system used to track costs by individual jobs. **p. 41**

Manufacturing overhead: A wide range of costs, all of which are part of the manufacturing process, but are not tied directly to any specific job (includes indirect materials, indirect labor, and other indirect costs). **p. 49**

Overapplied overhead costs: When overhead costs applied to production during the period are greater than the actual overhead costs. **p. 52**

Predetermined overhead rate: An estimate of total overhead costs for the period divided by total estimated cost driver activity. **p. 49**

Process costing system: A cost accounting system used to track costs for a manufacturing process most often involving large quantities of similar products. **p. 41**

Product costing system: System used to account for an organization's product costs and to provide timely and accurate unit cost information for pricing, cost planning and control, inventory valuation, and financial statement preparation. **p. 41**

Raw materials inventory: Cost of unused materials that have been purchased but not yet placed in the manufacturing process. **p. 42**

Schedule of cost of goods manufactured: A report that summarizes the flow of all manufacturing costs during the period for inventory completed and transferred out of work in process. **p. 60**

Total manufacturing costs: The complete costs of production during a given period (includes direct materials, direct labor, and applied overhead). **p. 61**

Underapplied overhead costs: When overhead costs applied to production during the period are less than the actual overhead costs. **p. 52**

Work in process inventory: Costs that have been assigned to partially completed products (includes direct materials, direct labor, and applied overhead). **p. 42**

SELF-STUDY QUESTIONS

1. Which of the following characteristics is unique to a job order costing system? **(LO2–1)**
   A. Tracking costs by department for homogeneous products.
   B. Assigning costs to individual batches or orders of unique products.
   C. Averaging costs over large production runs of identical units.
   D. Calculating department-level costs only at month end.

2. Which of the following business activities is most appropriate for a job order costing system? **(LO2–1)**
   A. Producing custom-designed kitchen cabinets for residential homes
   B. Manufacturing cans of soda in a bottling plant
   C. Refining crude oil into gasoline at a petroleum facility
   D. Producing rolls of paper in a pulp and paper mill

3. Which statement is true about indirect materials in a job order costing system? **(LO2–2)**
   A. Indirect materials are charged directly to each job cost sheet.
   B. Indirect materials are expensed immediately as Manufacturing Overhead when purchased.
   C. Indirect materials are first recorded in Raw Materials Inventory when purchased and then transferred to Manufacturing Overhead when used.
   D. Indirect materials never enter the Raw Materials Inventory account.

4. When a company transfers direct and indirect materials into production, which account(s) increase(s)? **(LO2–2)**
   A. Raw Materials Inventory
   B. Work in Process Inventory
   C. Manufacturing Overhead
   D. A & B
   E. B & C

5. Which of the following statements about direct labor is false? (**LO2–3**)
   A. Direct labor cost is recorded in Work in Process Inventory as it occurs.
   B. Direct labor cost is traced to individual jobs via job cost sheets.
   C. Direct labor cost appears as an expense in the income statement immediately when paid.
   D. A predetermined overhead rate can be expressed as a percentage of direct labor cost.

6. Compute the cost of direct labor if the Work in Process Inventory beginning balance was $3,000, direct materials used were $12,000, applied manufacturing overhead was $18,000, jobs costing $25,000 were completed, and the Work in Process Inventory ending balance is $23,000. (**LO2–3**)
   A. $9,000
   B. $12,000
   C. $15,000
   D. $18,000

7. Which of the following correctly describes the difference between applied overhead and actual overhead? **(LO2–4)**
   A. Applied overhead is recorded only at period-end; actual overhead is recorded continuously as production occurs.
   B. Applied overhead is based on estimated cost-driver activity; actual overhead is based on actual transactions that occur.
   C. Applied overhead is always more accurate than actual overhead.
   D. Applied overhead requires no adjustment; actual overhead must be adjusted by a predetermined rate.

8. Why do companies use a predetermined overhead rate during the period rather than waiting until the end of the period to allocate actual overhead? **(LO2–4)**
   A. To simplify bookkeeping by ignoring actual overhead entirely.
   B. Because actual overhead is always equal to estimated overhead.
   C. To ensure work-in-process always equals zero at month-end.
   D. To allocate timely cost estimates to jobs throughout the period.

9. At the beginning of the year, Brightline Tools estimates annual overhead of $360,000 and 45,000 direct labor hours (DLH). The company uses DLH as the basis for estimating overhead. In April, employees worked 3,500 DLH and actual overhead costs were $30,000. What amount of overhead is applied to production in April? **(LO2–4)**
   A. $58,000
   B. $30,000
   C. $28,000
   D. $31,500

10. Which statement best describes why transferring a completed job from Work in Process Inventory to Finished Goods Inventory does *not* affect Cost of Goods Sold or expense in the income statement? **(LO2–5)**
    A. Because costs remain on the balance sheet as an asset until the product is sold.
    B. Because only actual overhead differences are recorded when inventory is transferred.
    C. Because the job cost sheet already recorded Cost of Goods Sold at completion.
    D. Because direct materials and direct labor are expensed immediately as they occur.

11. When a product is sold, its cost is transferred to which account? **(LO2–5)**
    A. Finished Goods Inventory
    B. Work in Process Inventory
    C. Cost of Goods Manufactured
    D. Cost of Goods Sold

12. In June, a company recorded actual manufacturing overhead of $30,500 but applied overhead of $29,000. What was the result, and how should the difference be accounted for? **(LO2–6)**
    A. Overhead was overapplied by $1,500; the company decreases Cost of Goods Sold by $1,500.
    B. Overhead was underapplied by $1,500; the company increases Cost of Goods Sold by $1,500.
    C. Overhead was overapplied by $1,500; the company increases Work in Process Inventory by $1,500.
    D. Overhead was underapplied by $1,500; the difference is ignored and left in Manufacturing Overhead.

13. A manufacturing company has the following data for November: beginning Work in Process Inventory is $22,000; the cost of direct materials used is $32,000; direct labor costs are $18,000; and applied overhead costs are $24,000. What is the total manufacturing cost for the period? **(LO2–7)**
    A. $42,000
    B. $58,000
    C. $74,000
    D. $60,000

14. Blue Ridge Furniture begins the period with a Work in Process Inventory balance of $10,000; uses direct materials of $30,000; has direct labor costs of $25,000; applies overhead of $30,000; and ends the period with a Work in Process Inventory balance of $12,000. What is Blue Ridge's cost of goods manufactured? **(LO2–7)**
    A. $83,000
    B. $73,000
    C. $97,000
    D. $95,000

15. A law services firm treats each client case as a separate job. Which account holds costs until a case is completed and billed? **(LO2–8)**
    A. Finished Goods Inventory
    B. Work in Process Inventory
    C. Cost of Services
    D. Raw Materials Inventory

16. A graphic design agency has a beginning Work in Process Inventory balance of $5,000; has direct labor costs of $12,000; applies overhead of $4,000; and ends with a Work in Process Inventory balance of $3,000. What is the cost of services completed and transferred out? **(LO2–8)**
    A. $18,000
    B. $16,000
    C. $14,000
    D. $12,000.

REAL-WORLD PERSPECTIVES

Decision Analysis

LO2–4, LO2–6, LO2–7

RWP2–1 Precision Rides builds custom electric scooters for urban commuters. Each scooter is made to order and tracked under a job order costing system. In the second quarter, the company purchased $24,000 of raw materials and used $2,500 of those for indirect materials. Other costs include $18,000 in direct labor and $5,000 in indirect labor. Overhead was applied at 150% of direct labor cost, while actual overhead was $25,000. For the quarter, Precision Rides had sold many scooters, with total revenue of $85,000.

Additional Data:

- Raw Materials Inventory
  - Beginning: $6,000
  - Ending: $4,000
- Work in Process Inventory
  - Beginning: $10,000
  - Ending: $9,000
- Finished Goods Inventory
  - Beginning: $0
  - Ending: $7,000

Required:

1. Determine the following costs for the quarter:
    a. Cost of direct materials used.
    b. Total manufacturing costs.
    c. Cost of goods manufactured.
    d. Conceptually, what is the difference between the cost of direct materials used, total manufacturing costs, and cost of goods manufactured?
2. Answer the following questions related to overhead.
    a. Was overhead overapplied or underapplied for the quarter and by how much?
    b. Determine the unadjusted and adjusted cost of goods sold for the quarter.
    c. Recommend two actions management could take to improve accuracy in overhead allocation.

Conceptual Understanding

LO2–1, 2–4, 2–7

RWP2–2 Boulder Bike Works is a small manufacturer that specializes in custom-built bicycles. Each bike is made to order with specific design and material requirements, ranging from custom paint jobs to advanced gear systems. As part of a broader effort to improve internal cost

control and pricing decisions, the company is reevaluating its costing system and the way it tracks costs through production. You've been hired to help leadership understand how costing systems can improve managerial decision making.

Required:

1. What are the key characteristics of a job order costing system? Why is this system appropriate for Boulder Bike Works?
2. Explain the importance of tracking direct materials, direct labor, and overhead costs separately. How does this improve product pricing and cost control for a company producing customized goods?
3. Why do companies apply overhead to each job using a predetermined rate rather than waiting to use actual overhead costs? What are the implications if this estimate is substantially off?
4. What is the benefit of understanding cost flows through raw materials, work in process, finished goods, and cost of goods sold for managers outside of accounting (e.g., production managers and marketing managers)?
5. Why is it important to adjust for underapplied or overapplied overhead at the end of the period? What risks arise if this adjustment is ignored or misunderstood by managers?

LO2–4, LO2–6, LO2–7

Interpreting Management Reports

RWP2–3 SteelForm Fabrication manufactures custom metal enclosures used in telecom and renewable energy projects. The company uses a job order costing system and prepares a monthly Schedule of Cost of Goods Manufactured to track the flow of costs through raw materials, labor, and overhead. You are a junior management accountant tasked with reviewing the April cost report and identifying any trends or concerns that should be addressed by the operations manager. Recently, leadership has noticed discrepancies in job profitability and has requested a more detailed breakdown of manufacturing activity and cost flows.

Data for April:

- Raw Materials Inventory, April 1: $50,000
- Raw Materials Purchases: $160,000
- Indirect Materials Used: $10,000
- Raw Materials Inventory, April 30: $40,000
- Direct Labor: $90,000
- Actual Overhead: $112,000
- Work in Process Inventory, April 1: $30,000
- Work in Process Inventory, April 30: $45,000
- Finished Goods Inventory, April 1: $40,000
- Finished Goods Inventory, April 30: $55,000

Required:

1. Discussion of reporting.
   a. Why is the Schedule of Cost of Goods Manufactured important for SteelForm's operations team?
   b. Who will use this schedule, and how does it support decision making?
2. Calculate the following:
   a. Cost of Direct Materials Used.
   b. Applied Overhead (based on 120% of direct labor).
   c. Total Manufacturing Costs.
   d. Cost of Goods Manufactured (COGM).
   e. Adjusted Cost of Goods Sold, accounting for under- or overapplied overhead.
3. Prepare a complete Schedule of Cost of Goods Manufactured.
4. Prepare a brief analysis, highlighting any potential problems or patterns in the following:
   a. Fluctuations in work in process inventory.
   b. The difference between applied and actual overhead.
   c. Trends in finished goods inventory and implications for sales or production planning.

Ethical Dilemma

LO2–1, LO2–4, LO2–7

RWP2–4 Jordan Alvarez is a managerial accountant at MetroCraft Manufacturing, a firm that produces custom industrial components using a job order costing system. Near the end of the quarter, Jordan is preparing the Schedule of Cost of Goods Manufactured and preparing internal cost reports for management review. One job—#2219 for a key client—ran over budget due to material waste and unexpected labor overtime. To maintain healthy job margins on paper, Jordan's supervisor suggests applying a higher-than-standard overhead rate to spread some of the excess costs across other jobs.

This would shift overhead to unrelated jobs that were completed efficiently and billed out weeks ago, thereby avoiding any red flags on Job #2219's profitability. "It's just a minor timing adjustment," the supervisor explains. "We can clean it up next quarter. Plus, if this looks bad, the client might not renew." Jordan knows that overhead application is based on a predetermined rate but also understands the pressure to retain major clients and hit internal performance targets.

Required:

1. Understand the reporting effect: What is the role of managerial accounting in this scenario? How does it relate to planning, performance, evaluation, and communication?
2. Specify the options: What are Jordan's options?
3. Identify the impact: Which costs and accounts could be affected if Jordan adjusts the overhead allocations?
4. Make a decision: If you were Jordan, what would you do? Justify your decision.

Continuing Case: Great Adventures Trail Mix

LO2–2, 2–3, 2–4, 2–5, 2–6

(This is a continuation of the Great Adventures Trail Mix problem from Chapter 1.)

RWP2–5 In Chapter 1, Tony and Suzie launched a new division called *Great Adventures Trail Mix Company* to complement their adventure clinics. In January of the second year of operations, the company signed two major contracts:

- A wholesale order for regional winter camps.
- A large order of individually packaged trail mix for a local retailer.

To accurately track the costs of these separate contracts, Suzie adopts a job order costing system, assigning the following job numbers:

- Job #501: Winter Camps
- Job #502: Retail Order

During the month of January, the company engaged in the following transactions:

January 1: Purchased $14,000 of direct materials and $3,000 of indirect materials on account.
January 4: Issued $6,000 of direct materials to Job #501 and $8,000 to Job #502. Used $2,000 total of indirect materials for both jobs ($1,000 for each job).
January 10: Incurred direct labor costs of $4,500 for Job #501 and $6,000 for Job #502. Incurred $3,500 of indirect labor costs. These amounts have not yet been paid.
January 15: Applied overhead using a predetermined rate of $80 per direct labor hour. Job #501 used 90 hours; Job #502 used 120 hours.
January 20: Incurred actual manufacturing overhead costs:
- $3,600 for utilities to be paid.
- $5,000 for depreciation on equipment.
- $1,000 for supplies used.

January 25: Both jobs were completed and transferred to Finished Goods Inventory.

Required:

1. Determine the effect on account balances for each transaction. At the beginning of January, the company's inventory balances were Raw Materials Inventory at $2,500 and both Work in Process Inventory and Finished Goods Inventory at $0.

2. (a) Calculate whether the overhead is overapplied or underapplied, and (b) determine the effect on account balances for closing the Manufacturing Overhead account.
3. Complete the job cost sheets for Jobs #501 and #502, showing all cost components and total manufacturing cost.

	Winter Camps (#501)	Retail Order (#502)	Total
Direct materials			
Direct labor			
Applied overhead			
Total manufacturing cost			

BRIEF EXERCISES

Identify characteristics of job order costing (LO2–1)

BE2–1 Indicate whether a job order costing system would typically be appropriate for the following businesses (yes/no):

a. Mass manufacturing of water bottles.
b. Building custom-designed swimming pools.
c. Manufacturing limited-edition style robes.
d. Providing call center services to handle a large volume of customer orders.
e. Manufacturing canned food.
f. Providing accounting services to individual clients of different size.

Identify characteristics of job order costing (LO2–1)

BE2–2 Indicate whether a job order costing system would typically be appropriate for the following businesses (yes/no):

a. A custom furniture maker.
b. A soft drink manufacturer.
c. A home construction company.
d. A petroleum refinery.

Identify benefits of cost tracking (LO2–1)

BE2–3 Which of the following is typically a benefit of tracking costs? Select all that apply.

a. Setting accurate prices.
b. Controlling cost fluctuations.
c. Reducing employee turnover.
d. Improving productivity efficiency.
e. Generating reliable budgets.

Track costs through the manufacturing process (LO2–1)

BE2–4 The following steps in the manufacturing process are out of order. Sort the steps into the appropriate order.

Order	Step
1	Apply overhead costs
2	Finalize production
3	Purchase materials
4	Sell products
5	Incur labor costs for production
6	Transfer materials into production

Match costs with inventory accounts (LO2–1)

BE2–5 Costs of production are accounted for in one of the following accounts:

- Raw materials inventory
- Work in process inventory
- Finished goods inventory
- Cost of goods sold

Match each of the following steps in the manufacturing process to the appropriate account:

1. Purchase materials.
2. Transfer materials into production.
3. Incur labor costs for production.
4. Apply overhead costs.
5. Finalize production.
6. Sell products.

BE2–6 Elk Ridge Productions uses a job order costing system to track costs of manufacturing. At the start of November, the company purchases $40,000 of direct materials and $16,000 of indirect materials. All purchases are on account. Determine the effect on account balances for the purchase of direct and indirect materials on account.

Account for the purchase of direct and indirect materials **(LO2–2)**

BE2–7 During the month of November, Elk Ridge Productions transfers $30,000 of direct materials and $8,000 of indirect materials into production. Determine the effect on account balances for the transfer of direct and indirect materials into production.

Account for the transfer of direct and indirect materials into production **(LO2–2)**

BE2–8 North Mountain Manufacturing uses a job order costing system. At the start of the month, the company purchases $100,000 of direct materials and $200,000 of indirect materials, all on account. Determine the effect on account balances for the purchase of direct and indirect materials on account.

Account for the purchase of direct and indirect materials **(LO2–2)**

BE2–9 During the month, North Mountain Manufacturing transfers $75,000 of direct materials and $80,000 of indirect materials into production. Determine the effect on account balances for the transfer of direct and indirect materials into production.

Account for the transfer of direct and indirect materials into production **(LO2–2)**

BE2–10 During the month of November, Elk Ridge Productions has (but does not pay) $20,000 in direct labor costs and $5,000 in indirect labor costs in its manufacturing process. Determine the effect on account balances for the cost of direct and indirect labor.

Account for direct and indirect labor costs **(LO2–3)**

BE2–11 During the month, North Mountain Manufacturing has (but does not pay) $50,000 in direct labor costs and $15,000 in indirect labor costs. Determine the effect on account balances for the cost of direct and indirect labor.

Account for direct and indirect labor costs **(LO2–3)**

BE2–12 Elk Ridge Productions uses a predetermined overhead rate to apply manufacturing overhead based on a percentage of direct labor costs. At the beginning of the year, Elk Ridge estimated that its total manufacturing overhead cost would be $120,000 and its total direct labor costs would be $340,000. In November, the company had $20,000 in direct labor costs. (1) Calculate the predetermined overhead rate that Elk Ridge should use to apply overhead costs during the year (rounded to one decimal) and (2) determine the amount of overhead applied during the month of November.

Calculate the predetermined overhead rate and apply overhead **(LO2–4)**

BE2–13 At the beginning of the fiscal year, North Mountain Manufacturing determined that it would apply manufacturing overhead at a rate of 200% of direct labor costs. During the current month, the company had $50,000 in direct labor costs and $15,000 in indirect labor costs. (1) Calculate the amount of applied manufacturing overhead costs and (2) determine the effect on account balances of applying overhead.

Account for applied overhead costs **(LO2–4)**

BE2–14 Elk Ridge Productions had actual manufacturing overhead costs of $8,000 during the month of November related to other indirect costs, including utilities on the manufacturing facility. Assuming these costs were paid in cash, determine the effect on account balances for the actual overhead costs in November.

Account for actual overhead costs **(LO2–4)**

BE2–15 During the current month, North Mountain Manufacturing had actual overhead costs as follows: $30,000 for utilities (on account), $40,000 for accumulated depreciation on factory equipment, and $25,000 for factory supplies used. Determine the effect on account balances for the actual overhead costs in the current month.

Account for actual overhead costs **(LO2–4)**

BE2–16 At the end of November, Elk Ridge Productions completed production of goods with a total manufacturing cost of $35,000, including direct materials, direct labor, and applied overhead. These goods are transferred to the finished goods inventory. Determine the effect on account balances for the transfer of costs from production to finished goods inventory.

Account for the transfer to finished goods **(LO2–5)**

Account for the sale and cost of goods sold **(LO2–5)**

BE2–17 Assume that on December 1, finished goods costing $20,000 are sold for $45,000 (on account). Determine the effect on account balances for (1) the sale on account and (2) the recognition of the cost of goods sold.

Account for the transfer and sale of finished goods **(LO2–5)**

BE2–18 At the end of the current month, North Mountain Manufacturing completed production of goods with a total manufacturing cost of $60,000, which includes direct materials, direct labor, and applied overhead. These goods were transferred to the Finished Goods inventory. The following month, North Mountain Manufacturing sold finished goods costing $40,000 for $85,000 on account. Determine the effect on account balances for (1) the transfer of costs from production to finished goods inventory, (2) the subsequent sale on account, and (3) the recognition of the cost of goods sold.

Close the manufacturing overhead account **(LO2–6)**

BE2–19 Elk Ridge Productions applied manufacturing overhead costs of $7,058 for the month of November and had actual manufacturing overhead costs of $8,000. (1) Calculate the amount of overapplied or underapplied overhead at the end of November and (2) determine the effect on account balances for closing the Manufacturing Overhead account.

Close the manufacturing overhead account **(LO2–6)**

BE2–20 North Mountain Manufacturing applies manufacturing overhead at a rate of 200% of direct labor costs. During the month, the company had $50,000 in direct labor costs. North Mountain had actual manufacturing overhead costs totaling $95,000, including utilities, depreciation, and factory supplies. (1) Calculate the amount of overapplied or underapplied overhead for North Mountain Manufacturing and (2) determine the effect on account balances for closing the Manufacturing Overhead account.

Compute cost of goods manufactured **(LO2–7)**

BE2–21 CreativePrints Co. is a small company that designs custom printed materials. At the end of June, the company wants to prepare its Schedule of Cost of Goods Manufactured. The following information is available:

- Beginning Work in Process Inventory: $5,000
- Ending Work in Process Inventory: $3,000
- Direct Labor: $6,000
- Applied Manufacturing Overhead: $4,000
- Direct Materials Used: $8,000

Calculate (1) the total manufacturing costs and (2) the cost of goods manufactured for June.

Account for costs of a service company **(LO2–8)**

BE2–22 Edge Solutions, a software development company, specializes in custom web applications for small businesses. The company recently signed an agreement with Greenleaf Organic Grocers to create an e-commerce platform to expand online sales. To track costs associated with this project, Edge assigns a unique job number—Job #204—to the Greenleaf project. The project had the following costs:

- Indirect materials, $4,500 of shared computer accessories and prototyping materials.
- Direct labor, 120 hours on coding and interface design at a rate of $100 per hour.
- Applied overhead, $3,200.

Determine the effect on account balances for each of the three costs of Job #204.

EXERCISES

Identify product costs **(LO2–1)**

E2–1 Custom Publishers Company specializes in print-on-demand books. The company gathers the following information to budget next year's activities:

a. Cost of paper used in production.
b. Advertising costs.
c. Labor costs to operate printing machines.
d. Depreciation of printing machinery.

e. Repair costs for printing machinery.
f. Costs to deliver books to customers.
g. Office supplies costs.
h. Sales commissions.
i. Costs to design a book cover.
j. Cost of ink to print books.

Required:
Indicate whether each item would likely be included in a product costing system to determine the cost for print-on-demand books (yes/no).

E2–2 Below is a list of products:

Identify characteristics of job order costing **(LO2–1)**

a. Glue produced in large quantities as a uniform product.
b. Toothpicks mass-produced that are identical items.
c. Restaurant meal catering where each order is unique to customer specifications.
d. Clothing prepared by a custom tailor.
e. Wedding cakes customized based on customer specifications.
e. Liquid soap produced in large batches as a standardized product.
g. Propane gas canisters produced in large quantities for standard grills.
h. Compressed gas cylinders as standard gear used by scuba divers.

Required:
Determine whether a job order costing system would typically be appropriate to track the cost of the product (yes/no).

E2–3 Consider the following list of products:

Identify characteristics of job order costing **(LO2–1)**

a. Standard shirt buttons.
b. Printed graduation announcements.
c. Everyday glassware.
d. A limited-edition sculpture.
e. Flea collars for cats.
f. Oatmeal cereal.
g. Personal portrait.
h. An original painting.

Required:
Determine whether a job order costing system would typically be appropriate to track the cost of the product (yes/no).

E2–4 Premier Prints is a printing company specializing in custom yearbook printing. The company uses a job order costing system to track costs for each custom order. On April 1, Premier Prints began Job #1405 for Mountain View High School's yearbook order of 300 books. Premier Prints reports the following costs for Job #1405:

Track costs using a job cost sheet **(LO2–1)**

- Direct Materials: $15,000 (for paper, ink, and binding materials).
- Direct Labor: 200 hours at $25 per hour.
- Applied Manufacturing Overhead: $10,000.

Required:
1. Calculate the total manufacturing cost for Job #1405 by completing the job cost sheet with direct materials, direct labor, and applied overhead.
2. Calculate the product cost per unit for Job #1405.

Job cost sheet

Premier Prints

Customer Information	
Name:	Mountain View High School
Address:	Mesa, AZ
Phone:	555-555-5555

Job Information	
Job:	#1405
Date:	April 1

Cost description:	Amount:
Direct materials	
Direct labor	
Applied overhead	
Total manufacturing cost	
Units	
Cost per unit	

Account for the purchase of direct and indirect materials **(LO2–2)**

E2–5 Summit Custom Furniture uses a job order costing system to track manufacturing costs. At the beginning of March, the company purchases raw materials for two ongoing jobs:

- Direct materials: $12,000 for Job 701 (Conference Room Table) and $18,000 for Job 702 (Executive Desk Set)
- Indirect materials: $5,000 (varnishes, sandpaper, general shop supplies)

All purchases are made on account.

Required:

Determine the effect on account balances for the purchases of direct materials and indirect materials on account.

Account for the transfer of direct and indirect materials into production **(LO2–2)**

E2–6 Summit Custom Furniture began production on Jobs 701 and 702, transferring $10,000 of direct materials for Job 701 and $12,000 for Job 702, as well as $2,000 of indirect materials for each job ($4,000 total).

Required:

Determine the effect on account balances for the transfer of direct and indirect materials into production.

Account for the purchase and transfer of direct and indirect materials **(LO2–2)**

E2–7 ServerForge, a tech company specializing in building custom server systems, uses a job order costing system to track manufacturing costs for two pending projects:

- Project 501, a high-performance cloud server.
- Project 502, an AI-processing server.

At the beginning of April, the company purchases direct materials costing $300,000 and indirect materials costing $50,000. All purchases are made on account. During April, production begins on Projects 501 and 502. The company transfers $100,000 of direct materials to Project 501 and $120,000 to Project 502. Additionally, $20,000 of indirect materials are allocated to each project ($40,000 total).

Required:

1. Determine the effect on account balances for the purchase of direct and indirect materials on account.
2. Determine the effect on account balances for the transfer of direct and indirect materials into production for Projects 501 and 502.

E2–8 Below are inventory transactions for May and June:

Account for the purchase and transfer of raw materials **(LO2–2)**

May 8: Purchased direct materials on account, $12,000.
May 22: Purchased indirect materials with cash, $4,500.
May 23: Requested direct materials for production, $7,000.
June 5: Requested indirect materials for production, $1,500.
June 30: Requested direct materials ($5,000) and indirect materials ($3,000) for production.

Required:

Determine the effect on account balances for each transaction.

E2–9 Summit Custom Furniture has direct and indirect labor costs during the month of March for two ongoing jobs. All labor costs are paid at the end of the month.

Account for direct and indirect labor costs **(LO2–3)**

March 7: Direct labor cost for Job 701, Conference Room Table, $15,000.
March 14: Direct labor cost for Job 702, Executive Desk Set, $20,000.
March 21: Indirect labor cost for salaries for supervisors and maintenance staff, $5,000.
March 31: Paid all employee salaries for the month of March.

Required:

Determine the effect on account balances for each of the labor cost events.

E2–10 ModularIT, a tech company specializing in building custom hardware solutions, uses a job order costing system to track production costs. During the month of June, the following transactions occurred:

Account for materials and labor costs **(LO2–2, LO2–3)**

June 2: The company purchased $50,000 of direct materials for Project 301 (High-Speed Server Upgrade) and $30,000 of direct materials for Project 302 (Custom Data Storage System) on account.
June 5: The company purchased $10,000 of indirect materials using cash.
June 10: The production department requested $40,000 of direct materials for Project 301 and $20,000 for Project 302 to begin production.
June 15: The production department requested $5,000 of indirect materials.
June 20: Direct labor costs of $35,000 were charged to Project 301, and $25,000 to Project 302. Labor costs are paid at the end of the month.
June 23: Indirect labor costs for maintenance and support staff totaled $8,000. Labor costs are paid at the end of the month.
June 30: Paid all employees for the month, which included both direct and indirect labor.

Required:

Determine the effect on account balances for each of these transactions.

E2–11 EcoMoto Manufacturing, a company that produces custom EV motorcycles, uses a job order costing system. The company estimates that its total manufacturing overhead costs for the upcoming year will be $600,000. It also estimates that 9,000 direct labor hours will be used during the year. During the month of January, the company worked on three major jobs:

Calculate the predetermined overhead rate and apply overhead **(LO2–4)**

- Job A401 used 360 direct labor hours.
- Job A402 used 270 direct labor hours.
- Job A403 used 480 direct labor hours.

Required:

1. Calculate the predetermined overhead rate based on the estimated manufacturing overhead and estimated direct labor hours.
2. Using the actual direct labor hours, determine the effect on account balances for the total applied overhead for the month of January.

E2–12 JoCanvas, a company that creates custom murals for local businesses and offices, has an estimated manufacturing overhead for the year of $300,000 and expects to use 6,000 direct labor hours. In July, the company had actual manufacturing overhead costs that included $10,500 for supplies used, $12,000 for equipment depreciation, and $3,500 used of prepaid rent for the studio space, totaling $26,000. The actual direct labor hours for July were distributed as follows: Mural 3711 used 150 hours, Mural 3712 used 200 hours, and Mural 3713 used 250 hours.

Account for actual and applied overhead costs **(LO2–4)**

Required:

1. Calculate the predetermined overhead rate and the total applied overhead for January.
2. Determine the effect on account balances for applied overhead based on the actual direct labor hours.
3. Determine the effect on account balances for actual overhead costs.

Account for the transfer and sale of finished goods **(LO2–5)**

E2–13 JoCanvas completed the production of Mural 3711 and Mural 3712 at the end of July. The total production costs for Mural 3711 were $32,000, and the total production costs for Mural 3712 were $35,000. Both murals were transferred to the Finished Goods Inventory at the end of the month. In August, Mural 3711 was sold for $50,000 on account.

Required:

1. Determine the effect on account balances for the transfer of the completed murals (Mural 3711 and Mural 3712) to the Finished Goods Inventory.
2. Determine the effect on account balances for the (a) sale on account of Mural 3711 and (b) recognition of the cost of goods sold.

Determine and close under/overapplied overhead **(LO2–4, LO2–6)**

E2–14 Refer to the information in E2–12.

Required:

1. Calculate the amount of underapplied or overapplied overhead for the month (if any).
2. Determine the effect on account balances for closing the Manufacturing Overhead account (if necessary).

Determine and close under/overapplied overhead **(LO2–4, LO2–6)**

E2–15 JoCanvas Co. is a company that creates custom murals for local businesses. The company uses a job order costing system and applies overhead based on a predetermined overhead rate. The company estimated that manufacturing overhead for the year would be $300,000 and expects to use 6,000 direct labor hours. Direct labor hours used and actual overhead costs were as follows:

Month	Direct Labor Hours Used	Actual Overhead Costs
September	1,200	$55,000
October	900	$48,000
November	1,500	$75,000

Required:

1. Calculate the amount of underapplied or overapplied overhead for each month.
2. Determine the effect on account balances for closing the Manufacturing Overhead account each month (if necessary).

Prepare the schedule of cost of goods manufactured **(LO2–7)**

E2–16 Blue Horizon Manufacturing, a producer of custom outdoor furniture, is preparing its schedule of cost of goods manufactured for August. The following information is available.

Raw materials:	
Beginning balance	$ 8,000
Direct materials purchased	$45,000
Indirect materials used	$ 3,000
Ending balance	$ 6,000
Direct labor costs	$30,000
Overhead costs applied	25% of direct labor
Work in process inventory:	
Beginning balance	$12,000
Ending balance	$10,000

Required:

Prepare the schedule of cost of goods manufactured for August.

E2–17 Expedition LC specializes in modifying Toyota Land Cruisers into custom overlander vehicles designed for rugged overland exploration. The company uses a job order costing system to track production costs. The following transactions occurred in July for two Land Cruisers being modified, LC1036 and LC1037:

Track costs of materials, labor, overhead, and goods sold **(LO2–2, LO2–3, LO2–4, LO2–5, LO2–6)**

July 1: The company purchased $50,000 of direct materials and $10,000 of indirect materials on account.
July 5: Direct materials of $25,000 were issued for Land Cruiser LC1036 and $15,000 for Land Cruiser LC1037. Indirect materials of $5,000 total were used for both Land Cruisers.
July 10: Direct labor costs for the month were $15,000 for Land Cruiser LC1036 and $10,000 for Land Cruiser LC1037. Indirect labor costs for the month were $8,000. These labor costs were not yet paid.
July 15: Overhead is applied based on direct labor hours. The predetermined overhead rate is $60 per direct labor hour. The company recorded 400 direct labor hours for Land Cruiser LC1036 and 300 hours for Land Cruiser LC1037, totaling 700 hours.
July 20: Actual manufacturing overhead costs totaled $35,000 for the month: $12,000 for utilities to be paid, $18,000 for depreciation on equipment, and $5,000 for supplies used.
July 25: Both Land Cruisers were completed and transferred to the finished goods inventory.

Required:

1. Determine the effect on account balances for each transaction.
2. (a) Calculate whether the overhead is overapplied or underapplied and (b) determine the effect on account balances for closing the Manufacturing Overhead account.

E2–18 Refer to the information in E2–17. Expedition LC uses the job cost sheets below for each of the two Land Cruisers that were completed during the month of July.

Track costs for each unit **(LO2–2, LO2–3, LO2–4, LO2–5, LO2–6)**

	LC1036	LC1037	Total
Direct Materials			
Direct Labor			
Applied Overhead			
Total manufacturing cost			

Required:

Complete the job cost sheets and calculate total manufacturing costs.

E2–19 Refer to the information in E2–17 and E2–18. Assume Expedition LC had $20,000 in raw materials inventory at the beginning of the month but nothing in beginning Work in Process Inventory or Finished Goods Inventory.

Create the schedule of cost of goods manufactured and the income statement **(LO2–7)**

Required:

1. On July 31, Land Cruiser LC1036 was sold for $110,000 on account. Determine the effect on account balances for (a) the sale on account and (b) the recognition of the cost of goods sold. (*Hint*: Use the cost computed in E2–18.)
2. Prepare a Schedule of Cost of Goods Manufactured for Expedition LC for July. Use T-accounts where needed.
3. Prepare the Income Statement for Expedition LC for July. Assume selling and administrative expenses were $22,000. (*Hint*: Be sure to adjust for any over/underapplied manufacturing overhead.)

E2–20 PinPoint, a consulting company specializing in guiding companies on their strategic initiatives, uses a job order costing system to track project-related costs. The company is currently working on two major projects, both for the same client:

Account for project-related costs of a service company **(LO2–2, LO2–3, LO2–8)**

- Project 1820: Strategic Expansion Consultation.
- Project 1821: Digital Transformation Initiative.

As PinPoint is a service company, it has almost no direct materials. Instead, costs are derived from direct labor (consultants' billable hours) and directly traceable subcontracted services, as well as indirect service costs (support staff, administrative overhead, indirect materials, etc.).

During August, the following events occurred:

August 5: The company had $8,000 in actual service overhead costs related to administrative support and general office expenses. These were paid in cash.
August 10: PinPoint applied $10,000 of overhead costs to Project 1820, allocating these costs based on predetermined allocation rates.
August 15: The company had another $6,000 in actual service overhead costs for software subscriptions and other indirect support services. These were paid in cash.
August 25: The company applied $10,000 of overhead costs to Project 1821.
August 30: At the end of August, direct labor costs were paid in cash for both projects: $20,000 for Project 1820 and $15,000 for Project 1821.

Required:

Determine the effect on account balances for each transaction in PinPoint's job order costing system.

Track costs in a job order costing system for a service company **(LO2–2, LO2–3, LO2–4, LO2–6, LO2–8)**

E2–21 Refer to the information in E2–20. PinPoint uses the job cost sheets below for projects 1820 and 1821 that were completed on August 31.

	Job 1820	Job 1821	Total
Direct Labor			
Applied Overhead			
Total cost of services			

Required:

Complete the job cost sheets and calculate total service costs.

Account for completed services for a service company **(LO2–5, LO2–8)**

E2–22 Refer to the information in E2–20 and E2–21. On August 31, projects 1820 and 1821 were finalized and the services are considered fully completed. On that same day, PinPoint bills its clients and appropriately records the sale and costs related to the projects. The total amount billed to customers is $85,000.

Required:

Determine the effect on account balances for (a) the sale on account and (b) the cost of services provided. (*Hint*: Use the total cost computed in E2–21.)

Track costs in a job order costing system for a service company **(LO2–2, LO2–3, LO2–4, LO2–6, LO2–8)**

E2–23 BrightFrame Productions is a film production company specializing in creating short video ads for social media. The company uses a job order costing system to track the costs of each advertisement. At the end of July, the company completed production on two major advertising jobs: Ad801 and Ad802. The costs of Ad801 include $35,000 for direct labor and $10,000 for applied overhead. Ad802 has $22,000 for labor and $8,000 for applied overhead.

	Job Ad801	Job Ad802	Total
Direct Labor			
Applied Overhead			
Total cost of services			

Required:

1. Complete the job cost sheets below for each of the projects and compute total service costs.
2. The customer for Job Ad801 was billed $70,000 on account. Determine the effect on account balances for (a) the sale on account and (b) cost of services provided.

PROBLEMS

connect

P2–1 Edge Electrical manufactures two main products:

Identify characteristics of job order costing and calculate manufacturing costs **(LO2–1, LO2–2, LO2–3, LO2–4)**

a. Custom Machined Parts:
- Produced based on specific customer specifications.
- Each order varies in design, materials, and labor requirements.
- Overhead is applied based on direct labor hours.

b. Standardized Electrical Components:
- Mass-produced in large batches.
- All units are identical and production is continuous.
- Overhead is applied based on machine hours.

Required:

1. Determine for which product (Custom Machined Parts and Standardized Electrical Components) a job order costing system is likely to be used (yes/no). Explain your reasoning.
2. Calculate the total manufacturing cost for a specific order of Custom Machined Parts (Job #456), assuming the following costs occurred:
   - Direct materials used: $11,750.
   - Direct labor: 150 hours at $25 per hour.
   - Manufacturing overhead is applied at a rate of $30 per direct labor hour.
3. Using your answer in Requirement 2, calculate (a) the cost per unit for Job #456 if 10,000 units were produced and (b) the profit per unit if the job was sold for $25,000.

P2–2 CustomIT creates customized network security systems. The company accounts for costs using a job order costing system. Below is a job cost sheet for a single job to create and implement a net security solution at five different locations.

Track costs using a job cost sheet **(LO2–1)**

JOB COST SHEET
CustomIT

Customer Information		**Job information**	
Customer:	L. Kim	Job:	1820
Address:	Kowloon, HK	Date:	12/1/2025

Costs	**Previous Months**	**Current Month**	**Total Cost**
Direct materials	$5,400	$8,200	$?
Direct labor	3,400	6,200	?
Overhead applied	8,800	5,500	?
Totals	$?	$?	$?
Units completed			5
Product unit cost			$?

Required:

Complete the job cost sheet.

P2–3 Below are accounts and transactions related to Raw Materials Inventory, Work in Process Inventory, and Finished Goods Inventory for June and July.

Identify costs of materials, labor, overhead, and goods sold **(LO2–2, LO2–3, LO2–4, LO2–5, LO2–6)**

Account/Transaction	June	July
Beginning Raw Materials Inventory	$ (a)	$ (e)
Beginning Work in Process Inventory	8,605	(f)
Beginning Finished Goods Inventory	7,764	6,660
Direct materials requested for production	5,025	(g)
Raw materials purchased	5,100	6,216
Direct labor costs	4,760	5,540
Overhead applied (125% of direct labor costs)	(b)	(h)
Cost of units completed	(c)	21,861
Cost of Goods Sold	16,805	(i)
Ending Raw Materials Inventory	3,014	2,628
Ending Work in Process Inventory	(d)	(j)
Ending Finished Goods Inventory	6,660	3,515

Required:

Determine the missing amounts. (*Hint*: The ending balance of an account in June is the beginning balance of the account in July.)

Identify costs of materials, labor, and overhead and compute unit costs **(LO2–1, LO2–2, LO2–3, LO2–4)**

P2–4 Dude Corporation manufactures specialty lines of men's apparel. During February, the company worked on three special orders: B-2, B-3, and B-4. Cost and production data for each order are as follows.

	Job B-2	Job B-3	Job B-4
Direct materials:			
Fabric Q	$1,000	$1,800	$17,600
Fabric Z	2,000	2,200	13,400
Fabric YB	5,000	6,000	2,000
Direct labor:			
Garment maker	4,500	8,000	10,200
Layout	2,500	7,000	9,800
Packaging	3,000	5,000	5,000
Overhead:			
(150% of direct labor costs)	?	?	?
Number of units produced	500	1,200	500

Required:

1. Compute the total manufacturing cost associated with each job. Show the subtotals for each cost category.
2. Compute the product unit cost for each job.

Identify costs of materials, labor, and overhead costs **(LO2–1, LO2–2, LO2–3, LO2–4)**

P2–5 On July 1, MayaMisi Company reported the following balances:

- Work in Process Inventory, $9,000.
- Raw Materials Inventory, $40,000.
- Finished Goods Inventory, $20,500.
- Manufacturing Overhead, $0.

During the month of July, the company experienced the following activities related to manufacturing (in no particular order):

a. Direct materials costing $28,800 were requested for production.
b. Total paid for production-related payroll was $10,600, of which $2,600 was for indirect labor.

c. Indirect materials costing $8,400 were (i) purchased on account and (ii) placed into production.
d. Overhead was applied at a rate of 120% of direct labor costs.
e. Products costing $45,000 were transferred to Finished Goods Inventory.
f. Goods costing $40,000 were sold on account. Ignore sales revenues.

Required:

1. Determine the effect on account balances for each activity.
2. Compute the ending balance for each of the following accounts: Raw Materials Inventory, Work in Process Inventory, Manufacturing Overhead (unadjusted), and Finished Goods Inventory.

P2–6 Custom Floral, Inc., produces special-order artificial flower arrangements, so it uses a job order costing system. The following is a list of transactions for June:

Identify costs of materials, labor, overhead, and goods sold **(LO2–2, LO2–3, LO2–4, LO2–5, LO2–6)**

June 1: Purchased direct materials on account, $3,000.
June 2: Purchased indirect materials on account, $500.
June 5: Requested direct materials costing $2,500 ($2,000 used on Job AX and $500 used on Job BY) and indirect materials costing $400 for production.
June 10: Paid the following overhead costs in cash: utilities, $400; manufacturing rent, $3,000; and maintenance charges, $100.
June 14: Paid salaries for direct labor, $10,000 ($7,000 for Job AX and $3,000 for Job BY) and indirect labor, $4,000.
June 15: Applied overhead to production at the rate of 80% of direct labor cost.
June 16: Completed and transferred Job AX and Job BY to finished goods inventory; total cost of both jobs was $20,050.
June 23: Delivered Job AX to the customer. Billed customer for the sales price of $20,000; total production cost was $14,600.
June 30: Incurred additional actual overhead costs for the month: prepaid insurance expired, $300, and depreciation on machinery, $1500.

Required:

1. Determine the effect on account balances for each transaction.
2. (a) Compute the amount of underapplied or overapplied overhead as of June 30 and (b) determine the effect on account balances for closing the Manufacturing Overhead account.

P2–7 Aqua Designs uses a job order costing system to assign costs to custom pool installations. The company had no work in process or finished goods inventories at the beginning of July. The table below provides cost data for the three pool projects the company worked on in July:

Identify balances and costs of materials, labor, overhead, and goods sold **(LO2–2, LO2–3, LO2–4, LO2–5, LO2–6)**

Cost Category	Pool A	Pool B	Pool C
Direct materials	$48,000	$35,000	$42,000
Direct labor	$14,800	$12,700	$14,200
Direct labor hours	160	90	140

Notes:

- Overhead costs are applied to jobs based on direct labor hours, and the predetermined overhead rate is $65 per direct labor hour.
- Construction of Pools A and B were completed in July, but pools are not considered sold to the customer until the pool passes final inspection. By the end of July, Pool A has passed final inspection, but Pool B's customer delayed final inspection until August.
- Pool C was still under construction at the end of July.

Required:

1. Compute the amount of overhead cost applied to each pool project during July.
2. Compute the work in process inventory balance as of July 31.
3. Compute the finished goods inventory balance as of July 31.
4. Compute the cost of goods sold recognized for the month of July.

Determine job order costing for a service company (LO2–8)

P2–8 TechStack Advisors provides ERP installation consulting services. The company uses a job order costing system to track and bill each consulting project separately. The main cost components are direct labor and applied overhead. TechStack just completed a consulting gig (Job 1654E), in which the company helped Harper Dental install a new ERP system, with the following details:

- Total consulting hours: 120 hours.
- Average hourly labor rate: $100/hour.
- Overhead is applied at a rate of 80% of direct labor costs.

Required:

1. Compute the total job cost for Job 1654E.
2. The company operates on a cost-plus pricing strategy, aiming for a 40% profit margin. Determine the final price to charge the client.

Identify balances and costs of materials, labor, overhead, and goods sold (LO2–2, LO2–3, LO2–4, LO2–5, LO2–6)

P2–9 Eagle Carts, Inc. produces special-order golf carts, so Eagle Carts uses a job order costing system. Overhead is applied at the rate of 90% of direct labor cost. A list of transactions for January follows:

Jan. 1: Purchased direct materials on account, $215,400.
Jan. 2: Purchased indirect materials on account, $49,500.
Jan. 4: Requested direct materials costing $193,200 (all used on Job X) and indirect materials costing $38,100 for production.
Jan. 10: Paid the following overhead costs: utilities, $4,400; manufacturing rent, $3,800; and maintenance charges, $3,900.
Jan. 15: Recorded the following salaries for employees (not yet paid): direct labor, $120,000 (all for Job X); indirect labor, $60,620.
Jan. 15: Applied overhead to production.
Jan. 19: Purchased indirect materials costing $27,550 and direct materials costing $190,450 on account.
Jan. 21: Requested direct materials costing $214,750 (Job X, $178,170; Job Y, $18,170; Job Z, $18,410) and indirect materials costing $31,400 for production.
Jan. 31: Recorded the following salaries for employees (not yet paid): direct labor, $132,000 (Job X, $118,500; Job Y, $7,000; Job Z, $6,500); indirect labor, $62,240.
Jan. 31: Applied overhead to production.
Jan. 31: Completed and transferred Job X (375 carts) and Job Y (10 carts) to finished goods inventory; total cost was $855,990.
Jan. 31: Shipped Job X to the customer; total production cost was $824,520 and sales price was $996,800.
Jan. 31: Recorded the following overhead costs: prepaid insurance expired, $3,700; property taxes (payable at year end), $3,400; and depreciation—machinery, $15,500.

Required:

1. Compute the ending balance for each of the following accounts:
   - Raw Materials Inventory
   - Work in Process Inventory
   - Finished Goods Inventory
   - Manufacturing Overhead (before closing)
   - Cash
   - Accounts Receivable
   - Prepaid Insurance
   - Accumulated Depreciation—Machinery
   - Accounts Payable
   - Manufacturing Salaries Payable
   - Property Taxes Payable
   - Sales Revenue
   - Cost of Goods Sold (before adjusting for underapplied/overapplied overhead)

Note: Assume there are no beginning inventory balances and that salary entries were made directly to the Manufacturing Salaries Payable account.

1. Prepare job cost sheets for Job X, Job Y, and Job Z. (Round product unit cost to two decimal places.)
2. Determine the amount of underapplied or overapplied overhead as of January 31 and determine the ending balance of Cost of Goods Sold after closing the Manufacturing Overhead account.

Identify balances and costs of materials, labor, overhead, and goods sold **(LO2–2, LO2–3, LO2–4, LO2–5, LO2–6)**

P2–10 Thunderbird Industries has a unique business model that provides food waste recycling solutions for restaurants. The company is currently under contract for food recycling to three different restaurants, labeled Job A, Job B, and Job C. During September, Thunderbird completed the following transactions:

Sept. 1: Purchased direct materials on account, $59,400.
Sept. 3: Requested direct materials costing $26,850 for production (all for Job A).
Sept. 4: Purchased indirect materials for cash, $22,830.
Sept. 8: Paid the following overhead costs: utilities, $4,310; manufacturing insurance, $1,925; and repairs, $4,640.
Sept. 10: Requested direct materials costing $29,510 (all used on Job A) and indirect materials costing $6,480 for production.
Sept. 15: Recorded the following salaries for employees: direct labor, $62,900 (all for Job A); indirect labor, $31,610; manufacturing supervision, $26,900; and sales commissions, $32,980.
Sept. 15: Applied overhead to production at a rate of 120% of direct labor cost.
Sept. 22: Paid the following overhead costs: utilities, $4,270; maintenance, $3,380; and rent, $3,250.
Sept. 23: Recorded the purchase on account and receipt of $31,940 of direct materials and $9,260 of indirect materials.
Sept. 27: Requested $28,870 of direct materials (Job A, $2,660; Job B, $8,400; Job C, $17,810) and $7,640 of indirect materials for production.
Sept. 30: Recorded the following salaries for employees: direct labor, $64,220 (Job A, $44,000; Job B, $9,000; Job C, $11,220); indirect labor, $30,290; manufacturing supervision, $28,520; and sales commissions, $36,200.
Sept. 30: Applied overhead to production at a rate of 120% of direct labor cost.
Sept. 30: Completed and transferred Job A (58,840 units) and Job B (3,525 units) to finished goods inventory; total cost was $322,400.
Sept. 30: Shipped Job A to the customer; total production cost was $294,200 and sales price was $418,240.
Sept. 30: Recorded the following adjusting entries: $2,680 for depreciation—manufacturing equipment; and $1,230 for property taxes, manufacturing, payable at month end.

Required:

1. Compute the ending balance for each of the following accounts. Use T-accounts where needed.
   - Raw Materials Inventory
   - Work in Process Inventory
   - Finished Goods Inventory
   - Manufacturing Overhead (before closing)
   - Cash
   - Accounts Receivable
   - Accumulated Depreciation—Equipment
   - Accounts Payable
   - Manufacturing Salaries Payable
   - Property Taxes Payable
   - Sales Revenue
   - Cost of Goods Sold (before adjusting for underapplied/overapplied overhead)
   - Selling and Administrative Expenses

Note: Assume there are no beginning inventory balances and that labor costs are tracked in the Manufacturing Salaries Payable account.

1. Prepare job cost sheets for Job A, Job B, and Job C.
2. Determine the amount of underapplied or overapplied overhead as of September and determine the ending balance of Cost of Goods Sold after closing the Manufacturing Overhead account.

JOURNAL ENTRIES

Journal Entries—Brief Exercises

Record the purchase of direct and indirect materials **(LO2–2)**

JBE2–1 Elk Ridge Productions uses a job order costing system to track costs of manufacturing. At the start of November, the company purchases $40,000 of direct materials and $16,000 of indirect materials. All purchases are on account. Record the journal entry for these purchases.

Record the transfer of direct and indirect materials into production **(LO2–2)**

JBE2–2 During the month of November, Elk Ridge Productions transfers $30,000 of direct materials and $8,000 of indirect materials into production. Record the journal entry for these transfers.

Record the purchase of direct and indirect materials **(LO2–2)**

JBE2–3 North Mountain Manufacturing uses a job order costing system. At the start of the month, the company purchases $100,000 of direct materials and $200,000 of indirect materials, all on account. Record the journal entry for the purchase of direct materials and indirect materials on account.

Record the transfer of direct and indirect materials into production **(LO2–2)**

JBE2–4 During the month, North Mountain Manufacturing transfers $75,000 of direct materials and $80,000 of indirect materials into production. Record the journal entry for the transfer of direct materials and indirect materials into production.

Record direct and indirect labor costs **(LO2–3)**

JBE2–5 During the month of November, Elk Ridge Productions has (but does not pay) $20,000 in direct labor costs and $5,000 in indirect labor costs. Record the journal entry for direct labor costs and indirect labor costs.

Record direct and indirect labor costs **(LO2–3)**

JBE2–6 During the month, North Mountain Manufacturing has (but does not pay) $50,000 in direct labor costs and $15,000 in indirect labor costs. Record the journal entry for these labor costs.

Record applied overhead costs **(LO2–4)**

JBE2–7 Elk Ridge Productions uses a predetermined overhead rate to apply manufacturing overhead based on a percentage of direct labor costs. At the beginning of the year, Elk Ridge estimated that its total manufacturing overhead cost would be $120,000 and its total direct labor costs would be $340,000. In November, the company had $20,000 in direct labor costs. (1) Calculate the predetermined overhead rate that Elk Ridge should use to apply overhead costs during the year (rounded to one decimal). (2) Determine the amount of overhead applied during the month of November and record the corresponding journal entry.

Record applied overhead costs **(LO2–4)**

JBE2–8 At the beginning of the fiscal year, North Mountain Manufacturing determined that it would apply manufacturing overhead at a rate of 200% of direct labor costs. During the current month, the company had $50,000 in direct labor costs and $15,000 in indirect labor costs. Record the journal entry for the applied manufacturing overhead.

Record actual overhead costs **(LO2–4)**

JBE2–9 Elk Ridge Productions had actual manufacturing overhead costs of $8,000 during the month related to other indirect costs, including utilities on the manufacturing facility. Assuming these costs were paid in cash, record the journal entry for the actual manufacturing overhead costs in November.

Record actual overhead costs **(LO2–4)**

JBE2–10 During the current month, North Mountain Manufacturing had actual overhead costs as follows: $30,000 for utilities (on account), $40,000 for accumulated depreciation on factory equipment, and $25,000 for factory supplies used. Record the journal entry for these actual manufacturing overhead costs.

JBE2–11 At the end of November, Elk Ridge Productions completed production of goods with a total manufacturing cost of $35,000, including direct materials, direct labor, and applied overhead. These goods are transferred to the Finished Goods inventory. Record the journal entry for the transfer of costs from production to finished goods inventory.

Record the transfer and sale of finished goods **(LO2–5)**

JBE2–12 Refer to the information in JBE2–11. Assume that on December 1, finished goods costing $20,000 are sold for $45,000 (on account). Record the journal entries for (1) the sale on account and (2) the recognition of the cost of goods sold.

Record the cost of goods sold **(LO2–5)**

JBE2–13 At the end of the current month, North Mountain Manufacturing completed production of goods with a total manufacturing cost of $60,000, which includes direct materials, direct labor, and applied overhead. These goods were transferred to the Finished Goods inventory. The following month, North Mountain Manufacturing sold finished goods costing $40,000 for $85,000 on account. Record the journal entries for (1) the transfer of costs from production to finished goods inventory, (2) the subsequent sale on account, and (3) the recognition of the cost of goods sold.

Record the transfer and sale of finished goods **(LO2–5)**

JBE2–14 Elk Ridge Productions applied manufacturing overhead costs of $7,058 for the month of November and had actual manufacturing overhead costs of $8,000. Record the journal entry to close the Manufacturing Overhead account for the month of November.

Close the manufacturing overhead account **(LO2–6)**

JBE2–15 North Mountain Manufacturing applies manufacturing overhead at a rate of 200% of direct labor costs. During the month, the company had $50,000 in direct labor costs, resulting in applied manufacturing overhead of $100,000. Later, North Mountain had actual manufacturing overhead costs totaling $95,000, including utilities, depreciation, and factory supplies. (1) Calculate the amount of overapplied or underapplied overhead for North Mountain Manufacturing. (2) Record the journal entry to close the Manufacturing Overhead account for the month.

Close the manufacturing overhead account **(LO2–6)**

JBE2–16 Edge Solutions, a software development company, specializes in custom web applications for small businesses. The company recently signed an agreement with Greenleaf Organic Grocers to create an e-commerce platform to expand online sales. To track costs associated with this project, Edge assigns a unique job number—Job #204— to the Greenleaf project. The project had the following costs:

Account for costs of a service company **(LO2–8)**

- Indirect materials, $4,500 of shared computer accessories and prototyping materials.
- Direct labor, 120 hours on coding and interface design at a rate of $100 per hour.
- Applied overhead, $3,200.

Record the journal entries to track each of the three costs of Job #204.

Journal Entries—Exercises

JE2–1 Summit Custom Furniture uses a job order costing system to track manufacturing costs. At the beginning of March, the company purchases raw materials for two ongoing jobs:

Record the purchase of direct and indirect materials **(LO2–2)**

- Direct materials: $12,000 for Job 701 (Conference Room Table) and $18,000 for Job 702 (Executive Desk Set).
- Indirect materials: $5,000 (varnishes, sandpaper, general shop supplies).

All purchases are made on account.

Required:

Record the journal entry for the purchase of materials on account.

JE2–2 Summit Custom Furniture began production on Jobs 701 and 702, transferring $10,000 of direct materials for Job 701 and $12,000 for Job 702, as well as $2,000 of indirect materials for each job ($4,000 total).

Record the transfer of direct and indirect materials into production **(LO2–2)**

Required:

Record the journal entry for the transfer of direct and indirect materials into production.

Record the purchase and transfer of direct and indirect materials **(LO2–2)**

JE2–3 ServerForge, a tech company specializing in building custom server systems, uses a job order costing system to track manufacturing costs for two pending projects:

- Project 501, a high-performance cloud server.
- Project 502, an AI-processing server.

At the beginning of April, the company purchases direct materials costing $300,000 and indirect materials costing $50,000. All purchases are made on account. During April, production begins on Projects 501 and 502. The company transfers $100,000 of direct materials to Project 501 and $120,000 to Project 502. Additionally, $20,000 of indirect materials are allocated to each project ($40,000 total).

Required:

1. Record the journal entry for the purchase of direct and indirect materials on account.
2. Record the journal entry for transferring direct and indirect materials into production.

Record the purchase and transfer of direct and indirect materials **(LO2–2)**

JE2–4 Below are inventory transactions for May and June.

May 8: Purchased direct materials on account, $12,000.
May 22: Purchased indirect materials with cash, $4,500.
May 23: Requested direct materials for production, $7,000.
June 5: Requested indirect materials for production, $1,500.
June 30: Requested direct materials ($5,000) and indirect materials ($3,000) for production.

Required:

Record the journal entry for each transaction.

Record direct and indirect labor costs **(LO2–3)**

JE2–5 Summit Custom Furniture has direct and indirect labor costs during the month of March for two ongoing jobs. All labor costs are paid at the end of the month.

March 7: Direct labor cost for Job 701, Conference Room Table, $15,000.
March 14: Direct labor cost for Job 702, Executive Desk Set, $20,000.
March 21: Indirect labor cost (salaries for supervisors and maintenance staff), $5,000.
March 31: Paid all employee salaries for the month of March.

Required:

Record the journal entry for each of these labor cost transactions.

Record materials and labor costs **(LO2–2, LO2–3)**

JE2–6 ModularIT, a tech company specializing in building custom hardware solutions, uses a job order costing system to track production costs. During the month of June, the following transactions occurred:

June 2: The company purchased $50,000 of direct materials for Project 301 (High-Speed Server Upgrade) and $30,000 of direct materials for Project 302 (Custom Data Storage System) on account.
June 5: The company purchased $10,000 of indirect materials using cash.
June 10: The production department requested $40,000 of direct materials for Project 301 and $20,000 for Project 302 to begin production.
June 15: The production department requested $5,000 of indirect materials.
June 20: Direct labor costs of $35,000 were charged to Project 301, and $25,000 to Project 302. Labor costs are paid at the end of the month.
June 23: Indirect labor costs for maintenance and support staff totaled $8,000. Labor costs are paid at the end of the month.
June 30: Paid all employee for the month, which included both direct and indirect labor.

Required:

Record the journal entry for each of the transactions in ModularIT's job order costing system.

Calculate the predetermined overhead rate and record applied overhead **(LO2–4)**

JE2–7 EcoMoto Manufacturing, a company that produces custom EV motorcycles, uses a job order costing system. The company estimates that its total manufacturing overhead costs for the upcoming year will be $600,000. It also estimates that 9,000 direct labor hours will be used during the year. During the month of January, the company worked on three major jobs:

- Job A401 used 360 direct labor hours.
- Job A402 used 270 direct labor hours.
- Job A403 used 480 direct labor hours.

Required:

1. Calculate the predetermined overhead rate based on the estimated manufacturing overhead and estimated direct labor hours.
2. Using the actual direct labor hours, record the journal entry for the total applied overhead for the month of January.

JE2–8 JoCanvas, a company that creates custom murals for local businesses and offices, has an estimated manufacturing overhead for the year of $300,000 and expects to use 6,000 direct labor hours. In July, the company had actual manufacturing overhead costs that included $10,500 for supplies used, $12,000 for equipment depreciation, and $3,500 used of prepaid rent for the studio space, totaling $26,000. The actual direct labor hours for July were distributed as follows: Mural 3711 used 150 hours, Mural 3712 used 200 hours, and Mural 3713 used 250 hours.

Record actual and applied overhead costs **(LO2–4)**

Required:

1. Calculate the predetermined overhead rate and the total applied overhead for July.
2. Record the journal entry for applied overhead based on the actual direct labor hours.
3. Record the journal entry for actual overhead costs.

JE2–9 JoCanvas completed the production of Mural 3711 and Mural 3712 at the end of July. The total production costs for Mural 3711 were $32,000 and the total production costs for Mural 3712 were $35,000. Both murals were transferred to the Finished Goods Inventory at the end of the month. In August, Mural 3711 was sold for $50,000 on account.

Record the transfer and sale of finished goods **(LO2–5)**

Required:

1. Record the journal entry to transfer the completed murals (Mural 3711 and Mural 3712) to the Finished Goods Inventory.
2. Record the journal entries to record (a) the sale on account of Mural 3711 in August and (b) the recognition of the cost of goods sold.

JE2–10 Refer to the information in JE2–8.

Determine and close under/overapplied overhead **(LO2–4, LO2–6)**

Required:

a. Calculate whether the overhead for the month is underapplied, overapplied, or balanced.
b. Record the journal entry to close the Manufacturing Overhead account, if necessary.

JE2–11 JoCanvas is a company that creates custom murals for local businesses. The company uses a job order costing system and applies overhead based on a predetermined overhead rate. The company estimated that manufacturing overhead for the year would be $300,000 and expects to use 6,000 direct labor hours. Direct labor hours used and actual overhead costs were as follows:

Determine and close under/overapplied overhead **(LO2–4, LO2–6)**

Month	Direct Labor Hours Used	Actual Overhead Costs
September	1,200	$55,000
October	900	$48,000
November	1,500	$75,000

Required:

1. Calculate whether the overhead is overapplied, underapplied, or balanced in each month.
2. Record the journal entry to close the Manufacturing Overhead account each month, if necessary.

Record the costs of materials, labor, overhead, and goods sold **(LO2–2, LO2–3, LO2–4, LO2–5, LO2–6)**

JE2–12 Expedition LC specializes in modifying Toyota Land Cruisers into custom overlander vehicles designed for rugged overland exploration. The company uses a job order costing system to track production costs. The following transactions occurred in July for two Land Cruisers being modified, LC1036 and LC1037:

July 1: The company purchased $50,000 of direct materials and $10,000 of indirect materials on account.
July 5: Direct materials of $25,000 were issued for Land Cruiser LC1036 and $15,000 for Land Cruiser LC1037. Indirect materials of $5,000 total were used for both Land Cruisers.
July 10: Direct labor costs for the month were $15,000 for Land Cruiser LC1036 and $10,000 for Land Cruiser LC1037. Indirect labor costs for the month were $8,000.
July 15: Overhead is applied based on direct labor hours. The predetermined overhead rate is $60 per direct labor hour. The company recorded 400 direct labor hours for Land Cruiser LC1036 and 300 hours for Land Cruiser LC1037, totaling 700 hours.
July 20: Actual manufacturing overhead costs totaled $35,000 for the month: $12,000 is for utilities to be paid; $18,000 is for depreciation on equipment; and $5,000 is for supplies used.
July 25: Both Land Cruisers were completed and transferred to the Finished Goods Inventory.

Required:

1. Record the journal entry for each transaction.
2. (a) Calculate whether the overhead is overapplied or underapplied and (b) prepare the journal entry to close the Manufacturing Overhead account.

Track costs for each unit **(LO2–1, LO2–2, LO2–3, LO2–4, LO2–5, LO2–6)**

JE2–13 Refer to the information in JE2–12. Expedition LC uses the job cost sheets below for each of the two Land Cruisers that were completed during the month of July.

	LC1036	LC1037	Total
Direct Materials			
Direct Labor			
Applied Overhead			
Total manufacturing cost			

Required:

Complete the job cost sheets and calculate total manufacturing costs.

Create the schedule of cost of goods manufactured and the income statement **(LO2–7)**

JE2–14 Refer to the information in JE2–12 and JE2–13. Assume Expedition LC had $20,000 in raw materials inventory at the beginning of the month but nothing in beginning Work in Process Inventory or Finished Goods Inventory.

Required:

1. On July 31, Land Cruiser LC1036 was sold for $110,000 on account. Record the journal entry for (a) the sale on account and (b) the recognition of the cost of goods sold. (*Hint*: Use the cost computed in JE2–13.)
2. Prepare the Schedule of Cost of Goods Manufactured for Expedition LC for July.
3. Prepare the Income Statement for Expedition LC for July. Assume selling and administrative expenses were $22,000. (*Hint*: Be sure to adjust for any over/underapplied manufacturing overhead.)

Record project-related costs of a service company **(LO2–2, LO2–3, LO2–8)**

JE2–15 PinPoint, a consulting company specializing in guiding companies on their strategic initiatives, uses a job order costing system to track project-related costs. The company is currently working on two major projects, both for the same client:

- Project 1820: Strategic Expansion Consultation.
- Project 1821: Digital Transformation Initiative.

As PinPoint is a service company, it has almost no direct materials. Instead, costs are derived from direct labor (consultants' billable hours) and directly traceable subcontracted services, as well as indirect service costs (support staff, administrative overhead, indirect materials, etc.).

During August, the following events occurred:

August 5: The company had $8,000 in actual service overhead costs related to administrative support and general office expenses. These were paid in cash.
August 10: PinPoint applied $10,000 of overhead costs to Project 1820, allocating these costs based on predetermined allocation rates.
August 15: The company had another $6,000 in actual service overhead costs for software subscriptions and other indirect support services. These were paid in cash.
August 25: The company applied $10,000 of overhead costs to Project 1821.
August 30: At the end of August, direct labor costs were paid in cash for both projects: $20,000 for Project 1820 and $15,000 for Project 1821.

Required:
Record the journal entry for each transaction.

JE2–16 Refer to the information in JE2–15. On August 31, Projects 1820 and 1821 were finalized and the services are considered fully completed. On that same day, PinPoint bills its clients and appropriately records the sale and costs related to the projects. The total amount billed to customers is $85,000.

Record costs in a job order costing system for a service company **(LO2–2, LO2–3, LO2–5, LO2–8)**

Required:
1. Complete the job cost sheets below for each of the projects and compute total service costs.

	Job 1820	Job 1821	Total
Direct Labor			
Applied Overhead			
Total cost of services			

2. Record the journal entry for (a) the sale on account and (b) the cost of services provided. (*Hint*: Use the total cost computed in the job cost sheets.)

Journal Entries—Problems

JP2–1 Below are accounts and transactions related to Raw Materials Inventory, Work in Process Inventory, and Finished Goods Inventory for June and July.

Identify costs of materials, labor, overhead, and goods sold **(LO2–2, LO2–3, LO2–4, LO2–5, LO2–6)**

Account/Transaction	June	July
Beginning Raw Materials Inventory	$ (a)	$ (e)
Beginning Work in Process Inventory	8,605	(f)
Beginning Finished Goods Inventory	7,764	6,660
Direct materials requested for production	5,025	(g)
Raw materials purchased	5,100	6,216
Direct labor costs	4,760	5,540
Overhead applied (125% of direct labor costs)	(b)	(h)
Cost of units completed	(c)	21,861
Cost of Goods Sold	16,805	(i)
Ending Raw Materials Inventory	3,014	2,628
Ending Work in Process Inventory	(d)	(j)
Ending Finished Goods Inventory	6,660	3,515

Required:
Using T-accounts, determine the missing amounts. (*Hint*: The ending balance of an account in June is the beginning balance of the account in July.)

Record costs of materials, labor, and overhead costs **(LO2–1, LO2–2, LO2–3, LO2–4)**

JP2–2 On July 1, MayaMisi Company reported the following balances:

- Work in Process Inventory, $9,000.
- Raw Materials Inventory, $40,000.
- Finished Goods Inventory, $20,500.
- Manufacturing Overhead, $0.

During the month of July, the company experienced the following activities related to manufacturing (in no particular order):

a. Direct materials costing $28,800 were requested for production.
b. Total paid for production-related payroll was $10,600, of which $2,600 was for indirect labor.
c. Indirect materials costing $8,400 were (a) purchased on account and (b) placed into production.
d. Overhead was applied at a rate of 120% of direct labor costs.
e. Products costing $45,000 were transferred to Finished Goods Inventory.
f. Goods costing $40,000 were sold on account.

Required:

1. Record the journal entry for each activity.
2. Using T-accounts, compute the ending balance for each of the following accounts: Raw Materials Inventory, Work in Process Inventory, Manufacturing Overhead, and Finished Goods Inventory.

Record costs of materials, labor, overhead, and goods sold **(LO2–2, LO2–3, LO2–4, LO2–5, LO2–6)**

JP2–3 Custom Floral, Inc., produces special-order artificial flower arrangements, so it uses a job order costing system. The following is a list of transactions for June:

June 1: Purchased direct materials on account, $3,000.
June 2: Purchased indirect materials on account, $500.
June 4: Requested direct materials costing $2,500 ($2,000 used on Job AX and $500 used on Job BY) and indirect materials costing $400 for production.
June 10: Paid the following overhead costs in cash: utilities, $400; manufacturing rent, $3,000; and maintenance charges, $100.
June 14: Paid salaries for direct labor, $10,000 ($7,000 for Job AX and $3,000 for Job BY), and indirect labor, $4,000.
June 15: Applied overhead to production at the rate of 80% of direct labor cost.
June 16: Completed and transferred Job AX and Job BY to finished goods inventory; total cost of both jobs was $20,050.
June 20: Delivered Job AX to the customer; total production cost was $14,600 and billed customer for the sales price of $20,000.
June 30: Recorded additional actual overhead costs for the month: prepaid insurance expired, $300; and depreciation—machinery, $1,500.

Required:

1. Record the journal entries for all transactions in June.
2. (a) Compute the amount of underapplied or overapplied overhead as of June 30 and (b) record the journal entry to close the Manufacturing Overhead account.

DATA ANALYTICS & EXCEL

Visit Connect to view **Data Analytics & Excel** questions related to:

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5. Applying Excel

ANSWERS TO SELF-STUDY QUESTIONS

1. B; 2. A; 3. C; 4. E; 5. C; 6. C; 7. B; 8. D; 9. C; 10. A; 11. D; 12. B; 13. C; 14. A; 15. B; 16. A

CHAPTER FIVE

5 Cost-Volume-Profit (CVP) Analysis

Learning Objectives

PART A: COST BEHAVIOR AND CONTRIBUTION MARGIN

- **LO5–1** Define cost behavior and identify variable, fixed, and mixed costs.
- **LO5–2** Separate mixed costs into their variable and fixed components using the high-low method.
- **LO5–3** Prepare a contribution margin income statement.

PART B: CVP ANALYSIS AND BREAKEVEN POINT

- **LO5–4** Understand CVP analysis.
- **LO5–5** Define breakeven point and determine breakeven point for a single product or service.
- **LO5–6** Understand how managers apply CVP analysis to target profits.

PART C: ADDITIONAL ANALYSIS FOR DECISION MAKING

- **LO5–7** Determine breakeven point for multiple products or services.
- **LO5–8** Calculate the margin of safety and understand how managers use it.
- **LO5–9** Calculate the degree of operating leverage and understand how managers use it.

APPENDIX

- **LO5–10** Separate mixed costs into their variable and fixed components using the regression method.

Self-Study Materials

winhorse/iStock Unreleased/Getty Images

Feature Story

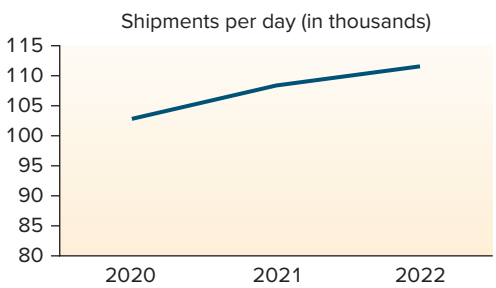
FedEx

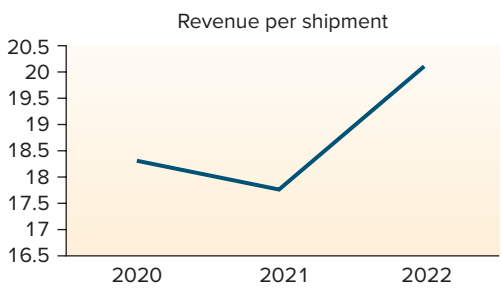
FedEx Corporation is a global leader in package delivery, operating in over 200 countries worldwide. The company is known for providing cost-effective, door-to-door delivery services to both businesses and individuals. The company ships over 100,000 packages per day, as illustrated in the line chart.

While FedEx's average revenue per shipment has recently risen to more than $20 per package, this positive development doesn't tell the whole story from a profitability perspective. FedEx has variable costs with each delivery, including expenses related to fuel, labor, sorting, taxes, and hazardous material. FedEx also has fixed costs to consider, such as vehicle and aircraft expenses, warehouse expenditures, rent, security costs, and administrative salaries.

For FedEx's management team, it's crucial to understand how changes in delivery volume, shipment revenue, variable costs, or fixed costs affect the company's bottom-line profitability. This understanding is especially important to FedEx's success when the company faces unforeseen events such as fuel price spikes, supply chain shocks, or shifts in delivery demand.

In this chapter, we'll explore a powerful analytical tool called cost-volume-profit (CVP) analysis. CVP analysis provides managers with the insights they need to understand and navigate the impact of these changes.





PART A

COST BEHAVIOR AND CONTRIBUTION MARGIN

Cost Behavior

■ LO5–1
Define cost behavior and identify variable, fixed, and mixed costs.

Cost behavior refers to the way costs change in response to changes in the level of an activity. In other words, it involves understanding how much total costs will increase if production or service volume increases, and how much total cost will decrease if volume decreases.

Knowing how costs behave under different activity levels helps managers make informed decisions about pricing, budgeting, production, and capital investment. Further, different types of companies need to understand their cost behaviors for different reasons:

- Manufacturing companies like **Whirlpool** and **Procter & Gamble** use their understanding of cost behavior to compare how changes in volume, costs, and sales affect the profitability of various product lines.
- Service companies like **Flickr**, **Meta**, and **Alphabet** consider cost behavior when planning the optimal mix of services to promote and offer to customers.

Variable, Fixed, and Mixed Costs

To effectively budget and plan, managers need to anticipate how costs may change, if at all, in response to changes in production or activity levels. They must differentiate between costs that fluctuate with changes in production (variable costs) and those that remain constant (fixed costs). Additionally, they should identify costs that have both variable and fixed components (mixed costs).

The relative proportion of variable, fixed, and mixed costs can vary across organization types. For example, restaurants like **Chipotle Mexican Grill** have high variable costs related to food costs and employee wages. In contrast, utility companies like **Duke Energy** have high fixed costs related to their investment in infrastructure, such as power plants. Illustration 5–1 provides examples of variable, fixed, and mixed costs for different types of companies. Illustration 5–2 provides examples of variable and fixed costs disclosed by **Peloton** in its annual report.

ILLUSTRATION 5–1 Examples of Variable, Fixed, and Mixed Costs by Company Type

Costs	Manufacturing Company—Tire Manufacturer	Merchandising Company—Department Store	Service Company—Bank
Variable	• Direct materials • Direct labor (hourly) • Indirect labor (hourly) • Operating supplies • Small tools	• Merchandise to sell • Sales commissions • Shelf stockers (hourly)	• Computer equipment leasing (Based on usage) • Computer operators (hourly) • Operating supplies • Data storage disks

Fixed	• Depreciation, machinery and building (straight-line)
	• Insurance premiums
	• Labor (salaried)
	• Supervisory salaries
	• Property taxes (on machinery and building)
		• Depreciation, equipment and building (straight-line)
		• Insurance premiums
		• Buyers (salaried)
		• Supervisory salaries
		• Property taxes (on equipment and building)
			• Depreciation, furniture and fixtures (straight-line)
			• Insurance premiums
			• Salaries:
			  • Programmers
			  • Systems designers
			  • Bank administrators
			• Rent, buildings

Mixed	• Electrical power • Telephone • Heat	• Electrical power • Telephone • Heat	• Electrical power • Telephone • Heat

Real-World Perspectives

Peloton discloses the following regarding the variable and fixed costs identified in its subscription service.

"[Our] costs consist of both fixed costs, including studio rent and occupancy, other studio overhead, instructor and production personnel-related expenses, as well as variable costs, including music royalty fees, content costs for past use, third-party platform streaming costs, and payment processing fees for our monthly subscription billings. While our fixed costs currently represent the majority of these costs, music royalty fees are our largest subscription variable cost"

Source: Peloton Interactive, Inc 2024 Annual Report pages 48 and 79. {https://www.sec.gov/Archives/edgar/data/1639825/000163982520000122/pton-20200630.htm

ILLUSTRATION 5–2
Excerpt from Peloton's Annual Report

VARIABLE COSTS

Variable costs are costs that change in direct proportion to changes in production or other activity levels. Typical examples of variable costs include

- **Direct materials**—the cost of the materials that go into a product,
- **Direct labor**—the cost of labor required to construct a product or provide a service, and
- **Overhead**—other costs necessary for manufacturing products and providing services, such as utilities and supplies.

Variable costs are referred to as *unit-level* activities because a cost occurs each time a unit is produced or a service is provided.

Variable costs fluctuate in relation to a specific activity, known as the **activity base** or "cost driver." In manufacturing companies, common activity bases include the number of units produced, the number of direct labor hours, or the number of machine hours used in production. In service companies, common activity bases may include the number of miles driven or flown, the number of calls received, or the number of items repaired. The key idea is that managers need to identify the activity that drives the variable costs.

While total variable costs fluctuate in response to changes in the activity base, the variable cost *per unit* remains constant. For example, let's consider a manufacturing company like **Hasbro.** Suppose the company requires $20 in raw materials to produce a particular toy. As presented in Illustration 5–3, the variable cost *per unit* remains constant at $20, whether Hasbro manufactures 1,000 units, $1,500 units, or 2,000 units. However, the *total* variable cost increases proportionally with the number of toys produced.

Number of Toys Produced	Direct Materials Cost per Unit	Total Materials Cost (Variable Cost)
1,000 units	$20	$20,000
1,500 units	$20	$30,000
2,000 units	$20	$40,000

ILLUSTRATION 5–3
Variable Cost Behavior and the Number of Units Produced

In this example, we *assume* variable cost per unit is constant, but only *within a relevant range of volume or activity.* **Relevant range** refers to the range of production or activity levels within which a company expects to operate and for which its cost behavior assumptions are valid. Within this range, the variable cost per unit stays fixed. However, if production or activity levels extend beyond the relevant range, other factors may arise that could affect the variable cost per unit.

FIXED COSTS

Fixed costs are costs that do not change with the level of production, as long as the activity remains within the relevant range. Common examples include rent, insurance, property taxes, administrative salaries, and straight-line depreciation. For instance, suppose Hasbro pays $15,000 per month to rent a production facility. The rent for Hasbro's manufacturing facility remains at $15,000 per month, whether the facility produces 10 units or 10,000 units. Fixed costs often are referred to as *facility-level* activities because they support the overall production facility or company.

While total fixed costs remain constant despite production fluctuations, the fixed cost *per unit* does change within the relevant range. Illustration 5–4 demonstrates the relationship between total fixed costs and volume within our Hasbro example's relevant range. As illustrated, *total* fixed cost stays the same as volume increases, but fixed cost *per unit* decreases as volume increases.

ILLUSTRATION 5–4
Fixed Cost Behavior and the Number of Units Produced

Number of Toys Produced	Total Monthly Rent (Fixed Cost)	Monthly Rent per Unit
1,000 units	$15,000	$15.00
1,500 units	$15,000	$10.00
2,000 units	$15,000	$ 7.50

Fixed costs could potentially change as activity moves beyond the relevant range. For example, if production increases significantly, a second salaried factory supervisor may need to be hired. Such fixed costs are known as **step fixed costs**.

In Illustration 5–5, we provide a summary of how variable and fixed costs behave, in total and per unit, within the relevant range.

ILLUSTRATION 5–5
Summary of Variable and Fixed Cost Behavior

Within the Relevant Range:	Per Unit	Total
Variable cost	Remains **constant** regardless of the level of production	**Increases** as the level of production (or activity base) increases
Fixed cost	**Decreases** as the level of production (or activity base) increases	Remains **constant** regardless of the level of production

MIXED COSTS

Alternative Names: Mixed costs are also known as semi-variable costs.

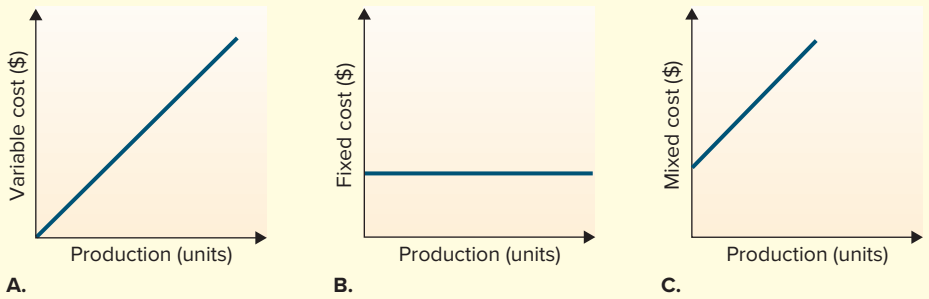
Mixed costs exhibit behaviors of both variable and fixed costs. They have a fixed component that remains constant and a variable component that changes with activity levels. For example, utility costs often have a fixed monthly service charge (fixed component), along with usage charges that vary with the amount of electricity or water consumed (variable component).

Illustration 5–6 demonstrates how total variable, fixed, and mixed costs change with changes in the level of production.

Note the following in Illustration 5–6:

- In the variable cost figure (graph A), the line begins at $0 variable cost because there are no variable costs when no units are produced. The total variable cost then increases at a constant rate as each additional unit is produced.

ILLUSTRATION 5–6 Relation between the Level of Production and Variable, Fixed, and Mixed Costs.



- In the fixed cost figure (graph B), the line starts above $0 because fixed costs occur even when no units are produced. The total fixed cost line does not change as additional units are produced.
- In the mixed cost figure (graph C), the line begins at the level of fixed costs and then increases at a constant rate equal to unit variable cost as additional units are produced.

COMMON MISTAKE

Students often mistakenly classify costs as fixed or variable based on how they change over time rather than how they respond to changes in activity level. A cost that increases each year due to inflation may still be fixed if it doesn't vary with units produced or sold.

KEY POINT

Cost behavior refers to the way costs change in response to changes in the level of an activity. Variable costs are costs that change in direct proportion to changes in production or other activity levels. Fixed costs are costs that do not change, regardless of the activity level. Mixed costs have a fixed component that remains constant and a variable component that changes with activity levels.

Separating Mixed Costs

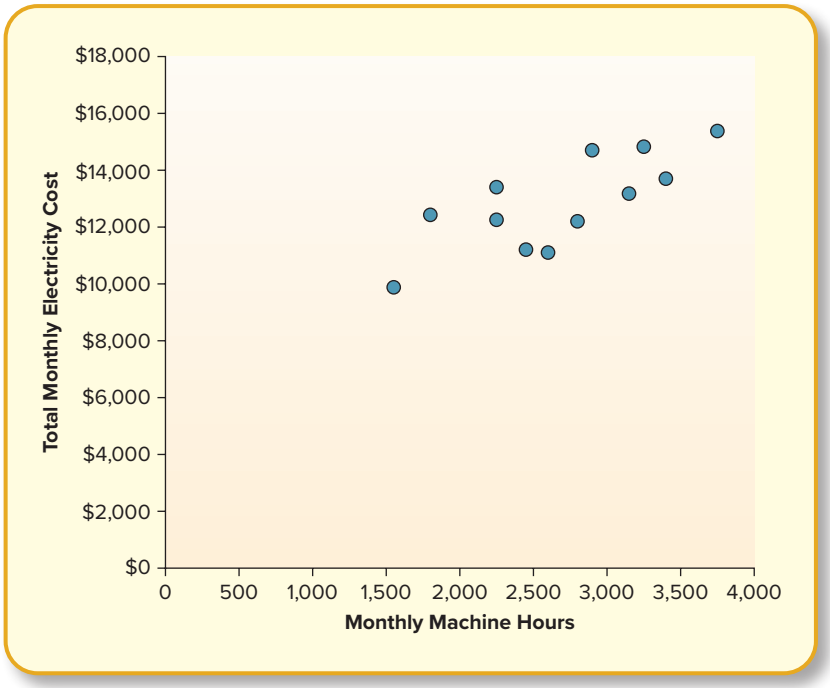
■ **LO5–2**
Separate mixed costs into their variable and fixed components using the high-low method.

In preparation to conduct cost-volume-profit analysis, and for general planning and budgeting purposes, mixed costs should be separated into variable and fixed costs. The first step in this process is to gather data on how costs vary with changes in the activity base. For example, suppose **Whirlpool** had the electricity costs provided in Illustration 5–7 while manufacturing a particular dishwasher component during the year.

ILLUSTRATION 5–7
Machine Hours and Electricity Costs by Month

Month	Machine Hours	Electricity Cost
January	2,250	$12,250
February	1,800	12,425
March	1,550	9,875
April	2,800	12,200
May	3,400	13,700
June	3,250	14,825
July	2,900	14,700
August	3,150	13,175
September	2,600	11,100
October	2,250	13,400
November	3,750	15,375
December	2,450	11,200
Totals	32,150	$154,225

ILLUSTRATION 5–8
Scatterplot of Monthly Machine Hours and Electricity Costs



The data in Illustration 5–7 can be plotted in a scatter diagram to visually demonstrate the relationship between machine hours and electricity costs. When creating a scatter diagram to assess mixed costs, we put the activity level (monthly machine hours) on the horizontal axis and the costs (monthly electricity cost) on the vertical axis, as presented in Illustration 5–8.

The next step is to draw a line that visually represents the relationship between machine hours and electricity cost. This line will help us separate mixed costs into their variable and fixed components. We'll cover two methods: (1) the simpler high-low method in the next section and (2) the regression method in the appendix to this chapter.

THE HIGH-LOW METHOD

The **high-low method** is a simple way to create a line that represents the plotted data. It relies on the idea that any two points can be connected with a straight line. In his case, we draw the line from the point with the *highest* activity level to the point with the *lowest* activity level. In Illustration 5–9, the solid line extends from the highest monthly machine hours to the lowest monthly machine hours. The dashed line represents the point where this line intersects the vertical axis, which indicates the amount of fixed cost.

We can now use this line to separate the total costs into their variable and fixed components in four steps.

Step 1: Determine the variable cost per unit. The slope of the plotted line represents the variable cost per unit. The slope of any line is calculated as the "rise over run." In this context, the "rise" refers to the increase in total monthly cost and the "run" refers to the difference in total machine hours. We calculate these differences as follows (refer back to amounts in Illustration 5–7):

- **Calculate the "rise"**—the difference in total cost between the highest and lowest activity levels.

November cost (highest activity)	$15,375
March cost (lowest activity)	−9,875
Difference	$ 5,500

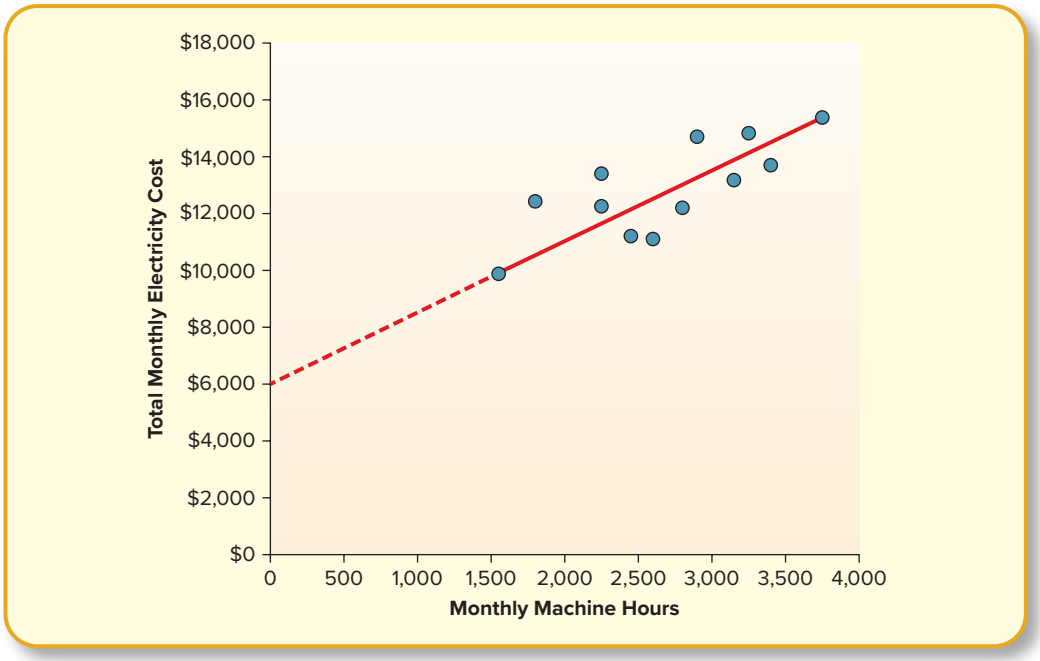


ILLUSTRATION 5–9
Scatterplot of Monthly Machine Hours and Electricity Costs with a Line Drawn Using the High-Low Method

- **Calculate the "run"**—the difference in activity level, measured in hours, between the highest and lowest activity levels.

November level (highest activity)	3,750 hours
March level (lowest activity)	−1,550 hours
Difference	2,200 hours

- **Calculate the slope**—the "rise" divided by the "run." This is our estimate of the variable cost per unit.

$$\textbf{Slope (variable cost per unit)} = \$5{,}500 \div 2{,}200 \text{ hours} = \$2.50/\text{hour}$$

Step 2: Determine total variable costs. Now that we have the variable cost per unit, we can calculate total variable costs at either the highest or lowest level of activity using the formula below. Both levels will yield the same total variable cost. For example, for the month of November (highest activity):

$$\text{Total variable costs} = \text{Variable costs per unit} \times \text{Volume}$$

$$\text{Total variable costs} = \$2.50 \times 3{,}750 \text{ hours} = \$9{,}375$$

Step 3: Determine the total fixed costs. We can now calculate the total fixed costs, using the following cost formula:

$$\text{Total mixed costs} = \text{Total variable costs} + \text{Total fixed costs}$$

This formula can be rearranged to solve for total fixed costs as follows:

$$\text{Total fixed costs} = \text{Total mixed costs} - \text{Total variable costs}$$

From the data in Illustration 5–7, we know that total mixed costs for the month of November are $15,375. From step 2, we determined that total variable costs are $9,375. We can now calculate total fixed costs as follows:

Total fixed costs = **$15,375** − **$9,375** = **$6,000**

We performed the calculations above using the month with the highest level of machine hours (November), but again, we would get the same fixed costs if we use the lowest level of production (March).

Step 4: Express the cost formula. We can now express the cost formula as follows:

				Total variable costs		
Total mixed costs	=	Total fixed costs	+	Variable costs per unit	×	Volume
Total mixed costs	=	$6,000	+	$2.50	×	Machine hours

KEY POINT

A common method to separate mixed costs into fixed costs and variable costs is the high-low method. Under this method, total mixed costs are determined at the lowest activity level and at the highest activity level. The linear relationship between these two activity levels (the slope) represents the variable costs per unit. Using the highest or lowest activity level to calculate total variable costs, total fixed costs can then be determined as the difference between total mixed costs and total variable costs.

Contribution Margin Income Statement

■ LO5–3
Prepare a contribution margin income statement.

After categorizing all costs as either variable or fixed and separating mixed costs into their variable and fixed components, the traditional income statement can be reorganized into a format that is more useful for internal operations and decision making.

This reorganized statement, known as the **contribution margin income statement**, emphasizes cost behavior by making a clear distinction between variable costs and fixed costs. This distinction provides managers with valuable information they can use when making decisions related to production and pricing decisions, as discussed in Part B of this chapter. This statement highlights the **contribution margin**, which we compute as

Sales revenue − **Total variable costs** = **Contribution margin**

Essentially, contribution margin represents the amount of money left from sales after covering all variable costs. This "leftover" amount is available to cover the fixed costs and contribute to profits.

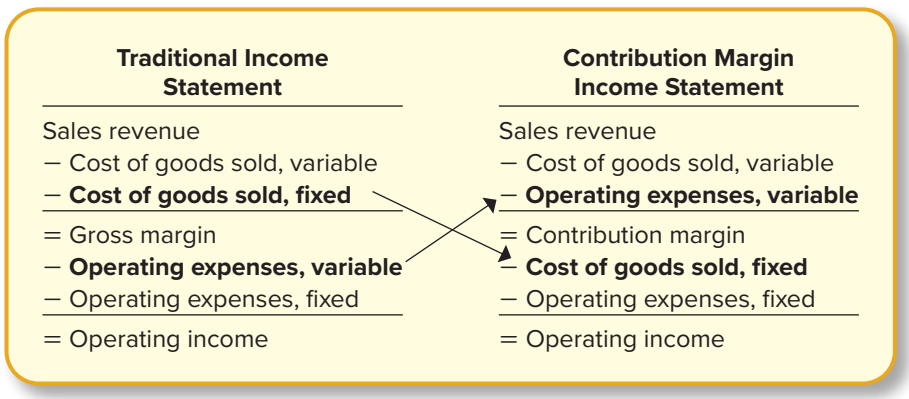
Then, the difference between contribution margin and total fixed costs equals the company's operating income.

Contribution margin − **Total fixed costs** = **Operating income**

Illustration 5–10 compares a traditional income statement to a contribution margin income statement. In a traditional income statement, both variable and fixed costs associated with cost of goods sold are subtracted from sales revenue to calculate gross margin.

Then, variable and fixed operating expenses are subtracted to calculate operating income. In contrast, a contribution margin income statement subtracts all variable costs (related to both cost of goods and operating expenses) from sales revenue to calculate the contribution margin. All fixed costs are then subtracted to arrive at operating income.

ILLUSTRATION 5–10
Comparison of Traditional and Contribution Margin Income Statements



COMMON MISTAKE

A common mistake is omitting variable selling and administrative expenses from the contribution margin section of the income statement. Students often focus only on variable production costs, forgetting that all variable costs belong above the contribution margin line.

ILLUSTRATION 5–11
Excerpt from El Pollo Loco's Annual Report

Real-World Perspectives

The restaurant chain **El Pollo Loco** discloses the following regarding its contribution margin:

> *"Restaurant contribution and restaurant contribution margin are neither required by, nor presented in accordance with, GAAP. Restaurant contribution is defined as company-operated restaurant revenue less company restaurant expenses which includes food and paper cost, labor and related expenses and occupancy and other operating expenses, where applicable. . . . Management uses restaurant contribution and restaurant contribution margin as key metrics to evaluate the profitability of incremental sales at our restaurants, to evaluate our restaurant performance across periods, and to evaluate our restaurant financial performance compared with our competitors.*

https://www.sec.gov/Archives/edgar/data/1606366/000160636619000007/loco-10k12262018.htm

Illustration 5–11 provides a disclosure from **El Pollo Loco** that discusses how the company defines and uses contribution margin.

The contribution margin income statement also can be formatted to allow managers to analyze the relationships between sales and costs on a *per-unit* basis. Illustration 5–12 presents this alternative format. When managers understand these relationships, they can answer important questions such as

- How many units do they need to sell to avoid operating at a loss?
- What should be the selling price per unit to cover all costs?
- How much profit can they expect to earn for a specific amount of sales revenue?

ILLUSTRATION 5–12
Contribution Margin Income Statement on a Per-Unit Basis

Contribution Margin Income Statement	Per-Unit Basis
Sales revenue	Sales price per unit × Units sold
− Variable costs	− Variable rate per unit × Units sold
= Contribution margin	= Contribution margin per unit × Units sold
− Fixed costs	− Fixed costs
= Operating income	= Operating income

KEY POINT

A contribution margin income statement differs from a traditional income statement. In a contribution margin income statement, sales revenue minus all variable costs are subtracted from sales revenue to calculate the contribution margin. We then subtract all fixed costs to calculate operating income.

Let's Review

Using the high-low method and the information that follows, (1) compute the monthly variable cost per kilowatt-hour, (2) compute the monthly fixed electricity cost, and (3) express the monthly electricity cost formula and its relevant range.

Month	Kilowatt-Hours	Electricity Used Costs
April	90	$450
May	80	430
June	70	420

Solution:

Volume	Month	Activity Level	Cost
High	April	90 hours	$450
Low	June	70 hours	420
Difference		20 hours	$ 30

1. Variable cost pet kilowatt-hour = $30 ÷ 20 hours
   = $1.50 per hour
2. Fixed costs for April: $450 − (90 × $1.50) = $315
   Fixed costs for June: $420 − (70 × $1.50) = $315
3. Monthly electricity costs = ($1.50 × Hours) + $315

The cost formula can be used for hourly activity between 70 and 90 hours per month.

CVP ANALYSIS AND BREAKEVEN POINT

PART B

CVP Analysis

■ LO5–4
Understand CVP analysis.

Cost-volume-profit (CVP) analysis is an analysis tool used by managers to help them examine how changes in costs, volume, and sales prices affect the company's profits. More specifically, CVP analysis helps managers with the following:

- **Pricing.** CVP analysis helps managers to examine how different pricing strategies affect profitability. This analysis helps in determining the best pricing to maximize profits.
- **Breakeven point.** CVP analysis helps managers identify the breakeven point, which is the level of sales or production at which the company has neither a profit nor a loss (operating income equals zero). This information can be used to help make decisions about whether to pursue a particular project or product.
- **Profit planning.** CVP analysis helps managers to determine profit targets and the necessary sales levels to achieve those targets. This helps in setting realistic budgets and performance goals.
- **Sales mix decisions.** CVP analysis helps managers determine the most profitable *mix* of products by comparing how each product contributes to margins.
- **Cost control.** CVP analysis helps managers understand how costs behave with changes in volume, which helps them identify ways to control costs and improve cost efficiency.
- **Capital budgeting.** CVP analysis helps managers evaluate investment decisions by helping them understand how changes in volume and costs will affect the return on investment of potential projects.
- **Performance evaluation:** CVP analysis helps managers assess the performance of the company's divisions and departments by determining their contribution margins and breakeven points.

In the context of CVP analysis, "profits" typically refer to operating income rather than bottom-line net income. We also typically make several simplifying assumptions. If any of these assumptions are unreasonable, the analysis may be misleading. The key assumptions underlying CVP analysis (within the relevant range) include

- The number of units sold equals the number of units produced.
- The sales price is constant.
- Variable cost per unit is constant.
- Total fixed costs do not change.

THE CVP EQUATION

At the heart of CVP analysis is the **CVP equation**, which is essentially a restatement of the contribution margin income statement. It is expressed as

Sales revenue (Sales price × Volume) − **Variable costs** (Variable cost per unit × Volume) − **Fixed costs** = **Profit** (Operating Income)

The five key variables in the CVP equation include

- Sales price.
- Volume of units produced and sold.
- Variable cost per unit (sometimes called the "variable rate").
- Fixed costs.
- Profit (operating income).

Managers use the CVP equation by entering actual values and then adjusting one variable to see how that change affects the overall analysis. For example, suppose managers at

a local **Best Buy** are projecting profits for TV installations in the upcoming year. They have the following details:

- 4,000 installation services are expected (volume).
- Variable costs per installation are $80.
- Fixed costs for the installation division are $12,000 per year.
- Desired profit (operating income) is $50,000.

What sales price does Best Buy need to charge its customers to earn a profit of $50,000? We can answer this question using the CVP equation. To do so, we simply plug in the known values and solve for the unknown variable, which, in this case, is the sales price of the installation service.

(Sales price × Volume) – (Variable costs per unit × Volume) – Fixed costs = Profit
(Sales price × $4,000) – ($80 × 4,000) – $12,000 = $50,000
(Sales price × $4,000) – $320,000 – $12,000 = $50,000
Sales price × $4,000 = $320,000 + $12,000 + $50,000
Sales price × $4,000 = $382,000
Sales price = $95.50

This means that Best Buy will need to charge customers $95.50 per installation to generate $50,000 in operating income from TV installations for the year.

KEY POINT

Cost-volume-profit (CVP) analysis is an analysis tool used by managers to help them examine how changes in costs, volume, and sales prices affect a company's profits. The basic equation shows that sales revenue minus variable costs and fixed costs equals operating income. Managers can adjust any one of the components to change the analysis.

Breakeven Analysis

■ **LO5–5**
Define breakeven point and determine breakeven point for a single product or service.

The **breakeven point** is a critical performance threshold where a company's total sales revenue exactly equals its total operating costs. In other words, it tells us the volume at which the company "breaks even" and operating income is zero.

- Volume **above** the breakeven point results in a **profit.**
- Volume **below** the breakeven point results in a **loss.**

When managers consider launching a new product line or offering new services, determining the breakeven point is a crucial step in evaluating its potential success. Additionally, breakeven analysis can help managers determine whether existing products or services should be continued or discontinued.

The equation for determining the breakeven point is

Sales revenue (Sales price × Volume) – **Variable costs** (Variable cost × Volume) + **Fixed costs** + **Zero profit**

Example #1: Solving for breakeven volume. Let's walk through an example of how to use the breakeven point equation to calculate the *sales volume* needed to break even. Suppose a local **Best Buy** store offers wireless speaker installation and has the following sales and cost information for the year:

- Sales price per installation is $90.
- Variable costs per installation are $50.
- Fixed costs related to installation services for this store are $20,000 per year.

How many installations does this Best Buy store need to sell to break even?

(Sales price × Volume) – (Variable rate × Volume) – Fixed costs = $0
($90 × Volume) – ($50 × Volume) – $20,000 = $0
$40 × Volume = $20,000
Volume = $20,000 ÷ $40
Volume = 500 units (breakeven)

The Best Buy store must perform 500 installations to break even on this particular service offering. The breakeven point is also often expressed in sales dollars, which we can determine by multiplying 500 units by the sales price of $90 to arrive at total sales dollars of $45,000. This means that the store needs to generate $45,000 in sales to break even on the installation services.

Example #2: Solving for breakeven sales price. Now suppose the Best Buy store offers appliance installation. Historical data suggest the following for the year:

- 400 installations are expected (volume).
- Variable costs per installation are $100.
- Fixed costs are $30,000 per year.

What sales price should Best Buy charge to break even?

(Sales price × Volume) – (Variable rate × Volume) – Fixed costs = $0
(Sales price × 400 installations) – ($100 × 400 installations) – $30,000 = $0
(Sales price × 400 installations) – $40,000 – $30,000 = 0
Sales price × 400 installations = $70,000
Breakeven sales price = $175 per installation

The analysis indicates that Best Buy will need to charge $175 per installation to break even. This results in total sales revenue of $70,000 (= $175 × 400 units).

BREAKEVEN ANALYSIS USING THE CONTRIBUTION MARGIN

Another way to determine the breakeven point is by using the contribution margin in the equation. As a reminder, the contribution margin is sales revenue minus variable costs.

Sales revenue (Sales price × Volume) – **Variable costs** (Variable rate × Volume) = **Contribution margin**

The contribution margin equation can be used to simplify the breakeven equation as

Contribution margin (Contribution margin per unit × Volume) – **Fixed costs** = **Zero profit**

Rearranging the equation highlights that the breakeven point occurs when the contribution margin equals fixed costs:

Contribution margin (Contribution margin per unit × Volume) = **Fixed costs**

By expressing contribution margin as contribution margin per unit multiplied by volume, we arrive at the following formula to calculate breakeven volume:

Breakeven volume = **Fixed costs** ÷ **Contribution margin per unit**

We can use this formula to determine breakeven volume. Let's illustrate how this works with another example.

Example #3: Solving for breakeven volume using contribution margin. Suppose the **Best Buy** store sells headphones and has the following information:

- Fixed costs associated with the headphones are $30,000 per year.
- Contribution margin per unit is $50 (the sale price per unit is $80 and the variable costs per unit are $30).

How many headphones must this Best Buy store sell to break even?

Breakeven volume = Fixed costs ÷ Contribution margin per unit
= $30,000 ÷ ($80 − $30)
= $30,000 ÷ $50
= 600 units

The analysis indicates that Best Buy must sell 600 headphones to break even. This translates into total sales of $48,000 (= $80 × 600 units).

BREAKEVEN ANALYSIS USING THE CONTRIBUTION MARGIN RATIO

An alternative way of determining the breakeven point in total sales uses the contribution margin ratio. This ratio measures the percentage of each sales dollar that contributes to covering a company's fixed costs and can be calculated on either a total-dollar basis or a per-unit basis.

Total-Dollar Basis:

Contribution margin ratio = **Contribution margin** (Contribution margin per unit × Volume) ÷ **Sales revenue** (Sales price × Volume)

Per-Unit Basis:

Contribution margin ratio = **Contribution margin per unit** ÷ **Sales price**

A higher contribution margin ratio indicates that a larger portion of sales revenue is available to cover fixed costs and, ultimately, generate profit. Therefore, a higher ratio is generally seen as a positive indicator of a company's financial health. Illustration 5–13 provides examples of contribution margins disclosed by various companies.

The breakeven point in total sales revenue can be calculated by dividing fixed costs by the contribution margin ratio.

Breakeven sales revenue = **Fixed costs** ÷ **Contribution margin ratio**

Let's revisit example #1 to understand how to use this formula in the context of **Best Buy's** installation of wireless speakers. The information for the year follows:

- Sales price per installation is $90.
- Variable costs per installation are $50.
- Fixed costs related to installation services for this store are $20,000 per year.

Real-World Perspectives

The contribution margin ratio varies by industry based on the general proportion of variable and fixed costs that are observed in that industry. Thus, managers typically compare the contribution margin ratios among companies in the same industry. Here are some examples of contribution margin ratios for some familiar companies in various industries:

Lyft	58.6%
Netflix	34.0%
Doordash	23.0%
Noodles and Company	11.9%
Netgear	13.7%

ILLUSTRATION 5–13
Contribution Margins of Various Companies

Contribution margin per unit = $90 – $50 = $40
Contribution margin ratio = $40 ÷ $90 = 44.44% (rounded)
Breakeven sales revenue = $20,000 ÷ 44.44% = $45,000

CVP ANALYSIS USING A GRAPH

Some managers find it useful to conduct CVP analysis using a graph, which highlights the relationships over a wide range of prices and volume. A **CVP graph** includes the following parts:

- A horizontal axis representing the volume (units of output).
- A vertical axis for dollars.
- A horizontal line originating from the vertical axis at the fixed cost level.
- A total cost line that starts at the point where the fixed cost line intersects the vertical axis and then slopes upwards to the right. The slope of this line is determined by the variable cost per unit.
- A total revenue line that starts from the point where both the vertical and horizontal axes meet (the origin). The slope of the total revenue line depends on the sales price per unit.

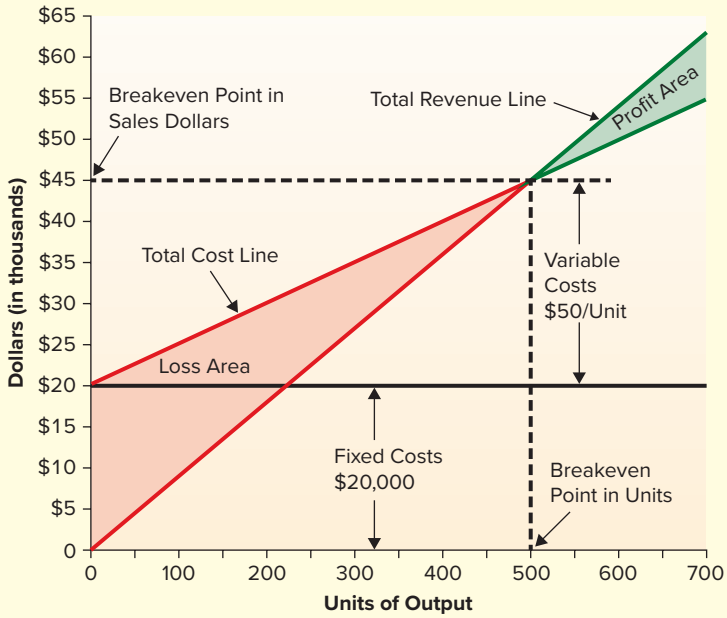
Let's revisit example #1 to demonstrate how a CVP graph is created. In this example, suppose a **Best Buy** store offers wireless speaker installation for $90. The variable cost is $50 per installation and fixed costs are $20,000 per year. Illustration 5–14 presents the CVP graph for wireless speakers.

The CVP graph highlights the "profit area" shaded green. When companies are operating in this area, it means they enjoy some cushion, or *a margin of safety*. The **margin of safety** is the excess sales dollars over the breakeven sales dollars. This concept is discussed in more detail later in the chapter.

KEY POINT

The breakeven point provides the conditions under which a company's total sales revenue exactly matches its total operating costs (variable costs plus fixed costs). The breakeven point is the point at which the company "breaks even" and profits are exactly zero. Activity beyond this point leads to a profit, while activity below this point leads to a loss.

ILLUSTRATION 5–14
CVP Graph for Wireless Speakers



Let's Review

A local business wants to make a profit of $10,000 each month. It has variable costs of $5 per unit and fixed costs of $20,000 per month. How much must it charge per unit if 6,000 units are sold?

Solution:

$$(\text{Sales Price} \times \text{Units Sold}) - (\text{Variable Rate} \times \text{Units Sold}) - \text{Fixed Costs} = \text{Profit}$$

$$(\text{Sales Price} \times 6{,}000) - (\$5 \times 6{,}000) - \$20{,}000 = \$10{,}000$$

$$\text{Sales Price} = \frac{(\$5 \times 6{,}000) + \$20{,}000 + \$10{,}000}{6{,}000 \text{ units}} = \frac{\$60{,}000}{6{,}000} = \$10 \text{ per unit}$$

Usefulness of CVP Analysis

■ **LO5–6**
Understand how managers apply CVP analysis to target profits.

In the decision-making process, CVP analysis is useful in three important ways:

1. **Planning.** During the planning phase, managers may start with a predetermined sales volume that they believe is realistic based on the company's capacity and market competition. In such cases, they use CVP analysis to explore how changes in sales prices or costs can help them achieve a specific profit target. In other cases, when sales prices or costs may be largely determined by market forces, CVP analysis can help determine how changes in volume might impact profitability.
2. **Budgeting.** CVP analysis plays a key role in the budgeting process by helping assess departmental activities within an organization. It serves as a valuable tool for making informed decisions about resource allocation.
3. **Evaluation.** At the end of a financial period, managers evaluate performance by comparing actual costs with projected costs, which are calculated using CVP analysis based on the actual sales volume. This evaluation helps managers make better decisions related to future planning and budgeting.

In the section to follow, we'll examine how managers use CVP analysis to create "what-if" scenarios. This discussion demonstrates how target profits are affected based on alternative assumptions used by managers.

APPLYING CVP ANALYSIS TO TARGET PROFITS

The primary goal of a business venture is not merely to break even, but to generate profits. Profits allow a company to grow, attract talented employees, and raise capital more easily from banks and investors. Many companies also set specific profit targets they want to meet or exceed. For example, when a company takes out a bank loan, management often agrees to debt covenants that require the company to maintain a certain level of profitability *above* breakeven. For publicly-traded companies, meeting the profit expectations of professional analysts is especially important.

Target profit analysis is a special type of CVP analysis that focuses on achieving a specified level of profitability. For this analysis, the goal is to determine what volume, price, or cost conditions are required to achieve a desired profit. The CVP equation is modified as follows:

Sales revenue (Sales price × Volume) − **Variable costs** (Variable rate × Volume) − **Fixed costs** = **Target profit**

To illustrate, let's revisit example #1 using a local **Best Buy** store that offers the installation of wireless speakers. We repeat the sales and cost information for the year:

- Sales price per installation is $90.
- Variable costs per installation are $50.
- Fixed costs related to installation services for this store are $20,000 per year.

Let's suppose that Best Buy wants to make a profit of $4,000 on this particular service. How many installations must the store sell to hit this target?

(Sales price × Volume) − (Variable rate × Volume) − Fixed costs = Target profit
($90 × Volume) − ($50 × Volume) − $20,000 = $4,000
$40 × Volume = $24,000
Volume = $24,000 ÷ $40
Target volume = 600 units

Alternatively, we can use the contribution margin per unit to arrive at this same target volume using this equation:

Target volume = (**Fixed costs** + **Target profit**) ÷ **Contribution margin per unit**

Target volume = (Fixed costs + Target profit) ÷ Contribution margin per unit
Target volume = ($20,000 + $4,000) ÷ ($90 − $50)
Target volume = $24,000 ÷ $40
Target volume = 600 units

To summarize Best Buy's plans for the coming year, a contribution margin income statement can be prepared, as presented in Illustration 5–15.

ILLUSTRATION 5–15
Contribution Margin Income Statement

Contribution Income Statement
For the Year Ended December 31

	Per Unit	Total for 600 Units
Sales revenue	$ 90	$ 54,000
Variable costs	−50	−30,000
Contribution margin	$ 40	$ 24,000
Fixed costs		−20,000
Operating income		$ 4,000

Now what if the Best Buy store wants to consider several alternatives to this baseline plan to see how operating income could change. Management identifies the following three alternatives.

Alternative 1: Decrease variable cost and increase sales volume. What if Best Buy could reduce variable cost by $3 per unit (from $50 to $47) by improving its hiring and increase sales volume by 10% (from 600 units to 660 units) by improving sales personnel training? How would these changes affect profits compared to those calculated in Illustration 5–15? Illustration 5–16 demonstrates that profits would increase by $4,380.

ILLUSTRATION 5–16

Alternative 1: Decrease in Variable Costs to $47 per Unit and Increase in Sales Volume to 660 Units

Alternative 1	Per Unit	Total for 660 Units
Sales revenue	$90	$59,400
Variable costs	−47	−31,020
Contribution margin	$43	$28,380
Fixed costs		−20,000
Operating income		$ 8,380
Increase in operating income ($8,380 − $4,000*)		$ 4,380

* See Illustration 5–15 for calculation of $4,000.

Alternative 2: Increase fixed costs and increase sales volume. What if the marketing department believes a $500 increase in advertising (a fixed cost) would increase sales volume by 5% (from 600 units to 630 units)? How would these changes impact profits compared to those calculated in Illustration 5–15? Illustration 5–17 demonstrates that profits would increase by $700.

ILLUSTRATION 5–17

Alternative 2: Increase in Fixed Costs to $20,500 per Unit and Increase in Sales Volume to 630 Units

Alternative 2	Per Unit	Total for 630 Units
Sales revenue	$90	$56,700
Variable costs	−50	−31,500
Contribution margin	$40	$25,200
Fixed costs		−20,500
Operating income		$ 4,700
Increase in operating income ($4,700 − $4,000*)		$ 700

* See Illustration 5–15 for calculation of $4,000.

Alternative 3: Increase sales price and decrease sales volume. What if the sales manager estimates that a $10 increase in the sales price per unit (from $90 to $100) would decrease sales volume by 15% (from 600 units to 510 units)? How would these changes impact profits compared to those calculated in Illustration 5–15? Illustration 5–18 demonstrates that profits would increase by $1,500.

ILLUSTRATION 5–18

Alternative 3: Increase in Sales Price to $100 and Decrease in Sales Volume to 510 Units

Alternative 3	Per Unit	Total for 510 Units
Sales revenue	$100	$51,000
Variable costs	− 50	−25,500
Contribution margin	$ 50	$25,500
Fixed costs		−20,000
Operating income		$ 5,500
Increase in operating income ($5,500 − $4,000*)		$ 1,500

* See Illustration 5–15 for calculation of $4,000.

Comparative summary. We can now compare the original plan with the three alternatives in a comparative summary report that demonstrates how changes in volume, price, or costs impact profits (refer to Illustration 5–19).

ILLUSTRATION 5–19 Comparison of Alternatives

	Original Plan	Alternative 1	Alternative 2	Alternative 3
	Totals for 600 Units	Decrease Direct Materials Costs for 660 Units	Increase Advertising Costs for 630 Units	Increase Selling Price for 510 Units
Sales revenue	$54,000	$59,400	$56,700	$51,000
Variable costs	−30,000	−31,020	−31,500	−25,500
Contribution margin	$24,000	$28,380	$25,200	$25,500
Fixed costs	−20,000	−20,000	−20,500	−20,000
Operating income	$ 4,000	$ 8,380	$ 4,700	$ 5,500
Breakeven point in whole units (FC ÷ CM):				
$20,000 ÷ $40 =	500			
$20,000 ÷ $43 =		466*		
$20,500 ÷ $40 =			513*	
$20,000 ÷ $50 =				400

*Rounded up to next whole unit

The three alternatives differ as follows:

- **Alternative 1** reduces variable costs, increasing the contribution margin per unit from $40 to $43 and lowering the breakeven point to 466 installations.
- **Alternative 2** raises fixed costs without changing the contribution margin per unit, increasing the breakeven point to 513 installations.
- **Alternative 3** increases the selling price, raising the contribution margin from $40 to $50 and lowering the breakeven point to 400 installations.

KEY POINT

A special use of CVP analysis is target profit analysis. This analysis focuses on determining how changes in sales price, volume, variable costs, and fixed costs affect the breakeven point needed to achieve a specified level of profitability (target profit).

Let's Review

A local real estate appraisal business is planning its home appraisal activities for the coming year. The manager estimates that the variable costs per appraisal will be $220, monthly fixed costs are $16,200, and service fee revenue will be $400 per appraisal. How many appraisals will the business have to perform each month to achieve a target profit of $18,000 per month?

Solution:

Sales revenue − Variable costs − Fixed costs = Profit

($400 × Targeted sales units) −

($220 × Targeted sales units) −$16,200 = $18,000

$180 × Targeted sales units = $34,200

Targeted sales units = 190 appraisals per month

PART C

ADDITIONAL ANALYSIS FOR DECISION MAKING

■ LO5–7
Determine breakeven point for multiple products or services.

Breakeven Analysis for Multiple Products

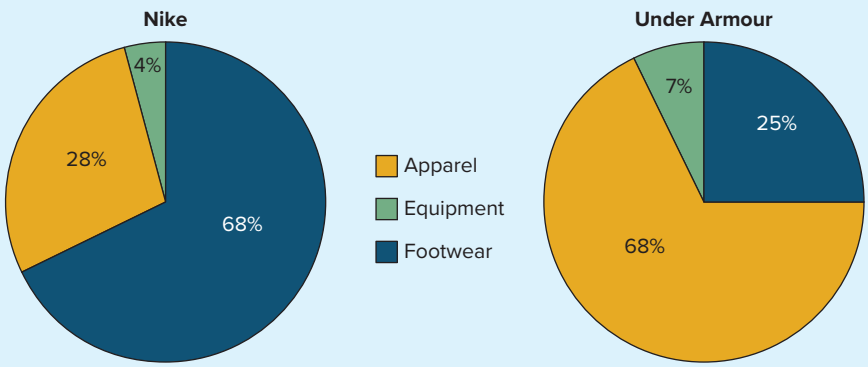
Most companies offer more than a single product or service, providing a range of offerings. When a company sells multiple products or services, CVP analysis becomes more complex. The challenge comes from the fact that different products typically have different selling prices, variable and fixed costs, and contribution margins. As a result, the breakeven point depends on the relative proportions (or mix) of the different products or services sold.

The **sales mix** is the proportion of different products or services a company typically sells. Illustration 5–20 presents the sales mix for two competitors in the footwear and apparel industry.

ILLUSTRATION 5–20
Excerpt from Nike's and Under Armour's Annual Reports

Real-World Perspectives

Nike and **Under Armour** are competitors but have very different sales mixes, as disclosed in their annual reports. Nike focuses more on footwear, while Under Armour focuses more on apparel.



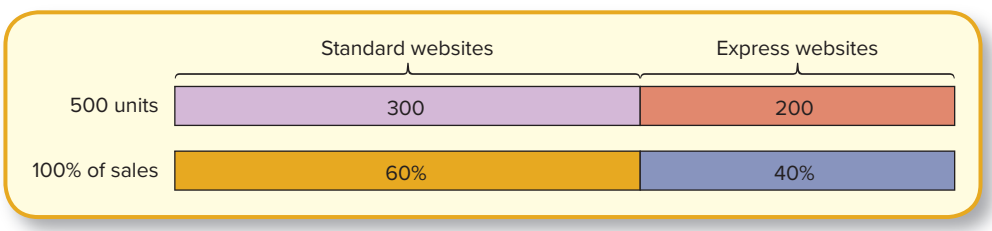
To conduct CVP analysis for multiple products, managers typically assume a constant sales mix to simplify the analysis. This assumption allows them to calculate breakeven points, while recognizing that real-world fluctuations in the sales mix may require managers to consider alternative scenarios.

Let's consider an example. Assume a web design company, such as **Squarespace**, offers two types of websites: standard and express. The company typically sells a total of 500 websites per year, with 300 being standard and 200 being express. Let's further assume total fixed costs of $320,000.

We can determine the breakeven point in four steps.

Step 1: Determine the sales mix. If the company sells a total of 500 websites, with 300 being standard and 200 being express, then the sales mix can be expressed as 3:2. In other words, for every three standard websites sold, two express websites are sold. As demonstrated in Illustration 5–21, the sales mix also can be stated in percentage terms. Of the 500 units sold, 60% (= 300 ÷ 500) are standard sales and 40% (= 200 ÷ 500) are express sales.

ILLUSTRATION 5–21
Sales Mix



Step 2: Calculate the weighted-average contribution margin per unit. Next, we calculate the weighted-average contribution margin by multiplying each product's contribution margin per unit by its percentage of the sales mix. In this case, the weighted-average contribution margin per unit is $320.

	Selling Price per Unit		Variable Cost per Unit		Contribution Margin per Unit		Percent of Sales Mix		Weighted-Average Contribution Margin per Unit
Standard	$900	–	$500	=	$400	×	60%	=	$240
Express	$400	–	$200	=	$200	×	40%	=	80
Weighted-average contribution margin									$320

Step 3: Calculate the weighted-average breakeven point. We next divide total fixed costs by the weighted-average contribution margin per unit to determine the weighted-average breakeven volume.

Breakeven volume = Fixed costs ÷ Weighted-average contribution margin per unit
= $320,000 ÷ $320
= 1,000 units

Step 4: Calculate the breakeven point for each product. Finally, we multiply the weighted-average breakeven point by each product's percentage of the sales mix to determine the breakeven point for each product.

	Weighted-Average Breakeven Point		Percent of Sales Mix		Breakeven Point
Standard	1,000 units	×	60%	=	600 units
Express	1,000 units	×	40%	=	400 units

We can verify the results by determining the contribution margin for each product and then subtracting the fixed costs.

Contribution margin:		
Standard	600 units × $400	$240,000
Express	400 units × $200	80,000
Total contribution margin		$320,000
Fixed costs		−320,000
Profit		$ 0

KEY POINT

When there are multiple products or services involved, the breakeven point depends on the relative proportions (or sales mix) of the different products or services sold.

Let's Review

Using the weighted-average contribution margin approach, find the breakeven point in units for a local business's two products: custom-printed crew stocks and beanies.

- Crew socks have a selling price of $20 per pair and a variable cost of $11.
- Beanies have a selling price of $12 each and a variable cost of $6.
- Fixed costs are $24,000, and the sales mix of crew socks to beanies is 2:1.

Solution:

Step 1.

	Selling Price		Variable Costs		Contribution Margin (CM)		Percentage of Sales Mix		Weighted-Average CM*
Crew socks	$20	−	$11	=	$9	×	66.67%	=	$6
Beanies	$12	−	$ 6	=	$6	×	33.33%	=	2
Weighted-average contribution margin									$8

*Rounded

Step 2.

Weighted-average breakeven point = $24,000 ÷ $8.00 = 3,000 units

Step 3. Breakeven point for each product line:

		Weighted-Average Breakeven Point		Sales Mix		Breakeven Point
Crew socks	=	3,000 units	×	0.6667	=	2,000 units
Beanies	=	3,000 units	×	0.3333	=	1,000 units

Step 4. Verify

Contribution margin:						
Crew socks	=	2,000	×	$9	=	$18,000
Beanies	=	1,000	×	$6	=	6,000
Total contribution margin						$24,000
Less fixed costs						24,000
Profit						$ 0

Margin of Safety

■ **LO5–8**
Calculate the margin of safety and understand how managers use it.

The **margin of safety** in CVP analysis represents the amount by which a company's actual or projected sales exceed its breakeven sales. Managers use this metric to evaluate financial risk, as it provides insight into the company's "cushion" above the breakeven point.

- A **higher** margin of safety indicates greater financial stability and less vulnerability to sales declines.
- A **lower** margin of safety indicates less financial stability and increased vulnerability to sales declines, as the company operates closer to its breakeven point.

The margin of safety helps managers understand how long their company can sustain operations during challenging periods and how much market share they can afford to lose to competitors without jeopardizing financial stability. Illustration 5–22 provides an example of how a sudden shock to a company's financial stability impacted one cruise line, **Royal Caribbean**, during the COVID-19 pandemic.

Real-World Perspectives

The cruise industry was hit particularly hard during the COVID-19 pandemic, with **Royal Caribbean** experiencing a dramatic 52.6% drop in sales that quickly surpassed its margin of safety. After 15 consecutive years of positive net income, the company reported its first net loss in 2020. The losses persisted into 2021 and 2022 as the pandemic continued. This unexpected prolonged financial downturn forced Royal Caribbean, like many companies in the industry, to find ways to stay afloat. With no cash coming in from operations, the company relied heavily on bank loans to survive, increasing its total debt by more than $4.1 billion between 2020 and 2022.

Source: Royal Caribbean Cruises LTD. Form 10-K for fiscal years ended December 31, 2021 and 2022.

ILLUSTRATION 5–22
Margin of Safety at Royal Caribbean

The margin of safety can be expressed in dollars or units.

$$\text{Margin of safety (dollars)} = \text{Actual or budgeted sales} - \text{Breakeven sales}$$
$$\text{Margin of safety (units)} = \text{Actual or budgeted units sold} - \text{Breakeven units}$$

The margin of safety also can be expressed as a percentage by dividing the margin of safety in dollars by total dollar sales. This margin of safety percentage is calculated as

$$\text{Margin of safety (percentage)} = \frac{\text{Margin of safety (dollars)}}{\text{Actual or budgeted sales}}$$

For example, suppose a **Best Buy** store needs to earn $45,000 in sales to break even on its wireless speaker installation services. Actual sales total $48,000. In this case, the margin of safety in dollars and as a percentage are calculated as

$$\text{Margin of safety (dollars)} = \$48{,}000 - \$45{,}000 = \$3{,}000$$
$$\text{Margin of safety (percentage)} = \frac{\$3{,}000}{\$48{,}000} = 6.25\%$$

This means that sales could decline by 6.25% before the company starts having losses on wireless speaker installations.

KEY POINT

The margin of safety measures how much sales can decline before reaching the breakeven point, providing an indicator of risk by quantifying the company's financial cushion against potential revenue shortfalls.

Operating Leverage

■ **LO5–9**
Calculate the degree of operating leverage and understand how managers use it.

Operating leverage measures the degree to which a company's costs are fixed versus variable. Companies with a relatively higher proportion of fixed costs have higher operating leverage. These companies are considered riskier because it takes them longer to reach the breakeven point.

The formula to determine the degree of operating leverage is

$$\text{Degree of operating leverage} = \frac{\text{Contribution margin}}{\text{Operating income}} = \frac{\text{Sales revenue} - \text{Variable costs}}{\text{Sales revenue} - \text{Variable costs} - \text{Fixed costs}}$$

Notice that fixed costs reduce operating income (the denominator) but do not affect the contribution margin (numerator). As a result, companies with higher fixed costs relative to variable costs have a higher degree of operating leverage.

The degree of operating leverage is an important measure of financial risk and reward because it reflects how changes in sales impact operating income. This relationship is demonstrated using an alternative version of the formula for the degree of operating leverage:

$$\text{Degree of operating leverage} = \frac{\text{\% Change in operating income}}{\text{\% Change in sales revenue}}$$

Companies with a higher degree of operating leverage experience a greater percentage change in operating income for a given percentage change in sales.

- **When sales are increasing,** companies with a higher degree of operating leverage have **greater growth in profits.** As fixed costs remain constant, each additional dollar of revenue contributes more significantly to operating income.
- **When sales are decreasing,** companies with a higher degree of operating leverage have **greater decline in profits.** As fixed costs remain constant, the decrease in revenue causes a more rapid decrease in operating income.

The degree of operating leverage is sometimes referred to as a "multiplier" because it shows how small changes in sales can lead to large changes in profits. An example of the multiplier effect of operating leverage is presented in Illustration 5–23.

ILLUSTRATION 5–23
Impact of Operating Leverage on Operating Income

Company	Degree of Operating Leverage	Operating Income		
		Before	After 10% Increase in Sales	After 10% Decrease in Sales
A	2	$1,000	$1,200	$800
B	4	$1,000	$1,400	$600

Notice that Company A has a degree of operating leverage of 2, indicating that a 10% increase in sales will cause a 20% increase in operating income ($1,000 × 120% = $1,200). Alternatively, a 10% decrease in sales will cause a 20% decrease in operating income ($1,000 × 80% = $800). Company B has a degree of operating leverage of 4, and it will have a 40% change in operating income ($1,400 or $600) with a 10% change in sales.

Different industries exhibit varying degrees of operating leverage based on their typical cost structures. For example, manufacturing firms often have high fixed costs due to significant investments in machinery and facilities, resulting in a high degree of operating leverage. In contrast, service companies, such as consulting firms, often have higher variable costs related to labor, resulting in a lower degree of operating leverage. Illustration 5–24 provides additional examples of companies with high and low fixed cost structures.

Finally, note that operating leverage also affects the breakeven point. Companies with high fixed costs must generate more sales to cover these fixed costs and achieve profitability. While this raises the threshold for breaking even, it also increases profitability once the breakeven point is surpassed, as each additional sale contributes more to operating income.

COMMON MISTAKE

Students sometimes mistakenly assume that a higher degree of operating leverage is always better. Don't forget that while high operating leverage can magnify profits when sales rise, it also increases risk by magnifying losses when sales decline. Higher does not necessarily mean better.

KEY POINT

Operating leverage represents the extent to which a company's costs are fixed versus variable. The degree of operating leverage provides insight into a company's financial risk and reward by measuring the sensitivity of company profits to changes in sales. Operating leverage increases profits during periods of sales growth and increases losses during periods of sales declines.

Real-World Perspectives

Industries with a Higher Proportion of *Fixed* Costs:

- **Airlines (Delta Air Lines):** High fixed costs from purchasing or leasing aircraft, maintaining fleets, and securing airport gate leases.
- **Automotive manufacturers (Ford):** Significant fixed costs for factory machinery, production facilities, and R&D investments.
- **Telecommunications companies (AT&T):** Substantial fixed costs for building and maintaining network infrastructure, including cell towers and fiber-optic cables.

Industries with a Higher Proportion of *Variable* Costs:

- **Online retailers (eBay):** Low fixed costs due to reliance on platform operations with minimal physical infrastructure.
- **Consulting firms (Boston Consulting Group):** Variable costs dominated by employee compensation tied directly to client projects.
- **Transportation services (Uber):** Variable costs primarily from independent driver payments, with limited fixed infrastructure costs.

ILLUSTRATION 5–24
Fixed and Variable Costs in Various Industries

CVP and the Management Process

As we've discussed in this chapter, CVP analysis serves various purposes throughout the decision-making process. It not only helps in planning and evaluation, but it also plays a valuable role in understanding cost dynamics during performance and communicating essential information to both internal and external stakeholders. Illustration 5–25 provides a concise summary of how CVP analysis aligns with different stages of the management process.

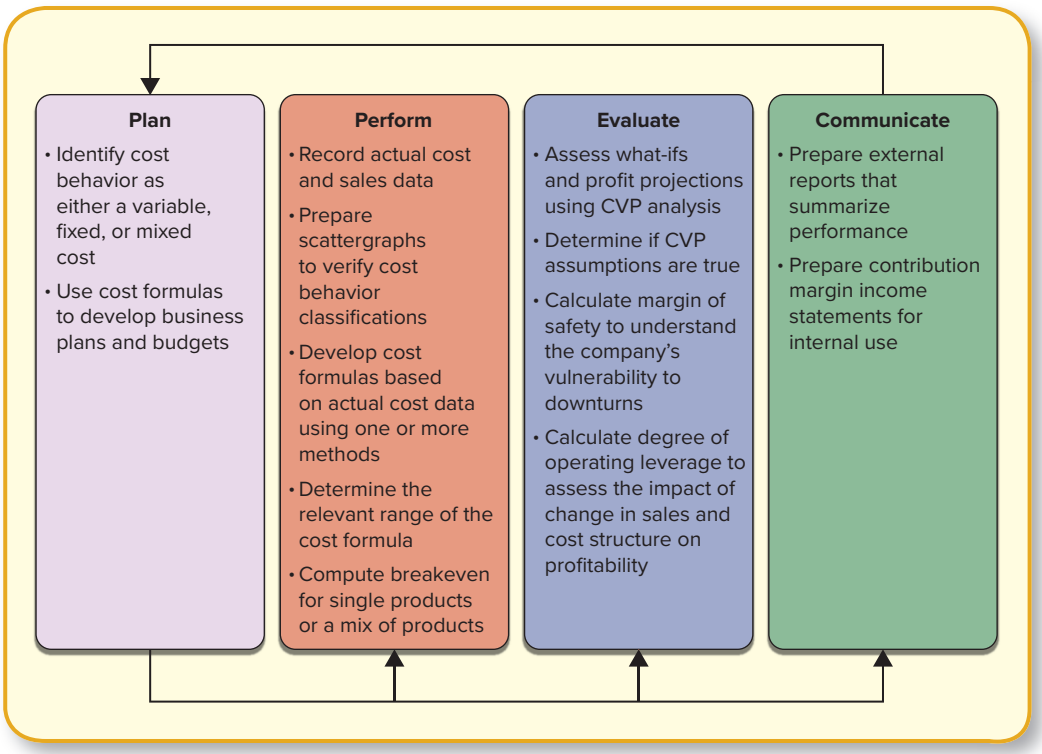


ILLUSTRATION 5–25
CVP and the Management Process

- Calculate margin of safety to understand the company's vulnerability to downturns.
- Calculate degree of operating leverage to assess the impact of change in sales and cost structure on profitability.

APPENDIX SEPARATING MIXED COSTS USING THE REGRESSION METHOD

■ LO5–10
Separate mixed costs into their variable and fixed components using the regression method.

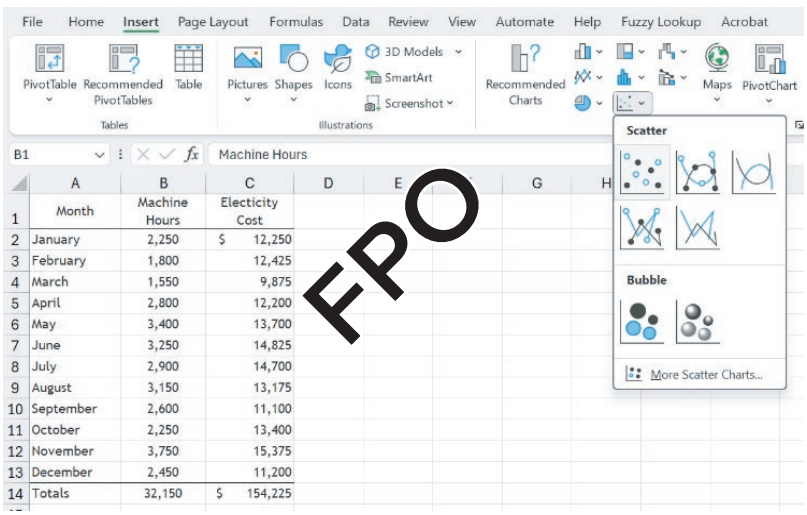
In the chapter, we learned how to separate mixed costs into their fixed and variable components using the high-low method. Another approach is the **regression method**, which uses a statistical approach to derive the linear relationship between activity levels and mixed costs. The advantage of this method is that it uses all data points (rather than just the highest and lowest activity levels).

Not to worry, however; we won't be determining regression lines by hand in this book. The mathematical calculations involved are complex, but fortunately, we can use readily available software like Excel to quickly calculate this line for us. Here are the steps to implement the regression method in Excel.

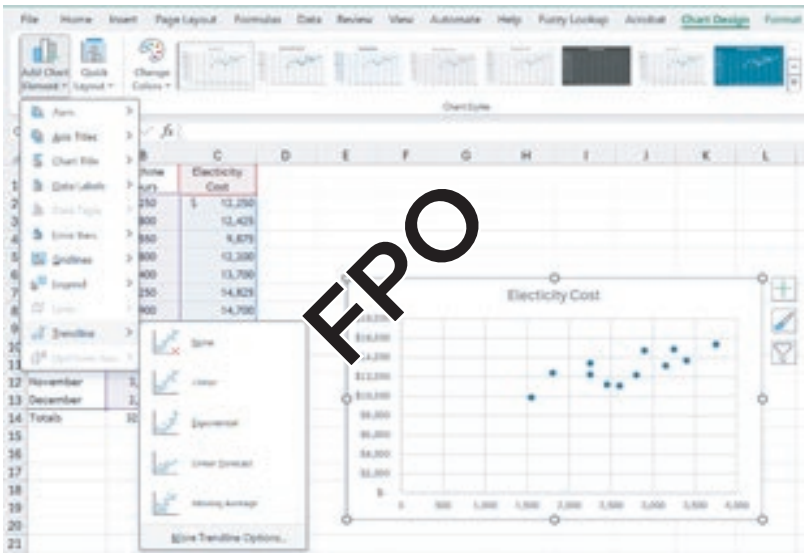
- **Step 1:** Select the two columns that you want to include in the regression. The column on the left will be on the x-axis and the column on the right will be the y-axis.

	A	B	C
1	Month	Machine Hours	Electicity Cost
2	January	2,250	$ 12,250
3	February	1,800	12,425
4	March	1,550	9,875
5	April	2,800	12,200
6	May	3,400	13,700
7	June	3,250	14,825
8	July	2,900	14,700
9	August	3,150	13,175
10	September	2,600	11,100
11	October	2,250	13,400
12	November	3,750	15,375
13	December	2,450	11,200
14	Totals	32,150	$ 154,225

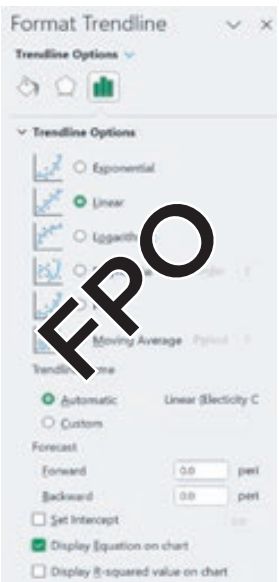
- **Step 2:** Click on the "Insert" tab and then select "Scatter."



- **Step 3:** Select the graph and then click on the "Chart Design" → "Add Chart Element" → "Trendline" → "More Trendline Options. . ."



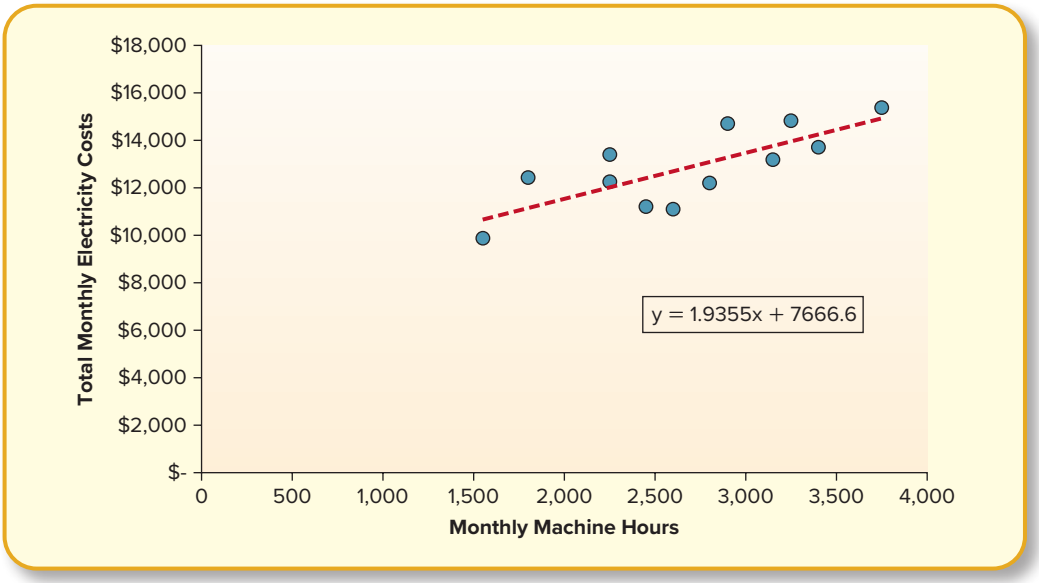
- **Step 4:** From the "Format Trendline" menu, select "Display Equation on chart."



- **Step 5:** The regression line equation will now appear in the figure and takes the form of Y = a + bX where
  - Y = the total mixed costs.
  - a = the total fixed costs (this is the Y-intercept).
  - b = the variable costs per unit (this is the slope).
  - X = the level of the activity.
- We present the scatterplot using the regression method in Illustration 5–26. The estimated variable cost per unit is $1.94 (rounded) and total fixed cost is $7,666.60. We note that these estimates differ from those based on the high-low method, which produced a variable cost per unit of $2.50 and total fixed costs of $6,000.00. Many would argue that the estimates produced by the regression method are more accurate because they are based on all of the available data.

ILLUSTRATION 5–26

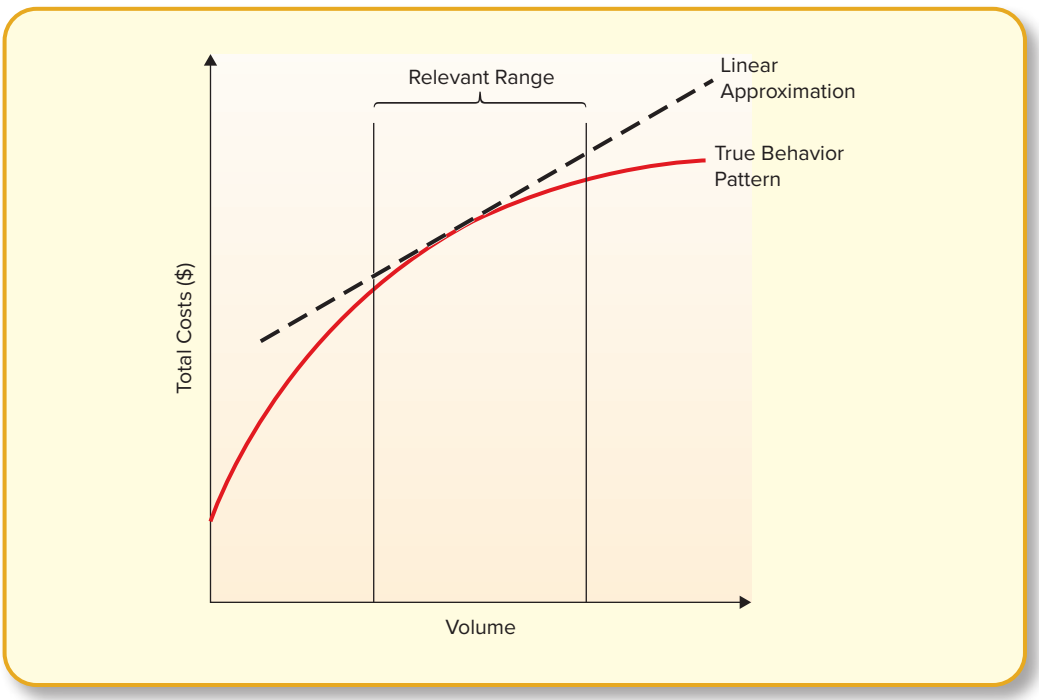
Scatterplot of Monthly Machine Hours and Electricity Costs with a Line Drawn Using the Regression Method.



Nonlinearity. The high-low method assumes a linear relationship between the activity base and total mixed costs. But what if that assumption doesn't hold? What if the mixed costs vary with the activity base in a nonlinear fashion? To simplify things, managers often assume that nonlinear costs are linear within a relevant range, as presented in Illustration 5–27.

ILLUSTRATION 5–27

Linear Approximation within the Relevant Range



A linear approximation of a nonlinear cost is not perfectly accurate, but it allows nonlinear costs to be included in cost behavior analysis. In most cases, the loss of accuracy is minimal.

KEY POINT

The regression method uses statistical software (such as Excel) to compute the linear relationship between activity level and mixed costs. The statistical output provides an intercept (the amount of total fixed costs) and a slope (variable costs per unit). Using this output, we can separate mixed costs into their variable and fixed components. The assumption of a linear relationship between activity level and mixed costs may be true only within the relevant range of activity.

THE BOTTOM LINE

LO5–1 Define cost behavior and identify variable, fixed, and mixed costs.

Cost behavior refers to the way costs change in response to changes in the level of an activity. Variable costs are costs that change in direct proportion to changes in production or other activity levels. Fixed costs are costs that do not change, regardless of the activity level. Mixed costs have a fixed component that remains constant and a variable component that changes with activity levels.

LO5–2 Separate mixed costs into their variable and fixed components using the high-low method.

A common method to separate mixed costs into fixed costs and variable costs is the high-low method. Under this method, total mixed costs are determined at the lowest activity level and at the highest activity level. The linear relationship between these two activity levels (the slope) represents the variable costs per unit. Using the highest or lowest activity level to calculate total variable costs, total fixed costs can then be determined as the difference between total mixed costs and total variable costs.

LO5–3 Prepare a contribution margin income statement.

A contribution margin income statement differs from a traditional income statement. In a contribution margin income statement, sales revenue minus all variable costs are subtracted from sales revenue to calculate the contribution margin. We then subtract all fixed costs to calculate operating income.

LO5–4 Understand CVP analysis.

Cost-volume-profit (CVP) analysis is an analysis tool used by managers to help them examine how changes in costs, volume, and sales prices affect a company's profits. The basic equation states that sales revenue minus variable costs and fixed costs equals operating income. Managers can adjust any one of the components to change the analysis.

LO5–5 Define breakeven point and determine breakeven point for a single product or service.

The breakeven point provides the conditions under which a company's total sales revenue exactly matches its total operating costs (variable costs plus fixed costs). The breakeven point is the point at which the company "breaks even" and profits are exactly zero. Activity beyond this point leads to a profit, while activity below this point leads to a loss.

LO5–6 Understand how managers apply CVP analysis to target profits.

A special use of CVP analysis is target profit analysis. This analysis focuses on determining how changes in sales price, volume, variable costs, and fixed costs affect the breakeven point needed to achieve a specified level of profitability (target profit).

LO5–7 Determine breakeven point for multiple products or services.

When there are multiple products or services involved, the breakeven point depends on the relative proportions (or sales mix) of the different products or services sold.

LO5–8 Calculate the margin of safety and understand how managers use it.

The margin of safety measures how much sales can decline before reaching the breakeven point, providing an indicator of risk by quantifying the company's financial cushion against potential revenue shortfalls.

LO5–9 Calculate the degree of operating leverage and understand how managers use it.

Operating leverage represents the extent to which a company's costs are fixed versus variable. The degree of operating leverage provides insight into a company's financial risk and reward by measuring the sensitivity of company profits to changes in sales. Operating leverage increases profits during periods of sales growth and increases losses during periods of sales declines.

LO5–10 Separate mixed costs into their variable and fixed components using the regression method.

The regression method uses statistical software (such as Excel) to compute the linear relationship between activity level and mixed costs. The statistical output provides an intercept (the amount of total fixed costs) and a slope (variable costs per unit). Using this output, we can separate mixed costs into their variable and fixed components. The assumption of a linear relationship between activity level and mixed costs may be true only within the relevant range of activity.

GLOSSARY

Activity base (or cost driver): The specific activity with which variable costs fluctuate. **p. 193**

Breakeven point: The level of activity at which a company's total sales revenue exactly equals its total operating costs (in other words, where operating income is zero). **p. 202**

Contribution margin: Sales revenue minus total variable costs. **p. 198**

Contribution margin income statement: A reorganized income statement that separates all variable costs from fixed costs to report a company's contribution margin. **p. 198**

Cost behavior: The way costs change in response to changes in the level of an activity. **p. 192**

Cost-volume-profit (CVP) analysis: An analysis tool used by managers to help them examine how changes in costs, volume, and sales prices affect the company's profits. **p. 201**

CVP equation: An equation that shows sales revenue minus variable and fixed costs is equal to profit (operating income). **p. 201**

CVP graph: A graph that includes a horizontal axis (volume), a vertical axis (dollars), a horizontal line originating from the vertical axis (fixed cost), a total cost line that starts at the point where the fixed cost line intersects the vertical axis and then slopes upwards to the right (variable cost per unit), and a total revenue line that starts from the point where both the vertical and horizontal axes meet (the origin) with a slope equal to the sales price per unit. **p. 205**

Fixed costs: Costs that do not change with the level of production, as long as the activity remains within the relevant range. **p. 194**

High-low method: A simple method used to create an equation that separates mixed costs into their variable and fixed components. **p. 196**

Margin of safety: The excess sales dollars over the breakeven sales dollars. **p. 205, 212**

Mixed costs: Costs that exhibit behaviors of both variable and fixed costs. **p. 194**

Operating leverage: The degree to which a company's costs are fixed versus variable. **p. 213**

Regression method: A statistical method used to create an equation that separates mixed costs into their variable and fixed components. **p. 216**

Relevant range: The range of production or activity levels within which a company expects to operate and for which its cost behavior assumptions are valid. **p. 193**

Sales mix: The proportion of different products or services a company typically sells. **p. 210**

Step fixed costs: Fixed costs that change as activity moves beyond the relevant range. **p. 194**

Target profit analysis: A special type of CVP analysis that focuses on achieving a specified level of profitability. **p. 207**

Variable costs: Costs that change in direct proportion to changes in production or other activity levels. **p. 193**

SELF-STUDY QUESTIONS

1. Which of the following best describes a variable cost? **(LO5–1)**
   A. A cost that remains the same per unit but varies in total with activity level.
   B. A cost that changes per unit but remains fixed in total.
   C. A cost that only occurs when production exceeds a certain threshold.
   D. A cost that occurs regardless of the activity level.

2. Which of the following is an example of a mixed cost? **(LO5–1)**
   A. Factory depreciation.
   B. Raw materials used in production.
   C. Utility bills that include a fixed monthly charge plus usage charges.
   D. Insurance premiums.

3. In the high-low method, the slope of the line represents: **(LO5–2)**
   A. The total mixed cost.
   B. The variable cost per unit.
   C. The total fixed cost.
   D. The breakeven point.

4. What is the contribution margin? **(LO5–3)**
   A. The total fixed costs of a company.
   B. Sales revenue minus variable costs.
   C. Gross margin minus depreciation.
   D. Sales revenue minus cost of goods sold.

5. What is the primary purpose of CVP analysis in managerial decision making? **(LO5–4)**
   A. To compute tax liabilities.
   B. To allocate overhead based on machine hours.
   C. To understand how changes in costs, volume, and price affect profits.
   D. To record actual cost behavior for financial reporting.

6. At the breakeven point: **(LO5–5)**
   A. Sales revenue equals variable costs.
   B. Contribution margin equals fixed costs.
   C. Net income equals operating income.
   D. Variable costs equal fixed costs.

7. If the sales price per unit is $100, variable cost per unit is $60, and fixed costs are $20,000, what is the breakeven sales revenue? **(LO5–5)**
   A. $25,000
   B. $33,333
   C. $50,000
   D. $80,000

8. Target profit analysis is a special type of CVP analysis because it: **(LO5–6)**
   A. Requires knowledge of the company's tax rate.
   B. Focuses on minimizing fixed costs.
   C. Identifies which customers are best to target for sales opportunities.
   D. Determines the sales needed to reach a specific profit goal.

9. Contribution margin per unit is $45 and fixed costs are $18,000. What sales volume is needed to achieve $9,000 in operating income? **(LO5–6)**
   A. 400 units
   B. 500 units
   C. 600 units
   D. 700 units

10. In multiproduct CVP analysis, the breakeven point depends on: **(LO5–7)**
    A. The variable cost of the highest-margin product.
    B. The total fixed cost of all products.
    C. The average sales volume across products.
    D. The sales mix among different products.

11. The margin of safety helps managers understand: **(LO5–8)**
    A. The amount of fixed costs in total cost.
    B. The change in variable costs over time.
    C. How much sales can decline before the company has a loss.
    D. How many units must be sold to achieve breakeven.

12. If sales are $360,000, contribution margin is $120,000, and operating income is $30,000, what is the degree of operating leverage? **(LO5–9)**
    A. 4
    B. 3
    C. 12
    D. 0.25

13. If a regression equation is Y = $6,000 + $2.50X, what is the total estimated cost for 3,000 units of activity? **(LO5–10)**
    A. $13,500
    B. $6,750
    C. $8,500
    D. $12,000

REAL-WORLD PERSPECTIVES

Decision Analysis: Calculate Target Profits and Prepare Contribution Margin Income Statement

LO5–3, LO5–6

RWP5–1 Terra Touch is an international importer-exporter of pottery with distribution centers in the United States, Europe, and Australia. The company was very successful in its early years, but its profitability has since declined. As a member of a management team selected to gather information for Terra Touch's next strategic planning meeting, you have been asked to review its most recent contribution margin income statement for the year ended December 31, 2028, which follows.

TERRA TOUCH
Contribution Margin Income Statement
For the year ended December 31, 2028

Sales revenue		$16,000,000
Less variable costs:		
Purchases	$6,000,000	
Distribution	2,115,000	
Sales Commissions	1,410,000	
Total variable costs		9,525,000
Contribution margin		$ 3,975,000
Less fixed costs:		
Distribution	$ 985,000	
Selling	1,184,000	
General and Administrative	871,875	
Total fixed costs		3,040,875
Operating Income		$ 934,125

In 2028, Terra Touch sold 15,000 sets of pottery.

For the upcoming year, 2029, Terra Touch's strategic planning team has targeted sales of 15,000 sets of pottery, reduced the selling price to $890 per set, increased sales commissions to 12% of the selling price, and decreased fixed distribution costs by 10% and variable distribution costs by 4%. All other costs are assumed to remain the same. Based on an analysis of these changes, Terra Touch's president is concerned that the proposed strategic plan may not achieve her goal of increasing operating income by 10% over last year's income and that operating income may actually fall below last year's level. She has asked you to perform an analysis of the proposed strategic plan, as well as an analysis of a special order she just received from an Australian distributor for 4,500 sets of pottery. The special order's selling price, variable purchase cost per unit, sales commission, and total fixed costs will be the same as those for the rest of the business in 2029, but the variable distribution costs will be $160 per unit. Total fixed costs remain unchanged even with the special order.

Required:

1. Calculate the targeted operating income for 2029 using just the proposed strategic plan. (Round to the nearest whole number.)
2. Prepare a budgeted contribution margin income statement for 2029 based on just the strategic plan. Determine the amount by which the company's projected operating income for 2029 will be less than or greater than the operating income for 2028.
3. Calculate the total contribution margin from the Australian sales.
4. Prepare a revised budgeted contribution margin income statement for 2029 that includes the Australian order. What is revised operating income for 2029? (*Hint:* Combine the information from 2 and 3 above.)
5. Does Terra Touch need the Australian sales to achieve its targeted operating income for 2029?

LO5–4, LO5–5

Conceptual Understanding: CVP Analysis and Breakeven Point

RWP5–2 Refer to the information in RWP5–1. The president of Terra Touch has asked you to conduct some CVP analysis to be included in the upcoming annual strategic planning meeting.

Required:

1. For each set of pottery sold in 2028, calculate the (a) selling price, (b) variable purchases cost, (c) variable distribution cost, (d) variable sales commission, and (e) contribution margin. Round all calculations to the nearest dollar.
2. Calculate the breakeven point in units and in sales dollars. Round the number of units up to the nearest whole unit.
3. Historically, Terra Touch's variable costs have been about 60% of sales. What was the ratio of variable costs to sales in 2028? (Round to two decimal places.) List three actions Terra Touch could take to address the difference.
4. How would fixed costs have been affected if Terra Touch had sold only 14,000 sets of pottery in 2028?

LO5–3, LO5–5, LO5–6

Interpreting Management Reports

RWP5–3 Velocity Bikes USA is a custom bicycle manufacturer specializing in high-performance road and mountain bikes. The company operates exclusively within the United States and has built a reputation for craftsmanship and quality. Despite early growth, profitability has stagnated in recent years. The management team is now evaluating strategic changes for 2029.

You are a financial analyst on the strategic planning team. The company president has asked you to evaluate a new financial plan to determine whether it will help achieve her goal of increasing operating income by at least 10% over last year's performance.

You've received the following internal report prepared by the accounting team:

VELOCITY BIKES USA
Contribution Margin Income Statement
For the year ended December 31, 2028

Description	Actuals Dec 31, 2028	Forecasts Dec 31, 2029
Units sold	12,000	12,000
Sales revenue	$10,000,000	$9,900,000
Less variable costs:		
— Materials & components	$4,000,000	4,000,000
— Shipping & delivery	1,600,000	1,503,960
Total variable costs	$5,600,000	$5,503,960
Contribution margin	**$4,400,000**	**$4,396,040**
Less fixed costs:		
— Shipping & delivery	$800,000	720,000
— Marketing	900,000	900,000
— General & administrative	700,000	700,000
Total fixed costs	$2,400,000	$2,320,000
Operating income	**$2,000,000**	**$2,076,040**

Required

1. By how much is the selling price forecasted to change in 2029?
2. By what percentage are variable shipping costs forecasted to change in 2029?
3. By what percentage are fixed shipping costs forecasted to change in 2029?
4. What factors are driving the forecasted increases in operating income expected in 2029?

Ethical Dilemma: Breaking Even

LO5–5

RWP5–4 Suppose a supervisor's annual bonus is based on the success of new products and is computed on the number of sales that exceed each new product's projected breakeven point. In reviewing the computations supporting the most recent bonus, the supervisor found that although an order for 7,500 units of a new product called R56 had been refused by a customer and returned to the company, the order had been included in the bonus calculations. The supervisor later discovered that the company's accountant had labeled the return an overhead expense and had charged the entire cost of the returned order to the plantwide Overhead account. This accounting treatment caused the cost of the returned units to be spread across all products, instead of reducing R56's actual sales. The result was that product R56 appeared to exceed breakeven by more than 5,000 units and the bonus from this product amounted to over $1,000.

Required:

1. Understand the effect: What was the consequence of labeling the returned R56 units as an overhead expense instead of a return?
2. Specify the options: What options does the supervisor have upon discovering the error?
3. Identify the impact: What is the likely impact if the supervisor accepts the bonus despite knowing about the error?
4. Make a decision: What is the most ethical course of action for the supervisor?

Continuing Case: Great Adventures Trail Mix

LO5–1, LO5–2, LO5–3, LO5–5

(This Great Adventures Trail Mix problem continues in each chapter.)

RWP5–5 To better understand pricing strategies, cost controls, and profitability of the *Great Adventures Trail Mix Company,* Tony and Suzie want to classify all costs as variable, fixed, or

mixed and prepare a contribution margin income statement. For their analysis, the following relevant costs have been identified for the company's standard trail mix:

- Direct Labor
- Trail mix ingredients
- Depreciation, equipment
- Packaging materials
- Insurance
- Supplies for production
- Utilities (base rate plus usage fee)
- Small tools used to package mixes

They also gathered electric bills for the past three months:

Month	Kilowatt-Hours Used	Electric Costs
August	1,439	$202
September	1,866	230
October	1,146	158

Finally, projected daily costs are shown below:

Type of Cost	Manufacturing	Nonmanufacturing
Variable	$100	$50
Fixed	120	60

Required:

1. Classify the standard trail mix costs as variable, fixed, or mixed.
2. Using the electric bills for the three months provided, use the high-low method to calculate the variable electricity cost per kilowatt-hour and the monthly fixed electricity cost. Then, express the monthly electric cost using the formula Total cost = (Variable rate per kilowatt-hour × Kilowatt-hours) + Monthly fixed cost.
3. Suppose the standard trail mix sells for $10.00 per bag. The company projects sales of 50 bags per day.
   a. Prepare a daily contribution margin income statement based on the assumptions given.
   b. What is the contribution margin ratio?
   c. What volume, in terms of bags, must the company sell to break even each day? (Round to the nearest whole bag.)

BRIEF EXERCISES

Define cost behavior (LO5–1)

BE5–1 Indicate whether each of the following costs typically increases or remains constant as production volume increases:

1. Direct materials used.
2. Factory rent.
3. Sales commissions.
4. Straight-line depreciation on manufacturing equipment over five years.
5. Utilities for the production facility.

Identify variable, fixed, and mixed costs (LO5–1)

BE5–2 Identify the following as (a) variable costs, (b) fixed costs, or (c) mixed costs under normal conditions:

1. Direct materials.
2. Electric utilities.
3. Factory building rent.
4. Administrative base salaries.
5. Hourly wages of production workers.

BE5–3 Match each cost with its most likely activity base:

Match costs and activity bases **(LO5–1)**

Costs	Activity Bases
1. Fuel costs	a. Machine hours
2. Shipping costs	b. Sales made
3. Utilities costs	c. Client sites visited
4. Sales commission costs	d. Miles driven
5. Travel costs	e. Packages mailed

BE5–4 A company has a total fixed cost of $100,000 for its production facility and variable costs of $50 per unit. If the company produces 1,000 units while selling an additional 200 units from beginning inventory, what is the fixed cost per unit of the 1,000 units produced?

Calculate fixed cost per unit **(LO5–1)**

BE5–5 The highest level of activity for a month is 4,500 hours, with a total cost of $180,000. The lowest level of activity for a month is 2,000 hours, with a total cost of $120,000. Using the high-low method, what is the variable cost per hour?

Calculate variable cost per unit using the high-low method **(LO5–2)**

BE5–6 The highest level of activity for a month is 6,000 units, with a total cost of $240,000. The lowest level of activity for a month is 1,500 units, with a total cost of $150,000. Using the high-low method, calculate (1) the variable cost per unit and (2) the total fixed cost.

Separate mixed costs into their variable and fixed components using the high-low method **(LO5–2)**

BE5–7 Using the high-low method, compute InfoDynamic Corporation's monthly (1) variable cost per data processing hour and (2) total fixed costs.

Separate mixed costs into their variable and fixed components using the high-low method **(LO5–2)**

Month	Data Processing Hours Used	Data Processing Costs
April	95	$4,350
May	90	4,230
June	100	4,680

BE5–8 Using the high-low method, compute Beaver Manufacturing's monthly (1) variable cost per machine hour and (2) total fixed costs.

Separate mixed costs into their variable and fixed components using the high-low method **(LO5–2)**

Month	Machine Hours Used	Total Machine Costs
January	120	$16,800
February	140	17,400
March	135	17,150

BE5–9 Panther Agency, a private investigation firm, investigated the following cases and had service overhead as follows:

Separate mixed costs into their variable and fixed components using the high-low method **(LO5–1, LO5–2)**

	No. of Cases	Service Overhead
October	92	$216,500
November	95	218,900
December	90	212,400

In addition, the company's direct labor cost is $1,800/case. Using the high-low method, compute the (1) variable service overhead cost per case, (2) total variable cost per case, and (3) fixed service overhead cost per case.

BE5–10 A company has $200,000 in sales revenue, $80,000 in variable costs, and $50,000 in fixed costs, with a target profit of $30,000. Calculate the contribution margin.

Calculate contribution margin **(LO5–3)**

BE5–11 Prepare a contribution margin income statement assuming a company sells 5,000 units for $150 per unit, has variable costs of $100 per unit, and has fixed costs of $200,000.

Prepare a contribution margin income statement **(LO5–3)**

BE5–12 CVP analysis involves understanding the relationships among which of the following variables (select all that apply):

Understand CVP analysis **(LO5–4)**

_____ Cost of assets
_____ Sales prices
_____ Fixed costs
_____ Liabilities

_____ Variable cost of product sold
_____ Cash paid to suppliers
_____ Volume of sales
_____ Cash collected from customers
_____ Profit (operating income)

Determine breakeven units and breakeven sales for a single product (LO5–5)

BE5–13 Royalty Company has the following: selling price per unit of $90, variable costs of $50 per unit, and fixed costs of $60,000. How many units must Royalty sell to break even? What is the total dollar of sales at the breakeven point?

Determine breakeven units using the contribution margin approach for a single product (LO5–5)

BE5–14 Stable Products has the following: selling price per unit of $11, variable cost per unit of $4, and fixed costs of $77,000. Using the contribution margin approach, find the breakeven point in units.

Determine the contribution margin ratio and breakeven point in sales dollars (LO5–5)

BE5–15 Madison Avenue Products has the following: selling price per unit of $20, variable cost per unit of $12, and fixed costs of $60,000. Compute the contribution margin ratio and the breakeven point in total sales dollars.

Perform CVP analysis to compute target profit (LO5–4, LO5–6)

BE5–16 Xelor Watches plans to sell 300 watches next month for $380 per watch. Variable costs are $180 per watch and fixed costs are $40,000. What is the projected profit?

Determine the sales volume needed to achieve target profits (LO5–6)

BE5–17 A local electronics retailer offers installation services for home security systems. Below are the sales and cost information for the year:

- Sales price per installation is $120.
- Variable costs per installation are $70.
- Fixed costs related to installation services for the store are $25,000 per year.

How many installations must the store provide to meet a target profit of $10,000?

Calculate contribution margin and breakeven point in units for two products (LO5–7)

BE5–18 SportsCo sells two types of athletic shoes: running shoes and basketball shoes. The company's sales mix is 60% running shoes and 40% basketball shoes. The contribution margin per unit for running shoes is $40, and for basketball shoes is $50. Total fixed costs are $176,000. Calculate the weighted-average contribution margin per unit and the breakeven point in units for running shoes and for basketball shoes.

Determine breakeven point for two products (LO5–7)

BE5–19 Product A's selling price per unit is $10, and its variable cost per unit is $4. Product B's selling price per unit is $8, and its variable cost per unit is $5. Fixed costs are $141,750, and the sales mix of Product A to Product B is 3:1. Using the contribution margin approach, find the breakeven point in units for each product.

Determine the margin of safety (LO5–8)

BE5–20 A local custom furniture maker needs $600,000 in sales to break even. During the year, the company generates $680,000 in actual sales. Use this information to calculate the margin of safety both in dollars and as a percentage (round your answers to two decimal places).

Calculate the degree of operating leverage (LO5–9)

BE5–21 An event planning firm reports the following financial data for its catering business:

- Sales revenue: $2,500,000
- Variable costs: $1,500,000
- Fixed costs: $750,000

Calculate the degree of operating leverage (DOL) at the current level of sales.

Separate mixed costs into their variable and fixed components using the regression method (LO5–10)

BE5–22 If the regression equation for a cost function is given as $Y = 5{,}000 + 2.25X$, what does the value of 5,000 represent?

Separate mixed costs into their variable and fixed components using the regression method (LO5–10)

BE5–23 If the regression equation for a cost function is given as $Y = 48{,}000 + 12.50X$, what does the value of 12.50 represent?

EXERCISES

E5–1 Identify whether each of the following costs of productive output is usually (a) variable or (b) fixed:

Identify variable and fixed costs (LO5–1)

1. License fee for company car.
2. Wiring used in radios.
3. Machine operator's hourly wages.
4. Wood used in bookcases.
5. City's annual permit to operate.
6. Machine depreciation based on machine hours used.
7. Supervisor's annual base salary.
8. Cost of required outside inspection of each unit produced.

E5–2 A company has provided the following monthly cost data:

Identify variable, fixed, and mixed costs (LO5–1)

- Direct materials: $15 per unit
- Direct labor: $40 per unit
- Factory rent: $8,000 per month
- Utilities: $3,000 per month + $0.50 per unit produced
- Straight-line depreciation on equipment: $5,000 per month
- Packaging: $2 per unit
- Sales commissions: 5% of sales price (sales price is $100 per unit)

Required:

1. Identify whether costs are (a) variable, (b) fixed, or (c) mixed.
2. Calculate the total variable cost per unit.
3. If the company produces and sells 2,000 units in a month, calculate the total variable costs and total fixed costs.

E5–3 Service Auto has been in business for six months. The company pays $3.00 per quart for the oil used in servicing cars. Each job requires an average of four quarts of oil. The company estimates that in the next three months it will service 250, 280, and 360 cars.

Identify variable costs (LO5–1)

Required:

1. Compute the total estimated cost of oil for each of the three months and for all three months combined.
2. Complete the following sentences by choosing the words that best describe the cost behavior at Service Auto:
   a. Cost per quart of oil _____ (increases, decreases, remains constant) as the quantity of oil used increases.
   b. Total cost of oil per month _____ (increases, decreases, remains constant) as the quantity of oil used increases.

E5–4 Madison Company manufactures major appliances. Because of growing interest in its products, it has just had its most successful year. In preparing the budget for next year, its controller compiled the following information:

Separate mixed costs into their variable and fixed components using the high-low method (LO5–2)

Month	Machine Hours	Electricity Cost
July	6,000	$60,000
August	5,000	$53,000
September	4,500	$49,500
October	4,000	$46,000
November	3,500	$42,500
December	3,000	$36,000

Required:

1. Using the high-low method, determine the variable electricity cost per machine hour and the monthly fixed electricity cost.
2. Estimate the total variable electricity costs and total fixed electricity costs if 4,800 machine hours are projected to be used next month.

Determine the cost formula using the high-low method **(LO5–2)**

E5–5 When Falcron Company's sales were $90,000, monthly costs were $80,000. When its sales were $50,000, monthly costs were $60,000. Use the high-low method to develop a monthly cost formula for Falcron's coming year using sales.

Prepare a contribution margin income statement **(LO5–3)**

E5–6 FitWear Co. manufactures and sells fitness trackers. The company has provided the following information for the month of June:

- Sales: 5,000 units at $150 per unit
- Variable manufacturing costs: $60 per unit
- Variable selling expenses: $10 per unit
- Fixed manufacturing overhead: $100,000
- Fixed selling and administrative expenses: $80,000

Required:

1. Prepare a contribution margin income statement for FitWear Co. for the month of June.
2. Calculate the contribution margin ratio.

Prepare a contribution margin income statement and calculate the contribution margin ratio **(LO5–3, LO5–5)**

E5–7 Brookhaven Company manufactures a single product that sells for $100 per unit. The company projects sales of 400 units per month. Projected monthly costs follow.

Type of Cost	Manufacturing	Nonmanufacturing
Variable	$10,000	$6,000
Fixed	$13,000	$5,000

Required:

1. Prepare a contribution margin income statement for the month.
2. Calculate the contribution margin ratio.
3. What volume, in terms of units, must the company sell to break even?

Understand the contribution margin income statement and breakeven analysis **(LO5–3, LO5–5)**

E5–8 Use the data in the contribution margin income statement for Broadway, Inc., that follows.

BROADWAY, INC.
Contribution Margin Income Statement
For the year ended December 31

Sales (20,000 units)		$16,000,000
Variable costs:		
Cost of goods sold	$8,000,000	
Selling, administrative, and general	4,000,000	
Total variable costs		12,000,000
Contribution margin		$ 4,000,000
Fixed costs:		
Overhead	$1,200,000	
Selling, administrative, and general	800,000	
Total fixed costs		2,000,000
Operating Income		$ 2,000,000

Required:

Calculate (1) selling price per unit, (2) variable costs per unit, and (3) breakeven point in units and in sales dollars.

E5–9 Chipper Design produces head covers for golf clubs. The company expects to generate a profit next year. It anticipates fixed manufacturing costs of $200,000 and fixed general and administrative expenses of $280,000 for the year. Variable manufacturing and variable selling costs per set of head covers will be $18 and $12, respectively. Each set will sell for $50.

Determine breakeven point for a single product **(LO5–5)**

Required:

1. Compute the breakeven point in sales units.
2. Compute the breakeven point in sales dollars.
3. If the selling price decreases to $46 per unit and fixed general and administrative expenses are cut to $240,000, what would the new breakeven point be in units?

E5–10. Americas Company has a plant capacity of 100,000 units per year, but its budget for this year indicates that only 60,000 units will be produced and sold. The entire budget for this year follows.

Perform CVP and breakeven analysis **(LO5–5, LO5–6)**

Sales (60,000 units at $3.75)		$225,000
Less cost of goods produced (based on production of 60,000 units):		
Direct materials (variable)	$60,000	
Direct labor (variable)	30,000	
Variable overhead costs	45,000	
Fixed overhead costs	75,000	
Total cost of goods produced		210,000
Gross margin		$ 15,000
Less selling and administrative expenses:		
Selling (fixed)	$24,000	
Administrative (fixed)	36,000	
Total selling and administrative expenses		60,000
Operating income (loss)		$(45,000)

Required:

1. Given the budgeted selling price and cost data, how many units would Americas have to sell to break even? (*Hint:* Be sure to consider selling and administrative expenses.)
2. Market research indicates that if Americas were to drop its selling price to $3.70 per unit, it could sell 100,000 units. Would you recommend the drop in price? What would the new operating income or loss be?

E5–11 New Ride makes electric vehicles, primarily used in public transportation. The company has been offered a government contract from which it may realize a profit. The contract purchase price is $130,000 per vehicle, but the number of vehicles to be purchased has not yet been decided. The company's fixed costs are budgeted at $4,035,000 and variable costs are $68,500 per unit.

Perform CVP analysis to achieve a target profit **(LO5–6)**

Required:

1. Compute the number of vehicles the company should agree to make at the stated contract price to earn a profit of $1,500,000.
2. Using a lighter material, the variable unit cost can be reduced by $1,730, but total fixed overhead will increase by $29,240. How many vehicles must be produced to make $1,500,000 in profit?
3. Assuming New Ride adopts the lighter material and the cost structure described in Requirement 2, how many additional vehicles must be produced to increase profit by $1,264,600?

E5–12 Short-term car rentals are InstaRentals, Inc.'s specialty. Average variable operating costs have been $40 per day per car. The company owns a fleet of cars. Fixed operating costs for the next year are expected to be $450,000. Average daily rental revenue per car is expected to be $100. Management would like to earn a profit of $150,000 during the year.

Perform CVP analysis to determine future sales **(LO5–6)**

Required:

1. Calculate the total number of daily rentals the company must have during the year to earn the targeted profit.
2. Determine the total sales dollars needed to achieve the targeted profit of $150,000.
3. What would the total sales dollars need to be if fixed operating costs could be lowered by $20,000 and the targeted profit increased to $200,000?

Perform CVP analysis to achieve a target profit in a service business **(LO5–6)**

E5–13. Westport Inspection Service specializes in inspecting cars that have been returned to leasing companies at the end of their leases. Westport's charge for each inspection is $75; its average cost per inspection is $25. The owner wants to expand his business by hiring another employee and purchasing another rental car. The fixed costs per month of the new employee and rental car would be $5,000 per month.

Required:

Determine how many inspections per month the new employee would have to perform for Westport to earn an additional monthly profit of $1,500.

Determine breakeven point for multiple products **(LO5–7)**

E5–14 Clearwater Aquarium manufactures and sells aquariums, water pumps, and air filters. The sales mix is 1:2:2 (i.e., for every one aquarium sold, two water pumps and two air filters are sold). The company's fixed costs are $104,000. Other information follows.

	Selling Price per Unit	Variable Costs per Unit
Aquariums	$120	$50
Water pumps	40	24
Air filters	20	6

Required:

Using the weighted-average contribution margin approach, find the breakeven point in units for each product.

Determine breakeven point for multiple products **(LO5–7)**

E5–15 Burger Barn sells hamburgers, drinks, and fries. The sales mix is 1:3:2 (i.e., for every one hamburger sold, three drinks and two fries are sold). The company's fixed costs are $17,400. Other information follows.

	Selling Price per Unit	Variable Costs per Unit
Hamburgers	$3.99	$1.35
Drinks	0.99	0.09
Fries	1.99	0.31

Required:

Using the weighted-average contribution margin approach, find the breakeven point in units for each product.

Determine breakeven point for multiple products **(LO5–7)**

E5–16 LuLu Hair Design provides three basic services: shampoo and set, permanent, and cut and blow dry. Its operating results from the past quarter follow.

Type of Service	Number of Customers	Total Sales	Contribution Margin in Dollars
Shampoo and set	1,200	$ 72,000	$14,700
Permanent	420	63,000	15,120
Cut and blow dry	1,000	45,000	10,000
	2,620	$180,000	$39,820
Total fixed costs			40,000
Profit (loss)			$ (180)

Required:

Compute the breakeven point in units for each type of service based on the weighted-average contribution margin for the sales mix.

E5–17 Beachside Supplies is a distributor of premium beach chairs sold to luxury resorts. The company provides the following data for the upcoming month:

Calculate the margin of safety **(LO5–8)**

- Selling price per unit: $50
- Variable expenses per unit: $30
- Fixed expenses per month: $12,000
- Unit sales per month: 800

Required:

1. What is the company's margin of safety in dollars?
2. What is the company's margin of safety as a percentage of expected sales?

E5–18 ChocoShop is a small chocolate company that specializes in handcrafted chocolate treats. Each treat is made with a unique blend of fine chocolates and infused with exotic flavors like lavender, chili, and sea salt. ChocoShop's management has gathered the following information for the current month:

Calculate breakeven sales and margin of safety **(LO5–5, LO5–8)**

- Average selling price per treat: $10.00
- Average variable cost per treat: $7.00
- Fixed costs for the month: $36,000
- Expected sales for the month: $150,000

Required:

Calculate:

1. The breakeven sales in dollars.
2. The margin of safety in sales dollars.
3. The margin of safety as a percentage of expected sales.

E5–19 [This exercise uses the same given information as E5–18.] ChocoShop is a small chocolate company that specializes in handcrafted chocolate treats. Each treat is made with a unique blend of fine chocolates and infused with exotic flavors like lavender, chili, and sea salt. ChocoShop's management has gathered the following information for the current month:

Calculate the degree of operating leverage **(LO5–9)**

- Average selling price per treat: $10.00
- Average variable cost per treat: $7.00
- Fixed costs for the month: $36,000
- Expected sales for the month: $150,000

Required:

1. Calculate ChocoShop's degree of operating leverage.
2. If sales *increase* by 6%, by what percentage would operating income change?
3. If sales *decrease* by 4%, by what percentage would operating income change?

E5–20 TechSavvy Inc. sells software subscriptions to small businesses. The company's most recent monthly contribution margin income statement is as follows:

Calculate the degree of operating leverage **(LO5–9)**

Sales revenue	$200,000
Variable expenses	(80,000)
Contribution margin	120,000
Fixed expenses	(70,000)
Operating income	$ 50,000

Required:

1. What is the company's degree of operating leverage?
2. Using the degree of operating leverage, by what percent would operating income change if sales increase by 10%.

PROBLEMS

Mc Graw Hill connect

Separate mixed costs into their variable and fixed components using the high-low method for a service business **(LO5–1, LO5–2)**

P5–1 Wabash Company specializes in refurbishing exterior painted surfaces that have been hard hit by humidity and insect debris. It uses a special technique, called pressure cleaning, before priming and painting the surface. The refurbishing process involves the following steps:

1. Unskilled laborers trim all trees and bushes within two feet of the structure.
2. Skilled laborers clean the building with a high-pressure cleaning machine, using about six gallons of chlorine per job.
3. Unskilled laborers apply a coat of primer.
4. Skilled laborers apply oil-based exterior paint to the entire surface.

On average, skilled laborers work 12 hours per job and unskilled laborers work 8 hours. The following data reflect a recent period in which **500 jobs were completed,** and the company wants to calculate its **average cost per job during that period:**

Skilled labor	$ 36	per hour
Unskilled labor	$ 24	per hour
Gallons of chlorine used	3,000	gallons, at $11.0 per gallon
Paint primer	7,536	gallons, at $31 per gallon
Paint	6,280	gallons, at $32 per gallon
Depreciation of paint-spraying equipment	$1,200	per month
Lease of van	$1,600	per month
Storage building rent	$ 500	per month

Use the historical utility cost behavior data below to estimate utility costs for the 500-job period. These data reflect total monthly labor hours (skilled + unskilled) and utility costs for the entire year. You should assume 20 labor hours per job (12 skilled + 8 unskilled).

Month	Number of Jobs	Cost	Hours Worked
January	42	$3,950	840
February	37	3,550	740
March	44	4,090	880
April	49	4,410	980
May	54	4,720	1,080
June	62	5,240	1,240
July	71	5,820	1,420
August	73	5,890	1,460
September	63	5,370	1,260
October	48	4,340	960
November	45	4,210	900
December	40	3,830	800

Required:

1. Classify the costs as variable, fixed, or mixed.
2. Using the high-low method, determine variable cost of utilities per hour worked and utilities fixed cost.
3. Compute the average cost per job for the year. (*Hint:* Divide the total of all costs for the year by the number of jobs completed.) Use estimated hours to determine utilities costs. (Round to two decimal places.)
4. **Business application.** Project the average cost per job for next year if variable costs per job increase 20%. (Round to two decimal places.)
5. **Accounting connection.** Why can actual utilities costs vary from the amount computed using the utilities cost formula?

P5–2 Officials of the Holland Park Golf and Tennis Club are in the process of preparing a budget for the year ending December 31. Because the club treasurer has had difficulty with two expense items, the process has been delayed. The two expense items are mixed costs—electricity and maintenance—and the treasurer has been having trouble breaking them down into their variable and fixed components. An accountant friend has suggested that he use the high-low method to divide the costs into their variable and fixed parts. The spending patterns and activity measures related to each cost during the past year are as follows:

Separate mixed costs into their variable and fixed components using the high-low method and understand how managers use CVP analysis to make decisions **(LO5–2, LO5–6)**

	Electricity Expense		Maintenance Expense	
Month	Amount ($)	Kilowatt-Hours	Amount	Labor Hours
January	$7,500	210,000	$7,578	220
February	8,255	240,200	7,852	230
March	8,165	236,600	7,304	210
April	8,960	268,400	7,030	200
May	7,520	210,800	7,852	230
June	7,025	191,000	8,126	240
July	6,970	188,800	8,400	250
August	6,990	189,600	8,674	260
September	7,055	192,200	8,948	270
October	7,135	195,400	8,674	260
November	8,560	252,400	8,126	240
December	8,415	246,600	7,852	230
Totals	$92,550	2,622,000	$96,416	2,840

Required:

1. Using the high-low method, compute the variable cost rates used last year for each expense. What was the monthly fixed cost for electricity and for maintenance? (Round variable cost rate answers to three decimal places.)
2. Compute the total variable cost and total fixed cost for each expense category for last year.
3. **Business application.** The treasurer believes that in the coming year, the electricity rate will increase by $0.003 and the maintenance rate, by $1.20. Usage of kilowatt-hours and labor hours and their fixed cost amounts will remain constant. Compute the projected total cost for each category. How will the cost increases affect the club's profits and cash flow? What steps could the company take to offset these rising costs?

P5–3 At the beginning of each year, LED Lighting's Accounting Department must find the point at which projected sales revenue will equal total budgeted variable and fixed costs. The company produces low-voltage outdoor lighting systems. Each system sells for an average of $435. Variable costs per unit are $210. Total fixed costs for the year are estimated to be $166,500.

Determine breakeven point **(LO5–5)**

Required:

1. Compute the breakeven point in sales units.
2. Compute the breakeven point in sales dollars.
3. **Business application.** Find the new breakeven point in sales units if the fixed costs go up by $10,125.
4. **Business application.** Using the original figures, compute the breakeven point in sales units if the selling price decreases to $425 per unit, fixed costs go up by $15,200, and variable costs decrease by $15 per unit.

P5–4 Legal Eagle, a law firm, is considering opening a legal clinic for middle- and low-income clients. The clinic would bill at a rate of $54 per hour. It would employ law students as paraprofessional help and pay them $27 per hour. Other variable costs are anticipated to be $16.20 per hour, and annual fixed costs are expected to total $81,000.

Determine breakeven point **(LO5–5)**

Required:

1. Compute the breakeven point in billable hours.
2. Compute the breakeven point in total billable dollars.
3. **Business application.** Find the new breakeven point in total billable dollars if fixed costs go up by $7,020.
4. **Business application.** Using the original amounts, compute the breakeven point in total billable dollars if the billing rate decreases by $3 per hour, other variable costs decrease by $1.20 per hour, and fixed costs go down by $10,800.

Determine breakeven point and perform CVP analysis to achieve target profits **(LO5–5, LO5–6)**

P5–5 Outdoor Industries is considering a new product for its Camping Division. The product's expected variable unit costs are as follows: direct materials, $18.50; direct labor, $4.25; production supplies, $1.10; selling costs, $2.80; and other, $1.95. Annual fixed costs are depreciation, building, and equipment, $36,000; advertising, $45,000; and other, $11,400. Plans are to sell the product for $55.

Required:

1. Using the contribution margin approach, compute the number of units the company must sell to (a) break even or (b) earn a profit of $70,224.
2. Using the original information, compute the number of units that must be sold to earn a profit of $139,520 if advertising costs rise by $40,000.
3. Using the original information and sales of 10,000 units, compute the selling price the company must use to make a profit of $131,600. (*Hint:* Calculate contribution margin per unit first.)
4. According to the vice president of marketing, the most optimistic annual sales estimate for the product would be 15,000 units, and the highest competitive selling price the company can charge is $52 per unit. If the selling price is set at $52, variable costs remain unchanged, and the company wants to achieve a target profit of $251,000, how much additional spending can be allocated to fixed advertising costs?

Determine breakeven point and perform CVP analysis to achieve target profits **(LO5–5, LO5–6)**

P5–6 Harbor Company has a maximum capacity of 200,000 units per year. Variable manufacturing costs are $12 per unit, and fixed manufacturing overhead is $600,000 per year. Variable selling and administrative costs are $5 per unit, and fixed selling and administrative costs are $300,000 per year. The current sales price is $23 per unit.

Required:

1. What is the breakeven point in (a) sales units and (b) sales dollars?
2. **Business application.** How many units must Harbor Company sell to earn a profit of $240,000 per year?
3. **Business application.** A strike at one of the company's major suppliers has caused a shortage of materials, so the current year's production and sales are limited to 160,000 units. To partially offset the effect of the reduced sales on profit, management is planning to reduce fixed costs to $841,000. Variable costs per unit are the same as last year. The company has already sold 30,000 units at the regular selling price of $23 per unit.
   a. What amount of fixed costs was covered by the total contribution margin of the first 30,000 units sold?
   b. What contribution margin per unit will be needed on the remaining 130,000 units to cover the remaining fixed costs and to earn a profit of $210,000 this year?

Determine breakeven point and apply CVP analysis for a service business **(LO5–5, LO5–6)**

P5–7 First Bank processes loan applications. The manager of the loan department has established a policy of charging a $300 fee for every loan application processed. Variable costs have been projected as follows: loan consultant's wages, $45 per hour (a loan application takes two hours to process); supplies, $12 per application; and other variable costs, $18 per application. Annual fixed costs associated with the loan department include depreciation of equipment, $15,000; office rental, $30,000; promotional costs, $28,000; and other fixed costs, $17,000.

Required:

1. Using the contribution margin approach, compute the number of loan applications the company must process to (a) break even or (b) earn a profit of $13,500.
2. Using the same approach and assuming promotional costs increase by $4,500, compute the number of applications the company must process to earn a profit of $18,000.

3. Assuming the original information and the processing of 500 applications, compute the loan application fee the company must charge if the targeted profit is $35,000.
4. The maximum number of loan applications that the department can process is 750. How much more can be spent on promotional costs if the highest fee tolerable to the customer is $330, variable costs cannot be reduced, and the targeted profit is $50,000?

P5–8 Roman Marbles manufactures birdbaths, statues, and other decorative items, which it sells to florists and retail home and garden centers. Its design department has proposed a new product, a frog statue, that it believes will be popular with home gardeners. Expected variable unit costs are direct materials, $9.25; direct labor, $24.00; production supplies, $0.55; selling costs, $2.40; and other, $3.05. The following are fixed costs: depreciation, $33,000; advertising, $40,000; and other, $6,000. Management plans to sell the product for $49.25.

Compute breakeven point using the contribution margin approach and apply CVP analysis to target profits **(LO5–5, LO5–6)**

Required:

1. Using the contribution margin approach, compute the number of statues the company must sell to (a) break even or (b) earn a profit of $50,000.
2. Using the original information, compute the number of statues that must be sold to earn a profit of $70,000 if advertising costs rise by $20,000.
3. Using the original information and sales of 15,000 units, compute the selling price the company must charge to make a profit of $101,000.
4. According to the vice president of marketing, if the price of the statues is reduced and advertising is increased, the most optimistic annual sales estimate is 25,000 units. How much more can be spent on fixed advertising costs if the selling price is reduced to $48.00 per statue, the variable costs cannot be reduced, and the targeted profit for sales of 25,000 statues is $120,000?

P5–9 Bear Company has a maximum capacity of 500,000 units per year. Variable manufacturing costs are $25 per unit and variable selling and administrative costs are $5 per unit. Fixed overhead is $900,000 per year and fixed selling and administrative costs are $300,000 per year. The current sales price is $36 per unit.

Compute breakeven point and perform CVP analysis to achieve target profits **(LO5–5, LO5–6)**

Required:

1. What is the breakeven point in (a) sales units and (b) sales dollars?
2. **Business application.** How many units must Bear Company sell to earn a profit of $600,000 per year?
3. **Business application.** A strike at one of the company's major suppliers has caused a shortage of materials, so the current year's production and sales are limited to 400,000 units. To partially offset the effect of the reduced sales on profit, management is planning to reduce fixed costs to $1,000,000. Variable cost per unit is the same as last year. The company has already sold 30,000 units at the regular selling price of $36 per unit.
   a. What amount of fixed costs was covered by the total contribution margin of the first 30,000 units sold?
   b. What contribution margin per unit will be needed on the remaining 370,000 units to cover the remaining fixed costs and to earn a profit of $290,000 this year?

P5–10 First Mortgage, Inc.'s primary business is processing mortgage loan applications. Last year, the manager of the mortgage application department established a policy of charging a $500 fee for every loan application processed. Next year's variable costs have been projected as follows: mortgage processor wages, $45 per hour (a mortgage application takes two hours to process); supplies, $10 per application; and other variable costs, $15 per application. Annual fixed costs include depreciation of equipment, $4,950; building rental, $34,000; promotional costs, $45,000; and other fixed costs, $20,000.

Compute breakeven point using the contribution margin approach and apply CVP analysis to target profits for a service business **(LO5–5, LO5–6)**

Required:

1. Using the contribution margin approach, compute the number of loan applications the company must process to (a) break even or (b) earn a profit of $50,050.
2. Using the same approach and assuming promotional costs increase by $5,450, compute the number of applications the company must process to earn a profit of $60,000.

3. Assuming the original information and the processing of 500 applications, compute the loan application fee the company must charge if the targeted profit is $40,050.
4. The mortgage department can handle a maximum of 750 loan applications. How much more can be spent on promotional costs if the highest fee tolerable to the customer is $400, variable costs cannot be reduced, and the targeted profit for the loan applications is $50,000?

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1. a 2. c 3. b 4. b 5. c 6. b 7. c 8. d 9. c 10. d 11. c 12. a 13. a

CHAPTER NINE

9 Decision Analysis

Learning Objectives

PART A: THE DECISION-MAKING PROCESS

- **LO9–1** Describe the decision-making process, incremental analysis, and its related concepts.

PART B: SHORT-TERM OPERATING DECISIONS

- **LO9–2** Perform incremental analysis for special-order decisions.
- **LO9–3** Perform incremental analysis for sales-mix decisions involving constrained resources.
- **LO9–4** Perform incremental analysis for sell-or-process-further decisions.

PART C: STRATEGIC BUSINESS DECISIONS

- **LO9–5** Perform incremental analysis for manufacture-or-outsource decisions.
- **LO9–6** Perform incremental analysis for keep-or-drop-segment decisions.

Self-Study Materials

Sundry Photography/Alamy Image

Feature Story

DuPont

DuPont is one of the oldest and most successful companies in the United States: founded well over 200 years ago, the company has grown into a diversified chemical giant, known for developing innovative materials. Some of its notable products include Teflon and Lycra.

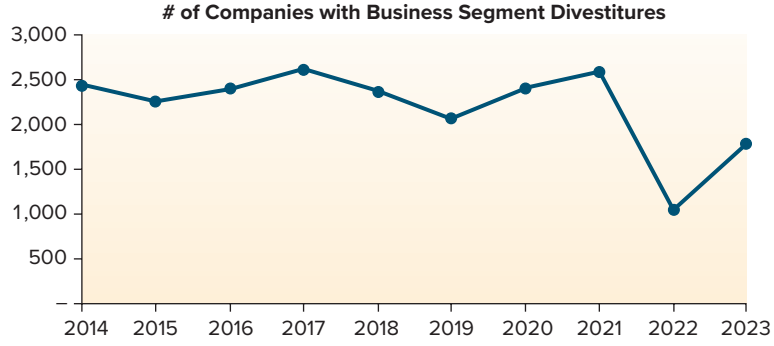
DuPont also developed Delrin, a high-performance plastic known for its strength, stiffness, and durability that can be used as a substitute for metal in certain applications. Its advantage over metal is its lighter weight, low friction, corrosion resistance, and cost-effectiveness. Despite its advantages, the Delrin product line faced financial challenges, recording net losses of $69 million and $57 million in 2022 and 2023, respectively.

In 2023, DuPont made the strategic decision to divest its ownership claim on the Delrin brand and discontinue its control over the manufacturing process. As demonstrated in the figure below, divestitures such as this one are commonplace among U.S. companies, though their prevalence has declined in more recent years.

Major business decisions, such as discontinuing a segment, are not made lightly and involve significant amounts of quantitative and qualitative analyses. Quantitative factors might include financial metrics like profit margins and net losses, while qualitative aspects could consider the product's alignment with the company's core competencies or strategic direction.

In this chapter, we focus on decision making. We'll begin by introducing key foundational concepts and frameworks that managers must understand in order to evaluate the relevant costs and benefits of the decision. We'll then apply these concepts and frameworks to a variety of common business decisions, including the decision to discontinue a business segment.

Source: Deloitte Quarterly divestiture reports.



PART A

THE DECISION-MAKING PROCESS

All managers make decisions, many often on a daily basis. In fact, it could be argued that making decisions is the primary responsibility of business managers, as it plays a central role in operational controls, resource allocation, cost management, performance evaluation, risk management, and more. Good decision making involves analyzing information, anticipating outcomes, and making choices that align with the business's strategic objectives. In this chapter, we focus on the frameworks managers use to make short-term operating decisions and longer-term strategic business decisions.

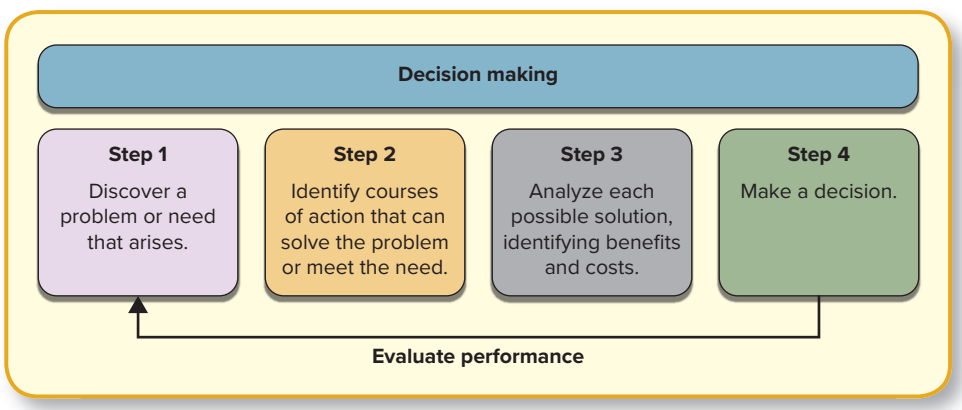
To make these decisions, managers carefully consider *quantitative* factors, such as the impact on profitability. They also consider *qualitative* factors, including the impact on employee morale, brand reputation, and customer satisfaction.

■ **LO9–1**
Describe the decision-making process, incremental analysis, and its related concepts.

Decision Making

The decision-making process is summarized in Illustration 9–1.

ILLUSTRATION 9–1
The Decision-Making Process



Step 1: Discover a problem. Management discovers a problem or specific need within the company, often revealed by variances, performance gaps, financial inefficiencies, or market changes.

Step 2: Identify courses of action. Management identifies viable solutions by consulting with team members and carefully considering various courses of action. Each proposed option must be feasible given the company's resource constraints and capabilities.

Step 3: Analyze possible solutions. Management conducts a comprehensive evaluation of each alternative, gathering detailed information on the relevant costs and benefits. The process of comparing alternatives by focusing on the differences in their projected revenues and costs is called **incremental analysis**.

Step 4: Make a decision. Management selects the best course of action based on the quantitative and qualitative assessments from the previous step.

After solutions are implemented, decisions can be evaluated by comparing the company's performance against the expected outcomes. If results do not resolve the problem, the decision-making process starts again.

Concepts Underlying Incremental Analysis

We'll spend most of this chapter discussing step 3 of Illustration 9–1, examining how incremental analysis is used to make a variety of important business decisions. It's critical that managers understand three important concepts in order to successfully conduct a cost-benefit analysis as part of the decision-making process.

Concept #1: Only Relevant Revenues and Costs Should Be Considered in the Analysis. A key to selecting the best option among alternatives is distinguishing between relevant and irrelevant revenues and costs. **Relevant revenues** and **relevant costs** are those that differ between alternatives and will affect the outcome of the decision. For example, the additional labor cost required to fulfill a special order and the revenue generated from that order are both relevant because they arise only if the special order is accepted.

- **Irrelevant revenues** are revenues that do not affect or influence a decision because *they remain unchanged* regardless of the action taken. In other words, they are benefits that are the same across all alternatives being considered.
- **Irrelevant costs** are costs that do not influence a decision because *they remain unchanged* regardless of the action taken. **Sunk costs** are a special type of irrelevant cost. These costs already have happened as a result of a prior decision and cannot be recovered (see Illustration 9–2). For example, the original purchase price of equipment or previous advertising expenses are sunk costs. Since they cannot be changed, sunk costs have no impact on future performance.

ILLUSTRATION 9–2
Example of Sunk Costs, the Concorde Effect

Real-World Perspectives

In behavioral science, the Concorde Effect, also known as the sunk cost fallacy, refers to the tendency to continue investing in a project based on previous investments rather than future benefits or costs. The effect gets its name from the Concorde, a supersonic jet developed by joint venture between **Aérospatiale** of France and the **British Aircraft Corporation** of the United Kingdom. Despite the project's lack of commercial viability, the companies continued to fund it. This effect highlights the irrational persistence in failing endeavors due to significant prior commitments.

Example. Suppose **Amazon** is considering an upgrade to the physical security at one of its large cloud computing centers. This substantial investment is intended to enhance data security and potentially prevent future lawsuits in the event of a data breach.

- Irrelevant revenues: Revenues from cloud storage and processing remain unchanged regardless of whether the facility upgrade is made. Therefore, they are considered irrelevant revenues and should be ignored in the decision-making process.
- Irrelevant costs: Existing expenses such as depreciation on the building, insurance on equipment, and property taxes typically do not change with the decision to upgrade the facility. These expenses are therefore considered irrelevant costs and also should be ignored in the decision-making process.

Concept #2: Incremental Revenues and Costs Should Be the Focus of the Analysis. Using only relevant revenues and costs, managers should focus on the incremental impact of each alternative.

- **Incremental revenues**, also known as *differential revenues,* are the additional revenues a company expects to earn from choosing one alternative over another. These revenues help evaluate the financial benefit of one option compared to another.
- **Incremental costs**, also known as *differential costs,* are the additional costs of choosing one alternative over another. These costs help determine which option is more cost-effective.

Example. Suppose **Lululemon** has excess storage capacity at one of its warehouses and is considering leasing the unused space to another company.

- Incremental revenues: Leasing the space would generate additional revenue from rental income.
- Incremental costs: Leasing the space also would have additional costs, such as hiring personnel to manage the leasing operation.

Concept #3: Opportunity Costs Should Be Considered in the Analysis. While incremental analysis (concept #2 above) focuses on quantitative differences (revenues and costs), management also must consider the value lost from not choosing a particular alternative.

- **Opportunity costs** are the expected profits lost by choosing one option over another. The lost opportunity to make profits may take the form of forgone revenues, forgone cost savings, or both. Opportunity costs are particularly relevant for companies operating at or near full capacity that must decide which products or services to prioritize.

Example. Suppose **Under Armour** has a manufacturing facility that currently produces 20,000 running shoes monthly, generating profits of $200,000 per month. The company is considering converting the facility to produce 15,000 soccer cleats and expects profitability to increase to $250,000 per month. Because the facility cannot produce both products simultaneously, choosing to continue producing running shoes means forgoing the higher profit from soccer cleats. The forgone profits of $50,000 (= $250,000 − $200,000) represent an opportunity cost of continuing with running shoes.

KEY POINT

The decision-making process involves four steps: (1) Discover a problem, (2) identify courses of action, (3) analyze possible solutions, and (4) make a decision. When analyzing possible solutions (step 3), irrelevant revenues and costs are ignored, while incremental revenues and costs are the focus.

PART B

SHORT-TERM OPERATING DECISIONS

In this section, we'll focus on decisions that impact the company's short-term profitability. Specifically, we'll consider three types of decisions:

1. **Special-order:** Should we accept a special order from a customer?
2. **Sales-mix:** What mix of products or services should we offer?
3. **Sell-or-process-further:** Should we sell a product at a particular point of development or should we process it further?

These decisions are generally short term, meaning they can be made today and easily reversed or adjusted in the near future.

Incremental Analysis for Special-Order Decisions

■ **LO9–2**
Perform incremental analysis for special-order decisions.

A **special order** is a one-time request for products or services that are not part of a company's usual production or service offerings. These orders often require careful consideration because they may differ significantly from standard operations in terms of pricing, production processes, and resource allocation. The decision to accept or reject a special-order request is known as the **special-order decision**.

Example. Let's apply incremental analysis to a special-order decision using a hypothetical restaurant and food truck company, Tio's Tacos. Suppose Tio's Tacos is approached to supply one truck at a multiday summer music festival. The order specifies that the price per taco will be reduced from the typical $4.50 per taco to $4.00.

Restaurant management determines that the company has one idle truck available for use at the festival. It then collects the following information:

- Revenues: Estimated special taco sales at the festival are 2,000 tacos at $4.00 each.

- Costs:
  - Direct materials are $2.25 per taco.
  - Direct labor is $600 total (or $0.30 per taco).
  - Variable overhead is $1,200 total (or $0.60 per taco).
  - Fixed overhead is $40,000 per truck per year.
  - Fixed advertising is $4,000 per truck per year.
  - Other fixed selling, general, and administrative (SG&A) expenses are $10,000 per truck per year.
- The food truck will continue to be idle if the special order is not taken.

Maica/Getty Images

Should Tio's Tacos Take the Special Order? First, we ignore irrelevant revenues and costs. Irrelevant costs include the *fixed costs* associated with overhead, advertising, and SG&A. Because these costs do not change regardless of whether or not the special order is accepted, they are considered irrelevant and should be ignored in the analysis.

We can now conduct an incremental analysis using only the relevant revenues and costs. Illustration 9–3 presents the analysis, identifying the incremental revenues, incremental costs, and contribution margin for the special order.

ILLUSTRATION 9–3
Incremental Analysis—Special-Order Decision

Tio's Tacos is deciding whether to accept a special order to provide one food truck at a summer musical festival that is expected to serve 2,000 tacos. Management estimates that the event will result in the following revenues, variable costs, and contribution margin.*

		Incremental
Sales revenue	$4.00 × 2,000 tacos	$8,000
Less variable costs:		
Direct materials	$2.25 × 2,000 tacos	(4,500)
Direct labor	$0.30 × 2,000 tacos	(600)
Overhead	$0.60 × 2,000 tacos	(1,200)
Total variable costs		(6,300)
Contribution margin		**$1,700**

Decision

The incremental analysis indicates that Tio's Tacos should **accept** the special order to place a food truck at the music festival. Accepting the special order would increase Tio's Tacos' annual contribution margin by $1,700.

*Not included in the analysis are irrelevant costs related to fixed overhead ($40,000), fixed advertising ($4,000), and other fixed SG&A expenses ($10,000).

Qualitative considerations. However, before making a final decision, management also should consider potential impacts beyond the profitability of the special order itself.

- Sales displacement: If the festival is near an existing Mountain Tacos location, special-order sales could reduce regular restaurant sales.
- Brand impact: If the festival's audience doesn't match Mountain Tacos' image, participation could harm the company's reputation.
- Staffing challenges: The special order may require schedule adjustments or additional staffing resources.
- Pricing precedent: Offering a lower price for this order could set expectations for future lower prices.

Ultimately, the special-order decision should integrate both quantitative and qualitative factors to help ensure that the restaurant's strategic objectives and public image are maintained.

MINIMUM BID PRICE FOR A SPECIAL ORDER

Another approach to a special-order decision is to calculate a special-order bid price by determining the minimum selling price the company is willing to accept. The bid price must cover all of the relevant costs and include a target profit. For example, suppose the festival organizers do not specify a required taco price of $4.00 per taco, but instead ask Tio's Tacos how low they would be willing to drop their price for the festival.

The incremental costs for the special order are $6,300 ("total variable costs" in Illustration 9–3). The special-order price should cover these costs and provide a target profit for the restaurant. If Tio's Tacos management wants to earn at least $1,000 from the special order, the food truck would need to generate revenues of $7,300 (= $6,300 + $1,000). This means that the taco sales price would need to be set at a minimum of $3.65 per taco (= $7,300 ÷ 2,000 tacos).

Capacity Considerations. Accepting a special order is only beneficial if the company has available capacity. If the food truck operations are already operating at full capacity, accepting the special order would require displacing existing sales. In such cases, Mountain Tacos should compare the profit from the special order with the profit from its regular business. The special order should only be accepted if it generates a higher overall profit or if the additional profit is sufficient to justify acquiring additional capacity to fulfill the order.

COMMON MISTAKE

Students sometimes decide to accept special orders without considering whether the company has enough capacity to fulfill the order without displacing regular sales. If fulfilling the special order reduces existing sales, the decision may result in a net loss, even if the order seems profitable in isolation.

KEY POINT

Special orders are unique orders for products or services that are not part of a company's usual production or service offerings. The decision to accept a special order is made only when incremental revenues are greater than incremental costs (that is, contribution margin of the special order is greater than zero).

Let's Review

Cloudloom Fabrics has received an order for throw blankets at a special selling price of $26 per blanket (suggested retail price is $30). Capacity exists to satisfy the special order. Unit costs to manufacture and sell these blankets are as follows: direct materials, $7.00; direct labor, $10.00; variable overhead, $8.00; fixed manufacturing costs, $5.00; and fixed general and administrative costs, $9.00. Should Cloudloom accept the order?

Solution

Variable costs to produce the throw blankets:

Direct materials	$ 7.00
Direct labor	10.00
Variable overhead	8.00
Total variable manufacturing costs	$25.00

Decision

Sample should **accept** the special order because the offered price of $26 exceeds the variable manufacturing costs of $25. [Notice that all fixed costs were ignored in this analysis.]

Incremental Analysis for Sales-Mix Decisions

■ **LO9–3**
Perform incremental analysis for sales-mix decisions involving constrained resources.

Sales mix refers to the proportion of various products or services that a company sells. It's typically presented as a percentage of total sales dollars or as a percentage of total units sold for each product or service.

The **sales-mix decision** involves management determining the mix of products or services to offer. When company resources, such as labor hours, machine time, raw materials, or warehouse space, are limited, management must prioritize those products and services that contribute most to profitability or other strategic initiatives. By analyzing the sales mix, a company can maximize the company's overall profitability. **Netflix** is an example of a company that successfully changed its sales mix to remain profitable (refer to Illustration 9–4).

ILLUSTRATION 9–4
Sales Mix for Netflix

Real-World Perspectives

Netflix is a prime example of a company that has successfully re-prioritized its mix of products and services over time. Initially launched as a DVD rental service by mail in 1998, Netflix shipped its first DVD, *Beetlejuice,* on March 10, 1998, and went on to ship over 5.2 billion DVDs. Recognizing the potential of online streaming, Netflix introduced streaming as a second product in 2007. After that, the company began to slowly phase out its DVD service. The final DVD was shipped on September 29, 2023.

To further enhance its offerings, Netflix began developing its own original content in 2011, starting with *House of Cards, Orange Is the New Black,* and a new season of *Arrested Development.* This strategic shift not only diversified its content library but also allowed Netflix to differentiate itself from competitors, creating a unique value proposition that has significantly contributed to its success in the highly competitive entertainment industry.

https://about.netflix.com/en/news/netflix-dvd-the-final-season

To determine the optimal sales mix, managers calculate the contribution margin per unit of constrained resources using the following two steps:

Step 1: Calculate the Contribution Margin per Unit. This step applies to each product or service that is subject to a constrained resource.

$$\text{Contribution margin per unit} = \text{Selling price per unit} - \text{Variable cost per unit}$$

Step 2: Calculate the Contribution Margin *per Unit of the Constrained Resource*. This step enables a comparison of contribution margins across products based on the company's limited resources.

$$\text{Contribution margin per unit of constrained resource} = \frac{\text{Contribution margin per unit (from step 1)}}{\text{Quantity of the constrained resource required per unit}}$$

Incremental analysis is then used to identify the relevant costs and revenues, helping managers determine the sales mix that maximizes profitability.

COMMON MISTAKE

When resources are limited, it's incorrect to prioritize products based solely on their total contribution margin per unit. Instead, managers must calculate and compare contribution margin per unit of the constrained resource, such as labor hours or machine time.

Example. Let's explore an example of the sales mix decision for a service company. In the Let's Review that follows this example, we'll examine the sales mix of a manufacturing company.

DEFT Systems charges a fee to customers for three types of loan processing assistance: commercial loans, auto loans, and home loans. The company's resources are limited to 100,000 hours of processing time in a given year. The company's loan processing information is provided in Illustration 9–5.

ILLUSTRATION 9–5
Processing Information by Loan Type

	Commercial Loans	Auto Loans	Home Loans
Current loan application demand	20,000	30,000	18,000
Processing hours per loan application*	2	1	3
Loan processing fee (sales revenue)	$96	$72	$133
Variable processing costs	$50	$40	$ 75
Variable selling costs	$26	$20	$ 25

*The current loan processing capacity of the company is 100,000 hours.

Which loan type should be prioritized first? Which should be second? Which is last? To determine the most profitable sales mix, we calculate the contribution margin per unit of constrained resource for each product line using the two-step process outlined above. Illustration 9–6 provides the calculations.

- **Step 1: Calculate the contribution margin per unit.** This amount is $20, $12, and $33 for commercial, auto, and home loans, respectively.
- **Step 2: Calculate the contribution margin *per unit of the constrained resource.*** In this example, the constrained resource is processing hours. Contribution margin per unit divided by the number of processing hours required for each type of loan provides a ranking to help determine which loan service to prioritize.

ILLUSTRATION 9–6
Incremental Analysis—Sales-Mix Decision

DEFT Systems charges a fee to customers for loan processing assistance. The company's current loan processing capacity is 100,000 hours. To determine the most profitable sales mix of loans, management estimates the following revenues, variable costs, and contribution margin per processing hour for each loan type.

	Commercial Loans	Auto Loans	Home Loans	
Loan process fee (sales revenue)	$ 96	$ 72	$ 133	
Less: Variable costs				
Processing	(50)	(40)	(75)	
Selling	(26)	(20)	(25)	
Total variable costs	$(76)	(60)	$(100)	
Contribution margin per loan	**$ 20**	**$ 12**	**$ 33**	**Step 1**
Processing hours per loan	÷ 2	÷ 1	÷ 3	
Contribution margin per processing hour	**$ 10**	**$ 12**	**$ 11**	**Step 2**
Sales mix priority	3rd	1st	2nd	

Decision

The incremental analysis indicates that DEFT Systems should prioritize the loans in the following order (based on contribution margin per processing hour): **auto loans** ($12 per hour), **home loans** ($11 per hour), and **commercial loans** ($10 per hour).

Sales mix. How many of each type of loan should DEFT Systems process to maximize its overall contribution margin based on the current loan processing capacity of 100,000 processing hours?

To answer this question, we first compare in Illustration 9–7 the total processing hours needed to meet all loan demand from customers (124,000 hours) with the loan processing capacity of the bank (100,000 hours). Notice that the company does not have the capacity to meet total demand, so it must prioritize some loan services over others.

ILLUSTRATION 9–7
Processing Hours Needed versus Bank Capacity

Loan Type	Loan Demand (refer to Illustration 9–4)	Processing Hours
Commercial loans	20,000 loans × 2 processing hours per loan =	40,000
Auto loans	30,000 loans × 1 processing hour per loan =	30,000
Home loans	18,000 loans × 3 processing hours per loan =	54,000
Total		124,000
		↕
Current loan processing capacity of the bank		100,000

We can determine the most profitable sales mix, given the processing constraints, by following the loan priority rankings provided previously in Illustration 9–6. Illustration 9–8 presents the calculation of the optimal sales mix.

ILLUSTRATION 9–8
Optimal Sales Mix by Loan Type

Loans Processing (in order of priority)		Processing Hours
Total capacity		100,000
Auto loans	30,000 loans × 1 hour =	(30,000)
Hours remaining		70,000
Home loans	18,000 loans × 3 hours =	(54,000)
Hours remaining		16,000
Commercial loans	**8,000** loans × 2 hours =	(16,000)
Hours remaining		0

Notice the following in Illustration 9–8:

- Of the 100,000 hours of processing capacity, the first 30,000 hours are allocated to auto loans, fulfilling the entire demand for that product.
- The next 54,000 hours are allocated to home loans, also meeting the entire demand.
- The remaining 16,000 hours (= 100,000 − 30,000 − 54,000) are allocated to commercial loans. Since each commercial loan requires two processing hours, the company can process only 8,000 commercial loans (8,000 loans × 2 hours = 16,000 hours).

Based on the sales mix determined in Illustration 9–8 and the contribution margin per loan determined in Illustration 9–6, the total contribution margin for DEFT Systems is calculated in Illustration 9–9. No other combination of loan processing will produce a higher contribution margin for the bank, at its current capacity of 100,000 processing hours.

Opportunity Costs. When resources are constrained, opportunity costs can arise. In the preceding example, prioritizing the auto and home loans prevents DEFT Systems from meeting the full demand for commercial loans. More specifically, the total customer demand for commercial loans is 20,000 loans, but the company has resources to process only 8,000

ILLUSTRATION 9–9
Contribution Margin of Optimal Sales Mix

Loan Type	Sales mix*	Contribution margin per loan**	Contribution Margin
Auto loans	30,000 loans	× $12 per loan =	$ 360,000
Home loans	18,000 loans	× $33 per loan =	594,000
Commercial loans	8,000 loans	× $20 per loan =	250,000
Total contribution margin			**$1,204,000**

* Amounts are from Illustration 9–7.
** Amounts are from Illustration 9–5.

of these loans. The inability to process the remaining 12,000 commercial loans (= 20,000 − 8,000) results in an opportunity cost equal to forgone contribution margin of $240,000, as detailed below.

$$\text{Opportunity cost} = \text{12,000 unmet commercial loans} \times \text{\$20 contribution margin per loan} = \$240{,}000$$

DEFT Systems is willing to bear this opportunity cost in order to prioritize services that provide a higher contribution margin. However, if the company could hire additional personnel to process the additional 12,000 commercial loans for less than $240,000, it would be beneficial to do so.

Qualitative Considerations. Before making a final decision on the sales mix, it's important consider qualitative factors, including the following:

- Customer relationships: Prioritizing certain products over others can impact long-term customer relationships. If commercial loan applicants feel underserved, they may take their business to competitors, reducing future revenue potential.
- Employee specialization: Employees may have expertise in specific loan types, so changing the mix of services offered may require additional training or changes in hiring practices.

KEY POINT

Sales mix refers to the proportion of different products or services that a company sells. When resources are constrained, a company cannot provide all products and services demanded by customers. In this case, the decision of the optimal sales mix is determined by computing the contribution margin per unit of constrained resource. Products and services with the highest contribution margin per unit of constrained resource are prioritized.

LET'S REVIEW

Surf, Inc., manufactures three kinds of surfboards, but it has a limited number of machine hours available to make them. Product line data are as follows. In what order should the surfboard product lines be produced?

	Fiberglass	Plastic	Graphite
Machine hours per unit	4	1	2
Selling price per unit	$1,500	$800	$1,300
Variable manufacturing cost per unit	500	200	800
Variable selling costs per unit	200	350	200

Solution

	Fiberglass	Plastic	Graphite
Selling price per unit	$1,500	$ 800	$1,300
Less variable costs:			
Manufacturing	$ 500	$ 200	$ 800
Selling	200	350	200
Total unit variable costs	$ 700	$ 550	$1,000
Contribution margin per unit	$ 800	$ 250	$ 300
Machine hours per unit	÷ 4	÷ 1	÷ 2
Contribution margin per machine hour	$ 200	$ 250	$ 150

Decision

Surf should produce **plastic** first, then **fiberglass,** and finally **graphite** surfboards.

Incremental Analysis for Sell-or-Process-Further Decisions

■ **LO9–4**
Perform incremental analysis for sell-or-process-further decisions.

Manufacturing companies sometimes produce goods that can be sold either in their current form or after additional processing. This is known as a **sell-or-process-further decision**. In a similar way, service companies have a decision to provide a basic service or one that is enhanced in some way.

The decision to process further (or enhance) is based on comparing the incremental revenues and incremental costs of the product in its current form or after further processing.

Here are some examples of sell-or-process-further decisions:

- Wine production: A vineyard can sell harvested grapes as fresh fruit or process them further into wine.
- Oil refinement: A company that extracts crude oil must decide whether to sell it as-is or process it further into gasoline, diesel, and other products.
- Lumber production: A logging company can sell raw timber logs or process them further into finished lumber, plywood, or paper products.
- Website development: A company can offer a basic template for website development or enhance it with custom-designed dashboards and e-commerce functionality.

In some cases, two or more products, known as **joint products**, share the same raw material inputs and are indistinguishable during early stages of production. These products become separate and identifiable at a specific stage called the **split-off point**. At this point, the company can choose to either sell the products as they are or process them further into different products for sale.

Costs that occur for all products up to the split-off point are called **joint costs**. These costs are shared by all products and are considered irrelevant in sell-or-process-further decisions. They do not change regardless of whether a product is sold as-is or processed further.

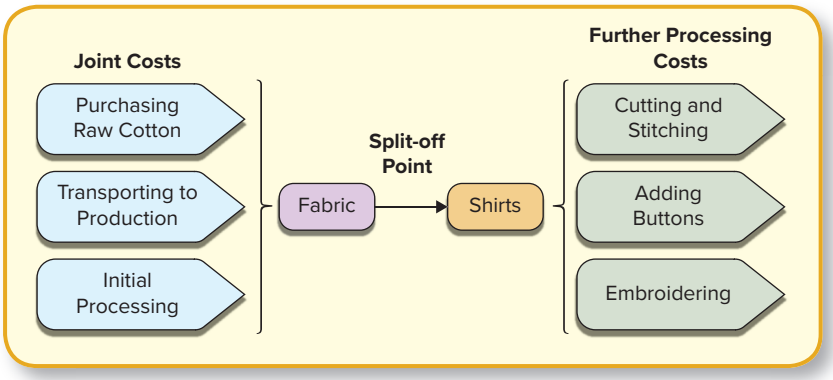
Illustration 9–10 depicts how these concepts relate to a textile factory that could produce two joint products: fabric or, after further processing, shirts.

The sell-or-process-further decisions in Illustration 9–10 involve the following:

Step 1: Calculate the Incremental Revenue.

$$\text{Incremental revenue} = \underset{\text{(Shirt)}}{\text{Total revenue } \textit{after further processing}} - \underset{\text{(Fabric)}}{\text{Total revenue } \textit{at split-off point}}$$

ILLUSTRATION 9–10
Joint Costs versus Further Processing Costs in the Sell-or-Process-Further Decision



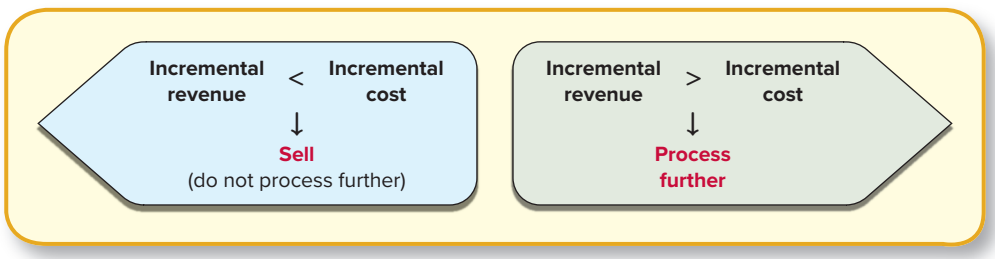
Step 2: Calculate the Incremental Cost.

$$\text{Incremental cost} = \underset{\text{(Shirt)}}{\text{Total cost } \textit{after further processing}} - \underset{\text{(Fabric)}}{\text{Total cost } \textit{at split-off point}}$$

Step 3: Calculate Incremental Operating Income. If the incremental revenue (step 1) exceeds the incremental costs (step 2), the resulting incremental operating income is positive and the company should process the product further.

As demonstrated in Illustration 9–11, the decision to process further is made only when the incremental revenues are greater than the incremental costs.

ILLUSTRATION 9–11
Incremental Revenues, Incremental Costs, and the Sell-or-Process-Further Decision



Example. Let's review an example of the sell-or-process-further decision for a manufacturing company. In the Let's Review that follows this example, we'll examine this decision for a service company.

As part of its strategic plan, Blue Ridge Denim's management is considering whether it should sell denim fabric to other clothing manufacturers or instead process the fabric further into denim jeans. To produce jeans, Blue Ridge would have additional production costs, including cutting, stitching, quality control, and packaging.

The revenues and costs for each option are provided in Illustration 9–12.

ILLUSTRATION 9–12
Sell-or-Process-Further—Blue Ridge Denim Company

Product	Description	Selling Price per Unit	Cost per Unit
Denim fabric	• Raw denim fabric sold to clothing manufacturers	$20	$12
Denim jeans	• Finished denim jeans sold to retail stores	42	29

Should the company sell the fabric or process it further into jeans? The incremental analysis is presented in Illustration 9–13 and is completed in three steps:

Step 1: Calculate incremental revenue. Revenue from denim jeans ($42) minus revenue from denim fabric ($20) results in incremental revenue of $22 per unit.

Step 2: Calculate incremental cost. Cost of denim jeans ($29) minus cost of denim fabric ($12) results in incremental cost of $17 per unit.

Step 3: Calculate incremental operating income. Incremental revenue ($22 from step 1) minus incremental cost ($17 from step 2) results an incremental operating profit of $5 per unit.

ILLUSTRATION 9–13
Incremental Analysis—Sell-or-Process-Further Decision

Blue Ridge Denim is deciding whether to process raw denim fabric into denim jeans. The company's management conducts the following analysis of the incremental revenues and costs.

	Process Further (Denim Jeans)
Step 1:	
Revenue per unit (denim jeans)	$42
Less: Revenue per unit (raw denim fabric)	(20)
Incremental revenue per unit	**$22**
Step 2:	
Cost per unit (denim jeans)	$29
Less: Cost per unit (raw denim fabric)	(12)
Incremental cost per unit (denim jeans)	**$17**
Step 3:	
Incremental operating income (loss) per unit	**$ 5**

Decision

The incremental analysis indicates that Blue Ridge Denim should **process further.** Processing the raw denim into finished jeans creates incremental profit of $5 per unit sold.

Qualitative considerations. Before making a final decision not to sell raw denim fabric, several qualitative factors should be considered.

- Customer loyalty: Selling finished jeans may help Blue Ridge Denim build stronger customer relationships.
- Brand reputation: Producing high-quality jeans could elevate the company's image and allow entry into premium clothing markets.
- Strategic growth: Offering finished products may open up retail and e-commerce opportunities not available when only selling raw materials.

KEY POINT

A sell-or-process-further decision involves determining whether to sell a product in its current form or to process it further and then sell. The decision to process further is made only when the incremental revenues after further processing are greater than the incremental costs.

Let's Review

Washington First Bank is a financial services company. Management is considering whether to enhance its basic account services (Basic Package) by offering additional financial planning and investment advice (Enhanced Package). The revenues and costs, as well as the features of each package, are as follows:

Package	Features	Annual Fee Revenue	Bank Cost
Basic	• Traditional banking services (online checking, debit card, and automatic bill pay)	$ 50	$ 30
Enhanced	• Features of the Basic Package, plus Services related to financial planning and investment advice	300	285

Should the bank offer the Enhanced Package?

Solution

	Enhanced Package
Step 1:	
Total revenue per account	$300
Less: Revenue from the Basic Package	(50)
Incremental revenue per account	**$250**
Step 2:	
Total cost per account	$285
Less: Cost from the Basic Package	(30)
Incremental cost per account	**$255**
Step 3:	
Incremental operating income (loss) per account	**$ (5)**

Decision

The incremental analysis indicates that the bank **should not offer** the Enhanced Package because it would lose $5 on each account.

PART C STRATEGIC BUSINESS DECISIONS

In this section, we'll focus on strategic business decisions. These decisions are generally longer-term in nature, as they often involve significant changes to the business that are more difficult to reverse or adjust in the short term.

The two strategic business decisions we consider are

1. **Manufacture-or-outsource:** Should we continue to do a specific task ourselves or outsource it?
2. **Keep-or-drop:** Should we keep a particular business segment or drop it?

Incremental Analysis for Manufacture-or-Outsource Decisions

■ **LO9–5**
Perform incremental analysis for manufacture-or-outsource decisions.

Sometimes, management must decide whether to produce products and services using in-house resources or instead purchase them from an outside supplier. This is known as a **manufacture-or-outsource decision**.

Outsourcing refers to the practice of contracting external entities to perform certain manufacturing functions or services that could be performed internally. The decision to outsource often is driven by factors such as reducing costs, focusing on core competencies, improving service quality, or accessing specialized expertise not available within the company. All of these outsourcing considerations potentially can improve profitability. **Nike** is an example of a company that has successfully outsourced virtually all of its production (refer to Illustration 9–14).

ILLUSTRATION 9–14
Outsourcing for Nike

Nike is one of the world's most popular brands, renowned for its high-quality footwear and athletic apparel. With over a thousand retail stores and approximately 83,000 employees globally, Nike has achieved global revenue of more than $50 billion. What may come as a surprise, however, is that Nike does not own any of its own manufacturing facilities. Instead, it outsources the manufacturing process to a network of outsourced factories, called "contract manufacturers," scattered across 42 countries. These factories specialize in different types of products to ensure efficient production and rapid distribution. In total, Nike's most recent annual report discloses that its contract manufacturers include 123 footwear factories and 291 apparel factories.

https://www.sec.gov/ix?doc=/Archives/edgar/data/320187/000032018723000039/nke-20230531.htm

Illustration 9–15 provides some of the key information managers need for the manufacture-or-outsource decisions.

ILLUSTRATION 9–15
Information Needed for Analysis of In-house Manufacturing versus Outsourcing

Information About In-house Manufacturing	Information About Outsourcing
• Variable costs of manufacturing the item	• Purchase price paid to outside entity
• Cost needed for additional machinery	• Rent or cash inflows to be generated from vacated space in the factory
• Incremental fixed costs	• Salvage value of disposed machinery

Example. Let's review an example of the sell-or-process-further decision for a manufacturing company. In the Let's Review that follows this example, we'll examine this decision for a service company.

Fizzle Inc. is a soda manufacturing company that produces and distributes specialty sodas to boutique retail stores. Suppose Fizzle has purchased packing cartons from an outside supplier for $2.25 per carton. Fizzle was recently notified that the supplier is raising the price to $2.70 per carton. Fizzle has available space and idle machinery that could be repurposed to produce the cartons in-house. Management is now considering whether to manufacture the cartons internally.

Management collects the following information:

- The annual carton production need is 20,000 units. Employees typically make 20 cartons per hour, so 1,000 direct labor hours are needed.
- Cost information for in-house production:
  - Direct materials cost is $1.25 per carton.
  - Direct labor cost is $1.05 per carton (= $21.00 per hour/20 cartons per hour).

- Variable overhead costs are $6.50 per direct labor hour.
- Fixed overhead costs include $4,000 of depreciation per year and $6,000 of other fixed costs.

- The idle machines will continue to be idle if the cartons are outsourced.

Should Fizzle continue to outsource the cartons or manufacture them in-house? The first step in the analysis is to identify any irrelevant revenues or costs that should be ignored. In this case, the machinery has already been purchased, and neither the machinery nor the required factory space has any alternative use. As a result, depreciation and other fixed overhead costs will be the same for both alternatives. Therefore, they are irrelevant and should be excluded from the analysis.

We can now conduct an incremental analysis using only the relevant revenues and costs. Illustration 9–16 presents a comparison of the two alternatives.

- **Manufacture:** The relevant costs to manufacture the 20,000 cartons in-house include direct materials, direct labor, and variable overhead of $52,500 total.
- **Outsource:** The relevant costs to continue outsourcing the 20,000 cartons include the increased purchase price of $2.70 per carton, for a total of $54,000.

ILLUSTRATION 9–16

Incremental Analysis—Manufacture-or-Outsource Decision

Fizzle is deciding whether to manufacture the cartons themselves or continue to outsource the production of its cartons. Management provides the following costs for each decision.*

		Manufacture		Outsource
Direct materials	$1.25 × 20,000 cartons	$ 25,000		–
Direct labor	$1.05 × 20,000 cartons	21,000		–
Variable overhead	$6.50 × 1,000 hours	6,500		–
Outside supplier	$2.70 × 20,000 cartons	–		$ 54,000
Total cost		**$52,500**	<	**$54,000**

*Not included in the analysis are irrelevant costs related to fixed overhead costs totaling $10,000 that are the same for both alternatives.

Decision

The incremental analysis reveals that Fizzle should **manufacture** the cartons in-house. Manufacturing is less costly than outsourcing by $1,500 (= $54,000 − $52,500).

Opportunity cost. Now suppose that if Fizzle decides to manufacture the cartons in-house, the company will no longer have machinery and factory space available to produce a new premium soda flavor. The new product is expected to be launched soon and generate annual profits of $5,000. Choosing to manufacture cartons would mean giving up this profitable opportunity. The $5,000 in forgone profits represents an opportunity cost of manufacturing.

Illustration 9–17 indicates that when opportunity cost is factored into the analysis, the total cost of manufacturing cartons increases to $57,500 (= $52,500 + $5,000), making outsourcing the lower-cost option. This example illustrates how opportunity costs can affect the outcome of a decision.

Qualitative considerations. Management should consider several important qualitative factors before making a final decision about whether to outsource:

- Workforce impact: Producing cartons in-house may create new jobs, contributing to the community's economic development. However, hiring and training employees for this new operation could introduce additional challenges.
- Production risks: In-house production may expose the company to new risks such as material shortages, labor stoppages, or equipment failures that could delay production.

ILLUSTRATION 9–17

Incremental Analysis—Manufacture-or-Outsource Decision with an Opportunity Cost

In addition to the information in Illustration 9–16, Fizzle could generate additional profits of **$5,000** by producing a new premium soda flavor using machinery and factory space that would be available if cartons were outsourced.*

		Manufacture		Outsource
Direct materials	$1.25 × 20,000 cartons	$25,000		–
Direct labor	$1.05 × 20,000 cartons	21,000		–
Variable overhead	$6.50 × 1,000 hours	6,500		–
Outside supplier	$2.70 × 20,000 cartons	–		$54,000
Forgone profits (opportunity costs)		**5,000**		
Total cost		**$57,500**	>	**$54,000**

*Not included in the analysis are irrelevant costs related to fixed overhead costs totaling $10,000 that are the same for both alternatives.

Decision

The incremental analysis reveals that Fizzle should **outsource** the cartons. Outsourcing is less costly than manufacturing by $3,500 (= $57,500 − $54,000). By outsourcing, machinery and factory space are available to manufacture the new premium soda flavor to generate additional profits of $5,000.

- Product quality: If Fizzle lacks expertise in carton manufacturing, the company may struggle to maintain consistent quality, potentially reducing customer satisfaction.
- Environmental impacts: In-house production could have negative environmental impacts due to increased energy use, waste production, or emissions. Fizzle should assess whether an external supplier has more environmentally friendly production practices or policies.

KEY POINT

A manufacture-or-outsource decision involves determining whether to manufacture a product in-house or to outsource production. Outsourcing refers to the practice of contracting outside entities to handle certain manufacturing functions or services that could be performed internally. The decision to outsource is made only when the total costs of outsourcing are less than the total costs of manufacturing in-house.

Let's Review

Office Associates is currently operating at less than capacity. The company thinks it could cut costs by outsourcing office cleaning to an independent cleaning service for $200 per week. Currently, a general office worker is employed for $30 an hour to do cleaning and other office duties. Cleaning the office usually takes one hour a day to perform and consumes $30 of supplies per week. There are $2 variable overhead costs per week associated with utilities and $8 of fixed overhead per week related to depreciation on the cleaning equipment. Should Office Associates continue to perform office cleaning, or should it outsource the task?

Solution

		In-House		Outsource
Direct labor	5 hours × $30	$150		–
Direct materials (supplies)		30		–
Variable overhead		2		–
Outside cleaning service		–		$200
Total cost		**$182**	<	**$200**

Decision

The cost of in-house cleaning ($182) is less than the cost of an outside cleaning service ($200). In this case, Office Associates should continue to perform the office cleaning **in-house.** [*Note:* The $8 of fixed overhead cost per week is ignored because it does not differ between the alternatives.]

Incremental Analysis for Keep-or-Drop-Segment Decisions

■ **LO9–6**
Perform incremental analysis for keep-or-drop-segment decisions.

As illustrated in the chapter's Feature Story, another type of strategic business decision is whether to retain or eliminate business segments. This is known as a **keep-or-drop-segment decision**.

A business **segment** is a portion of the company's overall operations whose sales and operations can be separately identified. Segments often are defined as product lines, service lines, sales territories, divisions, or departments.

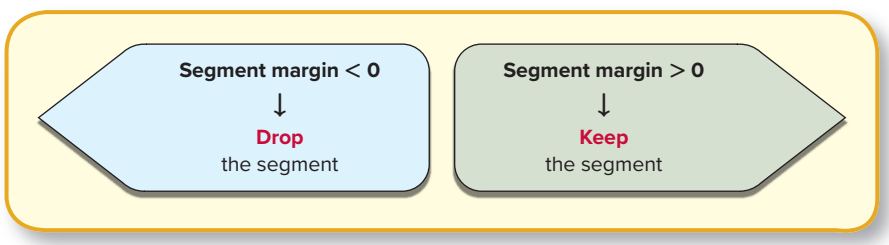
A **segment margin** represents the difference between a segment's sales revenue and the direct costs, both variable and fixed, that can be specifically attributed to that segment. If the segment is discontinued, its revenue will be lost. The same, however, is not necessarily true for its costs. There are two types of segment costs:

1. **Avoidable costs** are all variable and fixed costs directly tied to a segment that *would be eliminated* if the segment were discontinued. Variable costs include the segment's direct materials, direct labor, and variable overhead. **Direct fixed costs** include fixed costs that are directly attributable to a segment of the business.
2. **Common costs** are fixed costs that occur in the operation of a business that cannot be directly attributed to any one segment. These costs *would remain* even if the segment were discontinued. Common costs typically include items like facility rentals, utilities, or salaries of employees who serve multiple segments.

Analyzing segment profitability involves preparing a **segment income statement** that reports revenues, variable costs, and direct fixed costs separately by segments, followed by common costs that are not allocated to any particular segment. Managers use the segment margins from this statement to make their drop-or-keep-segment decisions.

As demonstrated in Illustration 9–18, if the segment margin is **negative,** the segment should be **dropped.** Its revenues are less than its direct costs, meaning that other segments would be needed to support the failing segment. Conversely, if the segment margin is **positive,** the segment should be **kept,** as it generates more revenues than its direct costs and contributes toward covering the company's common costs.

ILLUSTRATION 9–18
Segment Margin and the Keep-or-Drop-Segment Decision



Example. The Blossom Boutique is an owner-operated flower shop specializing in custom flower arrangements for major events. For the past five years, it also has offered doorstep flower delivery services but is now considering whether to eliminate this service. To help make this decision, management prepares a segment income statement that separates the revenues and costs for the two segments of the company. The segment income statement is provided in Illustration 9–19.

THE BLOSSOM BOUTIQUE
Segment Income Statement
For the current period

	Custom Arrangements	Flower Delivery	Total Company
Sales	$2,050,000	$450,000	$2,500,000
Less: Variable costs	(1,575,000)	(410,000)	(1,985,000)
Contribution margin	475,000	40,000	515,000
Less: Direct fixed costs	(215,000)	(59,000)	(274,000)
Segment margin	**$ 260,000**	**$(19,000)**	**241,000**
Less: Common fixed costs			(32,000)
Operating income			$ 209,000

ILLUSTRATION 9–19
The Blossom Boutique—Segment Income Statement

- Note that sales, variable costs, and direct fixed costs are separated between the Custom Arrangements segment and the Flower Delivery segment.
- Also note that the third column includes $32,000 in common fixed costs that cannot be attributed to any specific segment.

Should The Blossom Boutique keep or drop the flower delivery segment? We begin by identifying any irrelevant benefits or costs that should be excluded from the analysis. In this case, the common fixed costs are irrelevant because they are unavoidable and happen regardless of whether the company discontinues the Flower Delivery segment.

We now can conduct an incremental analysis using the information from the segment income statement. Illustration 9–20 provides this analysis, which is constructed as follows:

- **Keep.** The amounts for keeping the Flower Delivery segment come directly from the Total Company column in the segment income statement presented in Illustration 9–19. By keeping the segment, the company's overall structure and operations remain unchanged.
- **Drop.** The amounts for dropping the Flower Delivery segment reflect the performance of the remaining portion of the business, specifically the Custom Arrangements segment presented in Illustration 9–19.

ILLUSTRATION 9–20
Incremental Analysis—Keep-or-Drop-Segment Decision (Base Case)

Based on its segment income statement in Illustration 9–19, The Blossom Boutique is deciding whether to keep or drop the Flower Delivery segment.

	Flower Delivery Segment Decision		
Total Company After Decision	**Keep***		**Drop****
Sales	$2,500,000		$2,050,000
Less: Variable costs	(1,985,000)		(1,575,000)
Contribution margin	515,000		475,000
Less: Direct fixed costs	(274,000)		(215,000)
Segment margin	**$ 241,000**	<	**$ 260,000**

*Amounts are from the Total Company column in Illustration 9–19. Common fixed costs of $32,000 are not included in the analysis.
** Amounts are from the Custom Arrangements column in Illustration 9–19.

Decision

The incremental analysis indicates that The Blossom Boutique should **drop** the Flower Delivery segment, leaving only the Customer Arrangements segment. By doing so, segment margin will increase by $19,000 (from $241,000 to $260,000).

Change in sales of remaining segments. The decision to drop the Flower Delivery segment assumes there would be no effect on the continuing Custom Arrangements segment. But what if that's not the case? It's possible that some delivery customers become aware of the shop's custom arrangement offerings through their use of the delivery services. Thus, before making a final decision, management should assess the extent to which sales between segments are connected. If customers who use the flower delivery service also purchase custom arrangements, discontinuing the delivery segment could lead to a decline in sales for the remaining segment.

Now let's suppose that the shop owner estimates that dropping the Flower Delivery segment will result in a 5% decrease in sales of custom arrangements. This 5% decrease needs to be factored into the sales and variable costs reflected in the analysis. Illustration 9–21 provides the updated analysis that includes the 5% decline in sales and variable costs after dropping the Flower Delivery segment (see the second column).

ILLUSTRATION 9–21

Incremental Analysis—Keep-or-Drop-Segment Decision (5% Decline in Sales and Variable Costs)

In addition to the information in Illustration 9–20, The Blossom Boutique estimates a 5% decline in sales and variable costs (but not direct fixed costs) of the Custom Arrangements segment if the Flower Delivery segment is dropped.

	Flower Delivery Segment Decision		
Total Company After Decision	**Keep***		**Drop****
Sales	$2,500,000		$1,947,500
Less: Variable costs	(1,985,000)		(1,496,250)
Contribution margin	515,000		451,250
Less: Direct fixed costs	(274,000)		(215,000)
Segment margin	**$ 241,000**	**>**	**$ 236,250**

*Amounts are from the Total Company column in Illustration 9–19. Common fixed costs of $32,000 are not included in the analysis.
**Amounts (other than direct fixed costs) represent a 5% decline from the corresponding amounts in the Custom Arrangements column in Illustration 9–19.

Decision

The incremental analysis indicates that The Blossom Boutique should **keep** the Flower Delivery segment. Dropping the Flower Delivery segment would reduce the segment margin by $4,750 (from $241,000 to $236,250).

Qualitative considerations. While the quantitative analysis provides insights into the financial implications of keeping or dropping a segment, management also should consider several qualitative factors before making the final decision:

- Customer retention: Discontinuing a segment may disappoint loyal customers who rely on the service, potentially leading to a loss of long-term business.
- Employee morale: Discontinuing a segment could result in job losses or reassignments, affecting employee morale and retention. A discouraged workforce could negatively impact productivity and service quality.
- Idle resources: If discontinuing a segment frees up resources, management should consider whether those resources can be repurposed within the business. If not, underutilized assets may remain, potentially offsetting some of the anticipated cost savings.

COMMON MISTAKE

Students sometimes mistakenly treat all fixed costs as irrelevant. Some fixed costs, such as those directly tied to a business segment (e.g., a segment manager's salary), are avoidable and should be included in the decision analysis. Only common fixed costs that will remain regardless of the decision should be excluded.

KEY POINT

A keep-or-drop-segment decision involves determining whether to keep (continue) a segment of the business or drop (discontinue) those operations. A business segment represents a portion of the company's overall operations whose sales and operations can be separately identified. The decision to keep a segment is made only when the segment's margin (sales minus variable costs and direct fixed costs) is greater than zero.

Let's Review

Raindance Enterprises is evaluating its two segments, East Segment and West Segment.

- Sales, variable costs, and contribution margin for each segment are given below.

	East Segment	West Segment
Sales	$1,275,300	$677,700
Less: Variable costs	(566,800)	(301,200)
Contribution margin	708,500	376,500

- In addition, the company has total fixed costs of $1,100,000, of which $450,000 is traceable to the East Segment, $400,000 is traceable to the West Segment, and $250,000 is not traceable to a specific segment.

Should either division be dropped?

Solution

	East Segment	West Segment	Total Company
Sales	$1,275,300	$677,700	$1,953,000
Less: Variable costs	(566,800)	(301,200)	(868,000)
Contribution margin	$ 708,500	$376,500	$1,085,000
Less: Direct fixed costs	(450,000)	(400,000)	(850,000)
Segment margin	$ 258,500	$ (23,500)	$ 235,000
Less: Common fixed costs			(250,000)
Operating income (loss)			$ (15,000)

Decision

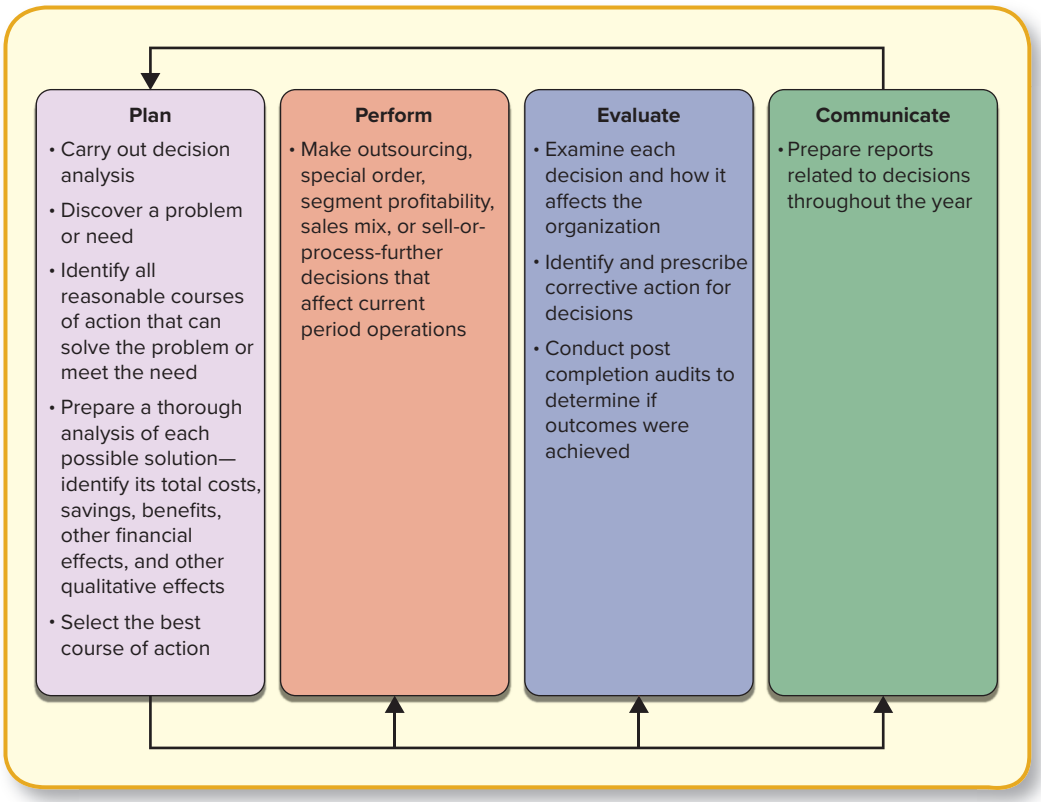
Raindance should **drop the West Segment** because its segment margin is negative. After dropping the West Segment, the remaining portion of the company (East Segment) will be profitable ($8,500 = $258,500 − $250,000 common fixed costs).

Incremental Analysis and the Management Process

This chapter focuses on identifying key concepts, such as relevant and irrelevant costs, incremental revenues and costs, and opportunity costs, to help managers understand which financial factors should be considered in their analyses. These foundational concepts are crucial for performing incremental analysis, which we applied to a variety of specific decisions.

Illustration 9–22 summarizes how decision analysis is integrated into the management process. You'll note that the four-step decision-making process in Illustration 9–1 is a critical part of the planning stage of the process.

ILLUSTRATION 9–22
Decision Analysis and the Management Process



THE BOTTOM LINE

LO9–1 Describe the decision-making process, incremental analysis, and its related concepts.

The decision-making process involves four steps: (1) Discover a problem, (2) identify courses of action, (3) analyze possible solutions, and (4) make a decision. When analyzing possible solutions (step 3), irrelevant revenues and costs are ignored, while incremental revenues and costs are the focus.

LO9–2 Perform incremental analysis for special-order decisions.

Special orders are unique orders for products or services that are not part of a company's usual production or service offerings. The decision to accept a special order is made only when incremental revenues are greater than incremental costs (that is, contribution margin of the special order is greater than zero).

LO9–3 Perform incremental analysis for sales-mix decisions involving constrained resources.

Sales mix refers to the proportion of different products or services that a company sells. When resources are constrained, a company cannot provide all products and services demanded by customers. In this case, the decision of the optimal sales mix is determined by computing the contribution margin per unit of constrained resource. Products and services with the highest contribution margin per unit of constrained resource are prioritized.

LO9–4 Perform incremental analysis for sell-or-process-further decisions.

A sell-or-process-further decision involves determining whether to sell a product in its current form or to process it further and then sell. The decision to process further is made only when the incremental revenues after further processing are greater than the incremental costs.

LO9–5 Perform incremental analysis for manufacture-or-outsource decisions.

A manufacture-or-outsource decision involves determining whether to manufacture a product in-house or to outsource production. Outsourcing refers to the practice of contracting outside entities to handle certain manufacturing functions or services that could be performed internally. The decision to outsource is made only when the total costs of outsourcing are less than the total costs of manufacturing in-house.

LO9–6 Perform incremental analysis for keep-or-drop-segment decisions.

A keep-or-drop-segment decision involves determining whether to keep (continue) a segment of the business or drop (discontinue) those operations. A business segment represents a portion of the company's overall operations whose sales and operations can be separately identified. The decision to keep a segment is made only when the segment's margin (sales minus variable costs and direct fixed costs) is greater than zero.

GLOSSARY

Avoidable costs: All variable and fixed costs directly tied to a segment that would be eliminated if the segment were discontinued. **p. 412**

Common costs: Fixed costs that occur in the operation of a business that cannot be directly attributed to any one segment. **p. 412**

Direct fixed costs: Fixed costs that are directly attributable to a segment of the business. **p. 412**

Incremental analysis: The process of comparing alternatives by focusing on the differences in their projected revenues and costs. **p. 396**

Incremental costs: The additional costs of choosing one alternative over another. **p. 397**

Incremental revenues: The additional revenues a company expects to earn from choosing one alternative over another. **p. 397**

Irrelevant costs: Costs that do not influence a decision because they remain unchanged regardless of the action taken. **p. 397**

Irrelevant revenues: Revenues that do not affect or influence a decision because they remain unchanged regardless of the action taken. **p. 397**

Joint costs: Costs that occur for all products up to the split-off point. **p. 405**

Joint products: Two or more products that share the same raw material inputs and are indistinguishable during early stages of production. **p. 405**

Keep-or-drop-segment decision: Management's decision on whether to keep or drop business segments. **p. 412**

Manufacture-or-outsource decision: Management's decision on whether to produce products and services using in-house resources or instead purchase them from an outside supplier. **p. 409**

Opportunity costs: The potential profits lost by choosing one option over another. **p. 398**

Outsourcing: The practice of contracting external entities to perform certain manufacturing functions or services that could be performed internally. **p. 409**

Relevant costs: Expenses that differ between alternatives and will affect the outcome of the decision. **p. 397**

Relevant revenues: Revenues that differ between alternatives and will affect the outcome of the decision. **p. 397**

Sales mix: The proportion of various products or services that a company sells. **p. 401**

Sales-mix decision: Management's decision on the mix of products or services to offer. **p. 401**

Segment: A portion of the company's overall operations whose sales and operations can be separately identified. **p. 412**

Segment income statement: A statement that reports revenues, variable costs, and direct fixed costs separately by segments, followed by common costs that are not allocated to any particular segment. **p. 412**

Segment margin: The difference between a segment's sales revenue and the direct costs, both variable and fixed, that can be specifically attributed to that segment. **p. 412**

Sell-or-process-further decision: Management's decision on whether to sell goods in their current form or after additional processing. **p. 405**

Special order: A one-time request for products or services that are not part of a company's usual production or service offerings. **p. 398**

Special-order decision: Management's decision to accept or reject a special-order request. **p. 398**

Split-off point: The point at which management can choose to either sell the products as they are or process them further into different products for sale. **p. 405**

Sunk costs: Irrelevant costs that already have happened as a result of a prior decision and cannot be recovered. **p. 397**

SELF-STUDY QUESTIONS

1. Which of the following is an example of an *irrelevant cost* in decision making? **(LO9–1)**
   A. The direct labor cost required to fulfill a new order.
   B. Additional shipping costs for a new product line.
   C. Depreciation on machinery that will not change with the decision.
   D. Additional raw materials needed for a special order.

2. What is the focus of incremental analysis in decision making? **(LO9–1)**
   A. Allocating common fixed costs evenly across all departments.
   B. Identifying sunk costs and historical spending patterns.
   C. Comparing total revenues and costs across multiple fiscal years.
   D. Evaluating the differences in relevant costs and revenues between alternatives.

3. Which of the following best describes an opportunity cost? **(LO9–1)**
   A. The cost of materials required for producing a product.
   B. The expected profit lost from not choosing the alternative.
   C. A fixed cost that does not change with production levels.
   D. The accounting cost recorded for the last decision made.

4. Which of the following costs is typically *irrelevant* in a special-order decision when sufficient capacity exists? **(LO9–2)**
   A. Direct materials.
   B. Variable overhead.
   C. Fixed SG&A expenses.
   D. Direct labor.

5. A special order generally should be accepted when: **(LO9–2)**
   A. The special order price is higher than the regular selling price.
   B. The company is at full capacity and the special order will replace regular sales.
   C. The incremental revenues exceed the incremental costs.
   D. The customer agrees to place recurring orders.

6. Hammie's Burgers receives a special order for 2,000 burgers at $4.00 each. Variable costs per burger are direct materials, $2.25; direct labor, $0.10; and variable overhead, $0.80. What is the total contribution margin from the special order? **(LO9–2)**
   A. $1,900
   B. $1,700
   C. $2,000
   D. $6,300

7. When resources such as machine time or labor hours are limited, the most profitable sales mix is determined by: **(LO9–3)**
   A. The total revenue each product generates.
   B. The lowest cost of production per unit.
   C. The product with the highest contribution margin per unit.
   D. The highest contribution margin per unit of the constrained resource.

8. A company produces two products using a limited machine time resource. Product A provides a contribution margin of $10 and requires two machine hours per unit. Product B provides a contribution margin of $12 and requires four machine hours per unit. Which product should be prioritized? **(LO9–3)**
   A. Product A.
   B. Product B.
   C. Both should be produced equally.
   D. Cannot be determined without knowing total demand.

9. Which of the following costs is typically *irrelevant* in a sell-or-process-further decision? **(LO9–4)**
   A. Additional processing costs.
   B. Joint costs that occur before the split-off point.
   C. Incremental revenue from further processing.
   D. Variable costs that occur after the split-off point.

10. Casings, Inc., can sell a basic casing for $20 or process it further into a high-grade casing that sells for $28. Additional processing costs are $6. The cost to produce the basic casing is $12. What is the incremental profit (or loss) from processing further? **(LO9–4)**
    A. $2
    B. $8
    C. $10
    D. $6

11. In a manufacture-or-outsource decision, which of the following would typically be *irrelevant?* **(LO9–5)**
    A. Direct materials cost for in-house production.
    B. Variable overhead that differs by alternative.
    C. Depreciation on existing equipment that will remain idle either way.
    D. Purchase price from the outside supplier.

12. Outsourcing is usually considered when: **(LO9–5)**
    A. Fixed costs are higher than variable costs.
    B. The company wants to eliminate joint costs.
    C. The outsourced cost is less than the relevant in-house cost.
    D. The outside supplier offers a better sales price.

13. A company can manufacture 20,000 shipping packages at a cost of $26,250, including $12,500 for direct materials, $10,500 for direct labor, and $3,250 for variable overhead. An outside supplier charges $1.35 per package. Should the company manufacture or outsource, and what is the cost difference? **(LO9–5)**
    A. Outsource; save $750.
    B. Manufacture; save $750.
    C. Outsource; save $1,000.
    D. Manufacture; save $1,350.

14. Which of the following best defines *avoidable costs* in a keep-or-drop-segment decision? **(LO9–6)**
    A. Costs that continue regardless of the segment's status.
    B. Costs that are shared across multiple business segments.
    C. Costs that are eliminated if the segment is dropped.
    D. Fixed overhead costs allocated across all departments.

15. In a keep-or-drop-segment decision, which of the following should be *excluded* from the analysis? **(LO9–6)**
    A. Segment revenue.
    B. Variable costs directly tied to the segment.
    C. Common fixed costs that remain unchanged regardless of the decision.
    D. Direct fixed costs that are eliminated if the segment is dropped.

16. The Blossom Boutique is considering dropping its Flower Delivery segment. If kept, total company segment margin is $241,000. If dropped, the Custom Arrangements segment will generate a segment margin of $260,000. What should the company do? **(LO9–6)**

A. Keep the Flower Delivery segment.
B. Drop the Flower Delivery segment.
C. Cannot decide without knowing sales.
D. Drop the segment only if sales decline.

REAL-WORLD PERSPECTIVES

Decision Analysis

LO9–2, LO9–6

RWP9–1 Rocky Ridge Chocolates produces gourmet chocolate bars sold primarily in specialty retail stores. A hotel chain in Canada has offered to buy 12,000 chocolate bars at $1.25 each, which is below the normal retail price of $2.00 per bar. Variable manufacturing cost is $0.95 per bar, and the company has enough idle capacity to fulfill the order. However, the marketing manager is concerned that accepting the lower price might affect the long-term pricing strategy and brand perception.

Required:

1. Calculate the total contribution margin from accepting the special order.
2. Determine whether the order should be accepted based on incremental analysis.
3. Identify any qualitative considerations that may affect the decision to accept the special order at the lower price.
4. Suppose Rocky Ridge would have to forgo 3,000 units of regular sales to fulfill the order. What is the opportunity cost related to these forgone sales?

Conceptual Understanding

LO9–4

RWP9–2 Cakes Company's management is considering a proposal to install a third production department in its factory building. With the company's existing production setup, direct materials are processed through the Mixing Department to produce Materials A and B in equal proportions. The Shaping Department then processes Material A to yield Product C. Material B is sold as is at $20.25 per pound. Product C has a selling price of $100.00 per pound. There is a proposal to add a Baking Department to process 100,000 pounds of Material B into Product D. It is expected that any quantity of Product D can be sold for $30.00 per pound.

Costs per pound under this proposal appear here.

Cost Item	Mixing Department (Materials A and B)	Shaping Department (Product C)	Baking Department (Product D)
Costs from Mixing Department	–	$52.80	$13.20
Direct materials	$20.00	–	–
Direct labor	6.00	9.00	3.50
Variable overhead	4.00	8.00	4.00
Fixed overhead:			
Traceable (direct, avoidable)	2.25	2.25	1.80
Allocated (common, unavoidable)	0.75	0.75	0.75
Totals	**$33.00**	**$72.80**	**$23.25**

Required:

1. What is the incremental revenue from the proposal to add a Baking Department to process 100,000 pounds of Material B into Product D.
2. What is the incremental operating income from adding the Baking Department?

3. Based only on your analysis in questions 1 and 2, should Cakes Company add a Baking Department and produce Product D, if 100,000 pounds of D can be sold?
4. For each qualitative item below, indicate whether it suggests the Baking Department should or should not be added:
   a) There are more profitable alternative uses for the company's resources.
   b) If Product D is sold, sales of other product lines will increase.
   c) Market analysis indicates that customers' demand for Product D is much lower than originally estimated.
   d) Competition is now selling a higher-quality product for a lower price.
   e) The company has idle resources.
   f) A more profitable product line could be produced.
   g) Market analysis indicates that sales demand will increase in the long run.

LO9–6

Interpreting Management Reports

RWP9–3 FreshFuel Juice Co. operates two product lines: Cold-Pressed Juices and Smoothies. The controller prepares the following income statement for the most recent quarter:

	Cold-Pressed	Smoothies	Total
Sales revenue	$450,000	$300,000	$750,000
Variable costs	225,000	180,000	405,000
Direct fixed costs	90,000	100,000	190,000
Common fixed costs			80,000
Segment margin	$135,000	$ 20,000	

Management is considering dropping the Smoothies line due to its low segment margin.

Required:

1. What would be the company's total segment margin if the Smoothies line is dropped?
2. What is the effect of this decision on the company's overall profitability?
3. What qualitative factors should FreshFuel consider before dropping the segment?

LO9–2

Ethical Dilemma

RWP9–4 Olivia is the production manager at PureGlow Candle Co., a small manufacturer known for its high-quality, hand-poured soy candles. Recently, the company received an urgent special-order request from a large national retailer interested in testing a limited run of PureGlow's candles for potential inclusion in its seasonal line.

Fulfilling the order would be a major opportunity, but it must be completed within two weeks. Olivia quickly reviews inventory levels and discovers that they have enough containers and fragrance oils but not enough of the premium soy wax normally used. The supplier of the premium wax cannot deliver in time.

Olivia considers using a less-expensive, lower-quality wax that they keep on hand for testing. This wax results in a shorter burn time and less consistent scent. When she raises the concern in a meeting, a senior executive responds, "It's just a trial run. We need to prove we can deliver on time. Let's not get bogged down in quality details right now."

Olivia must now decide how to respond.

Required:

1. Understand the effect: What are the risks of using the lower-quality wax for this special order?
2. Specify the options: What are Olivia's two possible courses of action?
3. Identify the impact: What are the potential consequences using the lower-quality wax (option A) or notifying the retailer and offering reduced trial quantity (option B)?
4. Make a decision: What is the most ethical course of action Olivia should take, and why?

Continuing Case: Great Adventures

LO9–3, LO9–5

(This Great Adventures Trail Mix problem continues in each chapter.)

RWP9–5 Tony and Suzie are preparing for the next board meeting of *Great Adventures Trail Mix Company.* They want to bring two important items to the board's attention.

Board Item #1: Dried Mango Shortage

A critical ingredient in two of the company's most popular products, Mountain Mango Blend and Tropical Trail Crunch, is suddenly in short supply. Their mango supplier has informed them that only 500 pounds of dried mango will be available for the next quarter. The two products rely on dried mango as follows:

Product	Contribution Margin per Bag	Mango per Bag
Mountain Mango Blend	$4.00	0.4 lb
Tropical Trail Crunch	5.00	0.6 lb

The company must decide how to allocate the available mango supply to maximize profitability.

Board Item #2: Labeling Cost Savings Opportunity

Currently, Great Adventures pays $0.15 per label to outsource all trail mix packaging labels. Tony found a used label printing machine available for $4,000 that would last four years and have no residual value (straight-line depreciation). Producing labels in-house would cost only $0.10 per label in materials and labor. The company prints about 40,000 labels each year.

The company must decide whether to continue outsourcing or invest in the labeling machine to bring production in-house.

Required:

1. (a) For Board Item #1, which product should be prioritized given the mango constraint?
   (b) Based on the product that should be maximized, what is the maximum number of bags that can be produced?
   (c) Based on the product that should be maximized and the maximum number of bags that can be produced, what is the expected contribution margin?
2. For Board Item #2, based on financial considerations, should Great Adventures outsource or manufacture the labels internally?

BRIEF EXERCISES

BE9–1 The owner of a Mexican restaurant is deciding whether to take fish tacos off the menu. State whether each item of decision information that follows is qualitative or quantitative. If the information is quantitative, specify whether it is financial or nonfinancial.

Identify information types (LO9–1)

1. The time needed to prepare the fish.
2. The daily number of customers who order the tacos.
3. Whether competing Mexican restaurants have this entrée on the menu.
4. The labor cost of the chef who prepares the fish tacos.
5. The fact that a loyal customer regularly brings 10 guests with him each week and orders fish tacos.

BE9–2 Match each step of the decision-making process with its correct description.

Understand the steps in the decision-making process (LO9–1)

Step		Description
Step 1:	Discover a problem	a. Managers evaluate each possible solution by gathering detailed cost and benefit information. They compare alternatives by focusing on differences in projected revenues and costs using incremental analysis.
Step 2:	Identify courses of action	b. A company realizes a variance, performance gap, financial inefficiency, or market change that requires attention.
Step 3:	Analyze possible solutions	c. Managers select the most effective solution based on quantitative and qualitative assessments and implement the decision.
Step 4:	Make a decision	d. Managers discuss all potential solutions that are possible with the company's resources and capabilities.

Perform incremental analysis **(LO9–1)**

BE9–3 Premier PrintWorks provides printing services to corporate clients. Based on current demand from corporate clients, the company's printers currently operate eight hours per day, Monday through Friday. However, the printers are capable of running 12 hours per day, including Saturday. The company is deciding whether to fill the idle hours with custom printing jobs for individual clients. These individual clients will generate additional revenues, but the company also will have additional costs for materials, personnel, and variable overhead related to additional maintenance, electricity, and depreciation of the printers because of additional use. Below are weekly amounts.

Estimated additional revenue from using idle printers	$2,560
Estimated additional costs from using idle printers:	
Direct materials	480
Direct labor	1,120
Variable overhead	320
Estimated profit per printing hour for individual clients	20
Actual profit per printing hour for corporate clients	35

Calculate the incremental weekly profit from using the idle printers. Given the lower profit per printing hour for individual clients, should the company use the idle printer hours for individual clients?

Perform incremental analysis for a special-order decision **(LO9–2)**

BE9–4 Homewood Company has received a special-order request for its incense candles at a selling price of $20 per candle. This order is over and above normal production, and budgeted production and sales targets for the year already have been exceeded. Capacity exists to satisfy the special order. No selling costs will occur in connection with this order.

Costs to manufacture and sell each candle are as follows:

Direct materials	$7.60
Direct labor	3.75
Variable overhead	9.25
Fixed overhead	4.85
Fixed general and administrative costs	6.75

Based on incremental analysis, what is the incremental profit or loss per candle from accepting the special order?

BE9–5 Bloom Boutique specializes in crafting floral centerpieces. A wedding planner has requested a special order of 50 centerpieces at a price of $55 each.

Perform incremental analysis for a special-order decision **(LO9–2)**

The following cost data apply to the boutique's operations, calculated per centerpiece:

- Direct materials: $25
- Direct labor: $20
- Variable overhead: $15

Additional information:

- The boutique has annual marketing costs of $20,000 and annual shop rent of $30,000, but these costs will not increase if they take this special order.

Based on incremental analysis, what is the incremental contribution margin from accepting the special order?

BE9–6 Compliance Services is considering a special order that it received from one of its corporate clients. The special order calls for Compliance to prepare the individual tax returns of the corporation's four largest shareholders. Compliance has idle capacity and has a target gross profit of $40 per return.

Determine the minimum bid price for a special-order decision **(LO9–2)**

The following data have been gathered about the preparation of individual tax returns:

- Materials cost per page: $1
- Average labor rate: $60 per hour
- Standard hours per return: 4
- Standard pages per return: 10
- Variable overhead cost per page: $0.50
- Fixed overhead cost per page: $0.50

Compute the minimum bid price for the entire order.

BE9–7 Alphabet Industries specializes in three types of mechanical pencils: AlphaPoint, GraphiCore, and LetterLine. The company is constrained to 50,000 labor hours each year. The company wants to determine which products to prioritize to maximize profitability. The product demand and labor hours per unit to manufacture are provided below.

Perform incremental analysis for a sales-mix decision involving constrained resources **(LO9–3)**

Product	Contribution Margin per Unit	Demand (units)	Labor Hours per Unit
AlphaPoint	$10	14,000	1.25
GraphiCore	12	12,000	2.5
LetterLine	6	16,000	1.0

Calculate the contribution margin per labor hour for each product, and determine which product should be prioritized.

BE9–8 Nature's Nursery is considering how to best allocate its labor resources to maximize profitability. The company grows lilies and sunflowers, both of which require significant labor to cultivate, pot, and sell. The management team is debating whether to prioritize lilies or sunflowers because the nursery cannot meet the full demand for both products.

Perform incremental analysis for a sales-mix decision involving constrained resources **(LO9–3)**

The nursery has a total of 6,000 labor hours available, and the following cost and labor data have been provided:

Product	Contribution Margin per Unit	Labor Hours per Unit	Demand (units)
Lilies	$7.50	1.5	6,000
Sunflowers	5.50	1.0	7,500

Calculate the contribution margin per labor hour for both products and determine which product should be prioritized.

Perform incremental analysis for a sales-mix decision involving constrained resources **(LO9–3)**

BE9–9 Blizzard, Inc., makes three kinds of snowboards, but it has a limited number of machine hours available to make them. Product line data are as follows:

	The Ride	The Cruiser	The Beast
Machine hours per unit	1.25	1.0	1.5
Selling price per unit	$600	$820	$1,000
Variable manufacturing cost per unit	445	650	780
Variable selling cost per unit	45	56	85

Calculate the contribution margin per machine hour for all products and determine in what order the snowboard product lines should be prioritized and produced.

Perform incremental analysis for a sales-mix decision involving constrained resources **(LO9–3)**

BE9–10 EverTrust Systems processes three types of loans for credit unions: commercial, auto, and home loans. The company has a processing capacity of 100,000 hours per year.

Loan Type	Processing Time per Loan	Contribution Margin per Loan
Commercial	2 hours	$5.00
Auto	1 hour	3.00
Home	2.5 hours	7.00

Calculate the contribution margin per processing hour for each loan type, and determine in what order the loan types should be prioritized.

Perform incremental analysis for a sell-or-process-further decision **(LO9–4)**

BE9–11 Global Industries manufactures nutritional supplements and provides three products from a single process. The selling price for each product is Core, $4 per unit; Flex, $6 per unit; and Prime, $10 per unit. When Flex is processed further into Prime, there are additional unit costs of $3. Each product has $2 of joint costs from the initial production operation.

Calculate the incremental operating income (loss) per unit from manufacturing Prime, and determine whether Flex should be sold as-is or processed further.

Perform incremental analysis for a sell-or-process-further decision **(LO9–4)**

BE9–12 In an attempt to provide superb customer service, Mighty Meats is considering the expansion of its product offerings from single hams and turkeys to full dinners. Each dinner would include a single ham or turkey, two side dishes, and six rolls or cornbread.

The company's accountant has compiled the following relevant information:

	Revenue		Cost	
Product	Single Product	Full Dinner	Single Product	Full Dinner
Ham	$30	$50	$20	$35
Turkey	20	30	15	30

Calculate the incremental operating income (loss) per dinner of providing full dinners for each product, and determine whether the company should sell full dinners or only single products.

Perform incremental analysis for a sell-or-process-further decision **(LO9–4)**

BE9–13 As part of its strategic plan, Penn-Paper Company, a regional supplier of premium paper products, is considering whether to expand its offerings to include custom journals. Currently, the company sells bulk paper, but management is debating whether further processing the paper into journals would be more profitable.

Product Option	Revenue per Unit	Total Cost per Unit
Bulk paper	$ 5	$ 2
Custom journals	20	16

Calculate the incremental operating income (loss) per journal of providing custom journals, and determine if Penn-Paper Company should sell bulk paper or customer journals.

BE9–14 Elite Sterilization is a company specializing in the sterilization of laboratory equipment. The company is considering whether to offer a base sterilization service or an enhanced service package that includes the base service plus additional equipment protection. The management team is evaluating which option will maximize profitability. The financial team has provided the following information:

Perform incremental analysis for a sell-or-enhance-further decision for a service company **(LO9–4)**

Service Option	Revenue per Service	Total Cost per Service
Base service	$100	$40.00
Enhanced service	200	80.00

Calculate the incremental operating income (loss) per enhanced service, and determine whether the company should offer the base service or enhanced service.

BE9–15 You are the manager of a car manufacturing company. One of your supervisors has come to you with an analysis showing that outsourcing the production of car doors would save $500,000 annually. The manager suggests that this cost-saving move could benefit the company financially. However, before deciding, which of the qualitative factors below relate most directly to this decision? (select all that apply)

Consider qualitative factors for a manufacture-or-outsource decision **(LO9–5)**

1. The potential impact on product quality and company reputation.
2. The reliability of the supplier and risk of production delays.
3. The fuel efficiency for vehicles produced.
4. The effect on employee morale and the local economy of moving jobs elsewhere.
5. The company's advertising costs for the year.
6. The loss of control over manufacturing processes and flexibility.
7. The effect of paint styles on consumer demand for electric vehicles.

BE9–16 Wolverine Company assembles kitchen and bathroom faucets. Each faucet consists of several interconnecting parts. The company manufactures some of the parts and buys some from outside vendors. The outside vendor for the Valve Assembly part has just increased its price to $20 per unit for the first 5,000 units and $18 per unit for each additional unit beyond 5,000 ordered each year. The company plans to use 7,500 units of the Valve Assembly part each year and is considering the following costs to manufacture the part in-house.

Perform incremental analysis for a manufacture-or-outsource decision **(LO9–5)**

- Direct materials: $7.00
- Direct labor: $4.00
- Variable overhead: $8.00
- Variable selling costs: $7.50

Calculate the incremental cost (or cost savings) of manufacturing the Valve Assembly part, and determine whether the company should manufacture in-house or continue to outsource.

BE9–17 Dental Associates, Inc., is currently operating at less than capacity. The company thinks it could cut costs by outsourcing dental cleaning to an outside dental hygienist for $130 per cleaning. An in-house dental hygienist currently costs $100 per cleaning. An in-house dental cleaning also consumes $10 of dental supplies, $8 of variable overhead, and $16 of fixed overhead.

Perform incremental analysis for a manufacture-or-outsource decision **(LO9–5)**

Calculate the incremental cost (or cost savings) of outsourcing dental cleaning, and determine whether the company should outsource or continue to perform dental cleanings in-house.

BE9–18 State whether each cost described below is an avoidable cost or a common cost among segments.

Identify avoidable and common costs **(LO9–6)**

1. Costs that are directly tied to a specific segment and would be eliminated if the segment were discontinued.
2. Fixed costs that cannot be directly attributed to one segment and would not be eliminated if the segment were dropped.
3. The cost of products manufactured by a specific segment and salaries of employees who work exclusively for that segment.
4. Facility rentals, utilities, and salaries of employees who serve multiple segments.

Perform incremental analysis for a keep-or-drop-segment decision (LO9–6)

BE9–19 Campus Vibes Co. provides products and services that boost student life on college campuses. The company has three primary segments: Study Snacks, Custom Merchandise, and Event Experiences. Data for each segment are shown below.

	Study Snacks	Custom Merchandise	Event Experiences
Sales	$220,000	$160,000	$250,000
Variable	100,000	110,000	140,000
Direct fixed costs	40,000	60,000	60,000

The company-wide (common) fixed costs that will not change if a segment is dropped are $100,000.

Calculate total company profit before and after dropping the Custom Merchandise segment. Should the Custom Merchandise segment be kept or dropped?

Perform incremental analysis for a keep-or-drop-segment decision (LO9–6)

BE9–20 Peruna Company reported a total company loss of $40,000 and is evaluating its two segments, North Segment and South Segment. Data for each segment's sales and direct costs are shown below.

	North	South	Headquarters
Sales	$530,000	$610,000	
Variable costs	290,000	340,000	
Direct fixed costs	130,000	174,000	
Headquarters fixed costs			$246,000

Calculate each segment's profit, and determine if Peruna should keep or drop each segment.

EXERCISES

Identify relevant costs, irrelevant costs, and opportunity costs (LO9–1)

E9–1 Mountain Bike Co. is considering introducing a new line of either electric bikes or road bikes. The company has gathered the following information related to electric bikes:

1. Expected sales:1,000 units per year.
2. Selling price: $2,000 per bike.
3. Variable costs: $1,200 per bike.
4. The company already has spent $50,000 on market research.

Required:

1. Classify each piece of information provided (a–d) as either relevant or irrelevant to the decision of whether to introduce the new electric bike line.
2. What is the potential opportunity cost in this scenario?

Perform incremental analysis for a special-order decision (LO9–2)

E9–2 Antiquities, Inc., produces antique-looking books. Management has just received a request for a special order of 2,000 books from Venus Company and must decide whether to accept it. Venus is offering to pay $22.00 per book.

The variable production costs per book include $9.20 for direct materials, $4.00 for direct labor, and $3.80 for variable overhead. The current year's production is 22,000 books, and maximum capacity is 25,000 books. Fixed costs, including overhead, advertising, and selling and administrative costs, total $80,000. The usual selling price is $25.00 per book. Shipping costs are $3.00 per book, regardless of whether the books are part of a special order.

Required:

1. Calculate the contribution margin per book under the special order.
2. Are the shipping costs relevant or irrelevant to the decision?
3. Based on the incremental analysis, should Antiquities accept the special order?

E9–3 Fun Sporting Goods, Inc., manufactures a complete line of sporting equipment. Lei Enterprises operates a large chain of discount stores. Lei has approached Fun with a special order for 20,000 deluxe baseballs. Instead of being packaged separately, the balls are to be packed in boxes containing 500 baseballs each. Lei is willing to pay $2.50 per baseball. Fun's standard annual expected production is 400,000 baseballs, but Fun is on track to produce 410,000 baseballs as the current year's production. Fun's maximum production capacity is 450,000 baseballs. The following additional information is available:

Perform incremental analysis for a special-order decision **(LO9–2)**

Standard unit cost data for 400,000 baseballs:	
Direct materials	$ 1.00
Direct labor	0.50
Variable overhead	0.60
Fixed overhead ($100,000 ÷ 400,000)	0.25
Packaging per unit	0.20
Advertising ($60,000 ÷ 400,000)	0.15
Other selling expenses ($120,000 ÷ 400,000)	0.30
Product unit cost	$ 3.00
Unit selling price	$ 4.00
Total estimated bulk packaging cost for special order	$2,000.00

Required:

1. Calculate the contribution margin of the special order. (*Hint:* Determine which costs are relevant to the special order.)
2. Based on the incremental analysis, should Fun accept the special order?

E9–4 Titan's Tales, a comic book publisher, has been approached by a large convention to produce a special run of exclusive comic books for an upcoming event. The client offers to purchase the comic books for $12 each. Titan's Tales wants to earn a minimum $2,000 profit from the order.

Perform incremental analysis for a special-order decision with a minimum bid price **(LO9–2)**

The production costs per comic are as follows:

- Direct materials: $4.50
- Direct labor: $2.00
- Variable overhead: $3.00
- Titan's Tales has sufficient idle capacity for this order, so no additional fixed costs will occur.

Required:

1. Calculate the contribution margin per comic book under the special order?
2. How many comic books must the convention purchase for Titan's Tales to meet its $2,000 profit goal at the $12 price per book?
3. If the convention only agrees to purchase 750 comic books, should Titan's Tales accept the order?

E9–5 Audio Tech Industries produces three products: headphones, chargers, and power banks. The company has a total of 40,000 labor hours available. During a recent business meeting, management wonders how it should prioritize production of the products given the labor hour constraint.

Perform incremental analysis for a sales-mix decision involving constrained resources **(LO9–3)**

The following cost data and demand information are provided:

Product	Selling Price per Unit	Variable Cost per Unit	Demand	Labor Hours per Unit
Headphones	$40	$ 4	12,000	3
Chargers	20	5	20,000	1
Power banks	50	10	15,000	2

Required:

1. Calculate the contribution margin per unit of the constrained resource for each product.
2. In what order should Audio Tech prioritize the production of the products to maximize total contribution margin?
3. How many units of each product should be produced to maximize the total contribution margin?

Perform incremental analysis for a sales-mix decision involving constrained resources **(LO9–3)**

E9–6 EZ, Inc., manufactures two products, Carry-On Bag and Checked Luggage, that both require machine processing. Although there is excess demand for both products, EZ could devote all its capacities to a single product. Unit prices, cost data, and processing requirements follow.

	Carry-On Bag	Checked Luggage
Unit selling price	$75	$200
Unit variable cost	$25	$ 80
Machine hours per unit	0.4	1.2

Next year, the company will be limited to 160,000 machine hours. Fixed costs for the year are $1,000,000.

Required:

1. Calculate the contribution margin per unit of the constrained resource for each product.
2. Which product should be prioritized to maximize profits?
3. Based on your answer on Requirement 2, how many units of each product should be produced to maximize the total contribution margin?

Perform incremental analysis for a sales-mix decision with a constrained resource **(LO9–3)**

E9–7 TurboTyke Enterprises manufactures three small toy cars for children: Rocket Star, Speed Master, and Road Warrior. The current production capacity is 100,000 machine hours.

The product line data follow.

	Rocket Star	Speed Master	Road Warrior
Maximum unit sales demand	20,000	30,000	18,000
Machine hours per unit	2.0	1.0	2.5
Selling price per unit	$20.00	$16.00	$30.00
Variable costs per unit	12.50	10.00	18.75
Selling costs per unit	6.50	5.00	6.25

Required:

1. Calculate the unit contribution margin per constrained resource.
2. Determine in what order the production of the toy cars should be prioritized.

3. How many of each type of toy car should be manufactured and sold to maximize the company's contribution margin based on the current production capacity of 100,000 machine hours?
4. Based on your answer in Requirement 3, calculate the total contribution margin at full production.

E9–8 Web Services provides web page services to small businesses. The services include the preparation of basic pages and custom pages.

Perform incremental analysis for a sales-mix decision with a constrained resource **(LO9–3)**

The following summary of information will be used to make decisions for Web Services:

	Basic Pages	Custom Pages
Revenue per page	$800	$1,750
Variable cost per page	$300	$ 750
Design labor hours needed	2	6

Total annual fixed costs are $78,000.

Required:

1. Calculate the contribution margin per unit of the constrained resource (design labor hours) for each product. Round your answer to two decimal places if necessary.
2. On which page type should this company focus?

E9–9 Big Ears, Inc., manufactures corn products. The company can sell basic cornmeal by grinding the corn kernels or process the cornmeal further by enriching it and blending with other grains for use in baking. As part of the company's strategic plan, management also is looking for new markets for corn by-products—corn germ and corn bran. Corn germ can be processed further into corn oil, and corn bran can be processed further into fiber supplements. The company's accountant provided these data:

Perform incremental analysis for a sell-or-process-further decision **(LO9–4)**

Product	Sales Revenue if Sold at Split-off	Sales Revenue if Sold After Further Processing	Additional Processing Costs
Cornmeal	$100,000	$200,000	$80,000
Corn germ	20,000	40,000	25,000
Corn bran	50,000	60,000	5,000

Required:

1. Calculate the operating income (loss) from processing each potential new product further.
2. Based on this analysis, which products should be processed further?

E9–10 Four Star Pizza manufactures make-at-home frozen pizza and calzone kits and sells them for $10 each to local stores. It is currently considering a proposal to manufacture and sell fully prepared products. The following relevant information has been gathered by management:

Perform incremental analysis for a sell-or-process-further decision **(LO9–4)**

Product	Sales Revenue if No Additional Processing	Sales Revenue if Processed Further	Additional Processing Costs
Pizza	$10	$20	$6
Calzone	10	15	6

Required:

1. Calculate the operating income (loss) from processing each potential new product further.
2. Based on this analysis, which products should be processed further?

Perform incremental analysis for a sell-or-process-further decision **(LO9–4)**

E9–11 Adelaide Farms grows apples and peaches. The farm has traditionally sold apples and peaches as fresh produce but is considering using them to make and sell apple cobbler and peach cobbler instead. The harvesting cost is $1.50 per unit for apples and $1.25 per unit for peaches.

The financial team has provided the following information:

Product	Revenue per Unit (fresh)	Revenue per Unit (cobbler)	Additional Processing Costs
Apples	$4.00	$7.50	$2.50
Peaches	3.50	7.00	3.00

Required:

1. Are the harvesting costs relevant or irrelevant?
2. Calculate the incremental operating income (loss) from processing each potential new product further.
3. Based on this analysis, which products should be processed further?

Perform incremental analysis for a sell-or-process-further decision **(LO9–4)**

E9–12 Freddie's Furniture specializes in high-quality wood products and is considering how to best utilize its wood inventory. The company can either sell the wood as-is or process it further to produce normal beds or bunk beds. Freddie's management team is debating which option will maximize profitability. The financial team has provided the following information:

Product Option	Total Revenue per Unit	Total Costs per Unit
Wood (as-is)	$250	$ 40
Process further:		
Normal beds	500	300
BunkbBeds	750	560

Required:

1. Determine the incremental revenue and incremental cost per unit for processing wood into normal beds and bunk beds.
2. Should the company sell wood as-is or process it further into normal beds, bunk beds, or both?

Perform incremental analysis for a manufacture-or-outsource decision **(LO9–5)**

E9–13 Cyber Queen Services' manager must decide whether to hire a new employee or to outsource some of the web design work to a freelance graphic designer. Hiring a new employee would involve paying the employee $30 per design hour for 500 hours of work and having service overhead costs of $2 per design hour. The new employee also would consume other company resources (such as the computer and server) that could have been used otherwise to generate $4,000 in additional revenue from existing web services work. Outsourcing would involve paying a freelance designer $34 per design hour for 500 hours of work.

Required:

1. Calculate the incremental cost or cost savings from outsourcing.
2. Based on this incremental analysis, should Cyber Queen Services outsource the work?

E9–14 One component of a radio produced by Audio Systems, Inc., is currently being purchased for $2.25 per part from an outside supplier. Management is studying the possibility of manufacturing that component in-house. Annual production (usage) at Audio is 70,000 units; fixed costs (all of which remain unchanged whether the part is manufactured or outsourced) are $38,500; and variable costs are $0.95 per unit for direct materials, $0.55 per unit for direct labor, and $0.60 per unit for variable overhead.

Perform incremental analysis for a manufacture-or-outsource decision **(LO9–5)**

Required:

1. Calculate the incremental cost or cost savings of manufacturing the part in-house.
2. Based on this incremental analysis, should Audio Systems manufacture or outsource the part?

E9–15 Golden Bakery is currently purchasing flour from an outside supplier but is considering milling its own flour in-house. The bakery's management team wants to evaluate whether milling the flour or continuing to purchase it would be less costly.

The following information is provided:

Perform incremental analysis for a manufacture-or-outsource decision **(LO9–5)**

- Purchase price for each bag of flour: $10
- Annual demand for flour: 5,000 bags
- Fixed costs (unchanged whether the flour is milled or purchased): $20,000
- Variable costs for milling each bag of flour:
  - Direct materials: $3 per bag
  - Direct labor: $4 per bag
  - Variable overhead: $2 per bag

Required:

1. Calculate the incremental cost or cost savings from manufacturing the flour in-house.
2. Based on this incremental analysis, should Golden Bakery mill the flour in-house?

E9–16 Sweater Company is deciding whether to manufacture its sweaters in-house or outsource production to Company A or Company B. The company wants to choose the lowest-cost option. Manufacturing in-house will involve fixed costs of $100,000 and variable costs of $10 per sweater. Outsourcing to Company A will involve a purchase price of $15 per sweater, while outsourcing to Company B will involve a purchase price of $12 per sweater. Marketing expenses, which are the same for all options, are $50,000 annually. The company expects to manufacture or outsource 20,000 sweaters per year.

Perform incremental analysis for a manufacture-or-outsourcing decision **(LO9–5)**

Required:

1. Calculate the total cost for manufacturing in-house, outsourcing to Company A, and outsourcing to Company B.
2. Which option should Sweater Company choose to minimize costs?

E9–17 Below Par, a company specializing in golf products and services, operates three business segments: Golf Balls, Golf Clubs, and Golf Bags. Recently, the manager raised concerns about the company's overall profitability. The Golf Bags segment has the lowest amount of sales, and management is considering the option to discontinue this segment.

Below Par has provided the following information:

Perform incremental analysis for a keep-or-drop-segment decision **(LO9–6)**

- Golf Balls: Sales revenue is $500,000; variable costs are $285,000; and fixed costs directly traceable to this segment are $55,000.
- Golf Clubs: Sales revenue is $900,000; variable costs are $450,000; and fixed costs directly traceable to this segment are $117,000.
- Golf Bags: Sales revenue is $200,000; variable costs are $120,000; and fixed costs directly traceable to this segment are $40,000.

Common fixed costs total $550,000, consisting of the CEO's salary, $400,000; warehouse expenses, $80,000; and marketing costs, $70,000. These costs are shared across all segments and cannot be directly traced to any one of them.

Required:

1. Prepare a segment income statement for Below Par including the Golf Bags segment.
2. Prepare a segment income statement for Below Par if the Golf Bags segment is dropped.
3. Would dropping the Golf Bags segment improve profitability?

Perform incremental analysis for a keep-or-drop-segment decision (LO9–6)

E9–18 Gold's Glass, Inc., has three divisions: Commercial, Nonprofit, and Residential. The segmented income statement for last year revealed the following:

	Commercial Division	Nonprofit Division	Residential Division	Total Company
Sales	$300,000	$523,000	$837,000	$1,660,000
Less variable costs	157,000	425,000	472,000	1,054,000
Contribution margin	$143,000	$ 98,000	$365,000	$ 606,000
Less direct fixed costs	114,000	116,000	139,000	369,000
Segment margin	$ 29,000	$ (18,000)	$226,000	$ 237,000
Less common fixed costs	–	–	–	168,000
Operating income	–	–	–	$ 69,000

Required:

1. How will segment margin be affected if the Nonprofit Division is dropped? Based on your answer, determine if the Nonprofit Division should be kept or dropped.
2. Assume the elimination of the Nonprofit Division causes the sales of the Residential Division to decrease by 10%. How will segment margin be affected if the Nonprofit Division is dropped? Based on your answer, determine if the Nonprofit Division should be kept or dropped under this condition?

Perform incremental analysis for a keep-or-drop-segment decision (LO9–6)

E9–19 Zulu Coms has two main segments: Phone Plans and Streaming Services. The company is evaluating whether to discontinue the Streaming Services segment due to its negative profitability. However, the Streaming Services segment is bundled with some of the higher-tier phone plans, and if it is dropped, Zulu Coms expects revenues from the Phone Plans segment to decrease by 15%. The company has provided the following data:

Phone Plans segment:

- Sales revenue: $2,000,000
- Variable costs: $1,200,000 (60% of sales)
- Direct fixed costs: $200,000

Streaming Services segment:

- Sales revenue: $500,000
- Variable costs: $375,000 (75% of sales)
- Direct fixed costs: $150,000

Common fixed costs:

- CEO salary, shared facilities, and marketing: $300,000

Prepare a segment income statement for Zulu Coms and analyze whether the company should keep or drop the Streaming Services segment.

Perform incremental analysis for a keep-or-drop-segment decision (LO9–6)

E9–20 Swift Fitness, a company specializing in fitness equipment and gym management, operates three business segments: Home Equipment, Commercial Equipment, and Gym Management Services. Recently, the CFO raised concerns about the company's overall profitability. The Gym Management Services segment has been underperforming, and management is considering whether to discontinue this segment to improve profitability.

Swift Fitness has provided the following financial information for each segment:

- Home Equipment: Sales revenue is $600,000; variable costs are $360,000; and fixed costs directly traceable to this segment are $90,000.
- Commercial Equipment: Sales revenue is $750,000; variable costs are $375,000; and fixed costs directly traceable to this segment are $120,000.
- Gym Management Services: Sales revenue is $250,000; variable costs are $200,000; and fixed costs directly traceable to this segment are $80,000.
- Common fixed costs: Total is $450,000, consisting of the CEO's salary, $250,000; warehouse expenses, $100,000; and marketing costs, $100,000. These costs are shared across all segments and cannot be directly traced to any one of them.

Required:

1. Prepare a segment income statement for Swift Fitness including the Gym Management Services segment.
2. Prepare a segment income statement for Swift Fitness if the Gym Management Services segment is dropped.
3. Should Swift Fitness drop the Gym Management Services segment to improve profitability?

PROBLEMS

P9–1 On March 26, Buoy Industries received a special-order request for 120 ten-foot aluminum fishing boats. Operating on a fiscal year ending May 31, the company already has orders that will allow it to produce at budget levels for the period. However, extra capacity exists to produce the 120 additional boats.

Perform incremental analysis for a special-order decision and determine the minimum bid **(LO9–2)**

The terms of the special order call for a selling price of $1,200 per boat, and the customer will pay all shipping costs. No sales personnel were involved in soliciting the order.

The ten-foot fishing boat has the following cost estimates:

- Direct materials, aluminum, two 49 × 89 sheets at $155 per sheet.
- Direct labor, 14 hours at $55.00 per hour.
- Variable overhead, $7.25 per direct labor hour.
- Fixed overhead, $4.50 per direct labor hour.
- Variable selling expenses, $46.50 per boat.
- Variable shipping expenses, $57.50 per boat.

Required:

1. Prepare an analysis of the incremental contribution margin for Buoy's management to use in deciding whether to accept or reject the special order. What decision should be made?
2. To make an $8,000 profit on this order, what would be the lowest possible price that Buoy could charge per boat? Round your answer to two decimal places if necessary.

P9–2 Leisure Resorts, Ltd., has approached HQ Printers, Inc., with a special order to produce 300,000 two-page brochures. Most of HQ's work consists of recurring short-run orders. Leisure Resorts is requesting a one-time order, and HQ has the capacity to handle the order over a two-month period.

Perform incremental analysis for a special-order decision and determine the minimum bid **(LO9–2)**

Leisure Resorts' management has stated that the company would be unwilling to pay more than $48 per 1,000 brochures. HQ's controller assembled the following cost data for this decision analysis

Cost Component	Cost
Direct materials (paper)	$26.80 per 1,000 brochures
Direct labor costs	$6.80 per 1,000 brochures
Direct materials (ink)	$4.40 per 1,000 brochures
Variable production overhead	$6.20 per 1,000 brochures
Variable packing costs	$4.30 per 1,000 brochures
Machine maintenance (fixed cost)*	$1.00 per direct labor dollar
Administrative expenses (fixed costs)*	$5.25 per direct labor dollar
Other fixed production overhead*	$2.40 per direct labor dollar

* Note: Fixed costs will occur regardless of whether the special order is accepted.

Required:

1. Prepare an analysis by computing total variable costs for HQ's management to use in deciding whether to accept or reject Leisure Resorts' offer. What decision should be made?
2. What is the lowest possible price HQ can charge per thousand and still make a $6,000 profit on the order?

Perform incremental analysis for a sales-mix decision and determine production priorities **(LO9–3)**

P9–3 Common Chemical Company's management is evaluating its product mix in an attempt to maximize profits. For the past two years, Common has produced four products, and all have large markets in which to expand market share. Common's scarce resource, machine hours, is being used to full capacity.

Common's controller has gathered the following sales and operating data.

Cost Component	Product A1	Product B7	Product C5	Product D9
Variable production costs	$ 71,000	$ 91,000	$ 91,920	$ 97,440
Variable selling costs	10,200	5,400	12,480	30,160
Fixed production costs	20,400	21,600	29,120	18,480
Fixed administrative costs	3,400	5,400	6,240	10,080
Total sales	122,000	136,000	156,400	161,200
Units produced and sold	85,000	45,000	26,000	14,000
Machine hours used	17,000	18,000	20,800	16,800

Required:

1. Compute the machine hours needed to produce one unit of each product.
2. Determine the contribution margin per machine hour for each product.
3. List the four products in order of priority for market share expansion.

Perform incremental analysis for a sales-mix decision and determine production priorities **(LO9–3)**

P9–4 Dr. Stott, who specializes in internal medicine, wants to find out how the time of the clinic's physician assistant can be used to generate the highest operating income. The physician assistant is constrained by the number of hours worked each day (seven hours) and has the following duties: sees individual patients in Dr. Stott's office, consults with individual patients over the telephone, and conducts a one-hour weight-loss support group each day attended by up to 20 patients.

Statistics for the three services are as follows.

Category	Office Visits	Phone Calls	Weight-Loss Support Group
Maximum number of patient billings per day	20	40	20
Hours per billing	0.25	0.1	0.05
Billing rate	$50	$25	$10
Variable costs per billing	25	12	6

Required:

1. Calculate the contribution margin per constrained resource for each billing, and then rank the services in order of priority based on your calculations.
2. Based on the ranking in Requirement 1, how much time should the physician assistant spend on each service in a day? (*Hint:* Remember to consider the maximum number of patient billings per day.) What would be the daily total contribution margin generated?
3. Dr. Stott believes that the weight-loss support group should be prioritized, regardless of its profitability. If the weight-loss support group is prioritized, how much time should the physician assistant spend on phone calls and office visits each day?
4. Based on the ranking in Requirement 3, what would be the daily total contribution margin generated? By how much does this contribution margin differ from the amount in Requirement 2.

P9–5 Bakers Bagels, Inc., produces and sells 20 types of bagels by the dozen. Bagels are priced at $6.00 per dozen (or $0.50 each) and cost $0.20 per unit to produce. The company is considering processing the bagels further into two products: bagels with cream cheese and bagel egg sandwiches. It would cost an additional $0.50 per unit to produce bagels with cream cheese, and the new selling price would be $2.50 each. It would cost an additional $1.00 per sandwich to produce bagel egg sandwiches, and the new selling price would be $3.50 each.

Perform incremental analysis for a sell-or-process-further decision **(LO9–4)**

Product (per unit)	Sales Revenue if Sold Without Further Processing	Sales Revenue if Processed Further	Additional Processing Costs
Bagels with cream cheese	$2.50	$4.00	Fruit: $1.75
Bagel egg sandwiches	3.50	5.50	Meat: $1.50

Required:

1. Calculate the incremental contribution margin for each product without further processing. Are there any sunk costs?
2. Based on the information in Requirement 1, should Bakers Bagels expand its product offerings?
3. Suppose that Bakers Bagels did expand its product line to include bagels with cream cheese and bagel egg sandwiches. Based on customer feedback, the company determined that it could further process those two products into bagels with cream cheese and fruit and bagel egg sandwiches with meat. Perform an incremental analysis to determine if Bakers Bagels should process its products further.

P9–6 CU, Inc., developed a promotional program for a local shopping center a few years ago. Having invested $360,000 in developing the original promotion campaign, the firm is ready to present its client with an add-on contract offer that includes the original promotion areas of

Perform incremental analysis for a sell-or-process-further decision **(LO9–4)**

(1) a TV advertising campaign, (2) a series of social media posts, and (3) a special rotating BIG SALE schedule for 10 of the 28 tenants in the shopping center. The revenue terms from the original contract with the shopping center and the offer for the add-on contract, which extends the original contract terms, follow.

Category	Original Contract Revenue	Extended Contract Revenue with Add-on Terms
TV advertising campaign	$520,000	$ 580,000
Social media posts	210,000	230,000
Rotating big sale schedule	170,000	190,000
Totals	**$900,000**	**$1,000,000**

CU estimates that the following additional costs will occur by extending the contract:

Category	TV Campaign	Social media	Big Sale Schedule
Direct labor	$30,000	$ 9,000	$7,000
Variable overhead	22,000	14,000	6,000
Direct fixed overhead	9,600	3,200	1,600

Required:

1. Calculate the total incremental costs that will occur for each part of the add-on contract offer.
2. Calculate the incremental revenue and incremental operating income for each part of the add-on contract. Based on the incremental total operating income, should CU accept or reject the add-on contract?
3. If the management of the shopping center indicates that the terms of the add-on contract are negotiable, how should CU respond?

Perform incremental analysis for a manufacture-or-outsource decision **(LO9–5)**

P9–7 Freeze Refrigerator Company purchases ice makers and installs them in its products. The ice makers are purchased from an outside supplier for $138 each. The supplier recently gave advance notice that the price will increase by 50% immediately. Freeze Refrigerator Company has idle equipment that could be used to produce similar ice makers.

Cost estimates have been prepared under the assumption that the company could manufacture the product itself. Direct materials would cost $100.80 per ice maker. Direct labor required would be five minutes per ice maker at a labor rate of $36.00 per hour. Variable overhead would be $55.20 per ice maker. Fixed overhead, which would occur under either decision alternative, would be $32,420 a year for depreciation and $234,000 a year for other fixed costs. Production and usage are estimated at 6,250 ice makers per year. (Assume that any idle equipment cannot be used for any other purpose.)

Required:

1. Prepare an incremental analysis to determine whether the ice makers should be manufactured within the company or continue to be purchased from the outside supplier at the higher price.
2. Compute the variable unit cost to (a) manufacture one ice maker or (b) purchase one ice maker from the outside vendor at the higher price.

Perform incremental analysis for a manufacture-or-outsource decision **(LO9–5)**

P9–8 Sisters Restaurant purchases cheesecakes and offers them as dessert items on its menu. The cheesecakes are currently purchased from an outside vendor for $24 each. The supplier recently gave notice that the price will increase by 20% immediately. Sisters has idle equipment that could be used to produce similar cheesecakes.

Cost estimates have been prepared under the assumption that the company could make the product itself. Direct materials would cost $7.00 per cheesecake. Direct labor required would be 0.5 hour per cheesecake at a labor rate of $24.00 per hour. Variable overhead would be $9.00 per cheesecake. Fixed overhead, which would occur under either decision alternative, would be $35,200 a year for depreciation and $230,000 a year for other costs. Production and usage are estimated at 3,600 cheesecakes a year. (Assume that any idle equipment cannot be used for any other purpose.)

Required

1. Prepare an incremental analysis to determine whether the cheesecakes should be manufactured within the company or purchased from the outside supplier at the higher price.
2. Based only on your analysis in required 1, should the company manufacture or outsource cheesecake production?
3. Compute the variable unit cost to (a) make one cheesecake and (b) purchase one cheesecake from the outside vendor at the higher price.

P9–9 URL Services has two divisions: Basic Webpages and Custom Webpages. The CFO wants to find out why the Custom Webpages division is not profitable. Each division has three segments for which it tracks profitability: Design, Build, and Maintain. The following information is available.

Perform incremental analysis for a keep-or-drop-segment decision **(LO9–6)**

SEGMENTED INCOME STATEMENT

	Basic Webpages Division (1,000 units)	Custom Webpages Division (200 units)	Total Company
Service revenue	$ 200,000	$150,000	$ 350,000
Direct professional labor: Design	32,000	80,000	112,000
Direct professional labor: Build	30,000	4,000	34,000
Direct professional labor: Maintain	15,000	36,000	51,000
Total variable costs	$ 77,000	$120,000	$ 197,000
Contribution margin	**$123,000**	**$ 30,000**	**$153,000**
Depreciation on computer equipment	6,000	12,000	18,000
Depreciation on servers	10,000	20,000	30,000
Total direct fixed costs	$ 16,000	$ 32,000	$ 48,000
Segment margin	**$107,000**	**($2,000)**	**$105,000**
Building rent			24,000
Supplies			1,000
Insurance			3,000
Telephone			1,500
Website rental			500
Total common fixed costs			$ 30,000
Operating income			**$ 75,000**

Custom Webpages Division Segment Margin

	Design	Build	Maintain	Total
Service revenue	$ 60,000	$ 25,000	$ 65,000	$150,000
Less variable costs	80,000	4,000	36,000	120,000
Contribution margin	**($20,000)**	**$21,000**	**$29,000**	**$ 30,000**
Less direct fixed costs	6,000	13,000	13,000	32,000
Segment margin	**($26,000)**	**$ 8,000**	**$16,000**	**($2,000)**

Required:

1. How will the segment margin be affected if the Custom Webpages division is dropped?
2. How will the segment margin be affected if the Design segment of the Custom Webpages division is dropped?
3. Provide a recommendation to the CFO for whether to drop the entire Custom Webpages division or drop only the Design segment of the Custom Webpages division.

Perform incremental analysis for a keep-or-drop-segment decision **(LO9–6)**

P9–10 Security Services has two divisions: Basic Monitoring, with 1,000 locations, and Custom Monitoring, with 200 locations. Each division has three segments for which it tracks profitability: Design, Install, and Monitor. The manager wants to find out why the Custom Monitoring division is not profitable and has prepared the reports that follow.

SEGMENTED INCOME STATEMENT

	Basic Monitoring	Custom Monitoring	Total Company
Service revenue	$ 250,000	$100,000	$ 350,000
Direct professional labor: Design	25,000	40,000	65,000
Direct professional labor: Install	20,000	14,000	34,000
Direct professional labor: Monitor	5,000	16,000	21,000
Total variable costs	$ 50,000	$ 70,000	$ 120,000
Contribution margin	**$200,000**	**$ 30,000**	**$230,000**
Depreciation on computer equipment	6,000	14,000	20,000
Depreciation on servers	50,000	20,000	70,000
Total direct fixed costs	$ 56,000	$ 34,000	$ 90,000
Segment margin	**$144,000**	**($4,000)**	**$140,000**
Building rent			34,000
Supplies			2,000
Insurance			6,000
Telephone			2,500
Equipment rental			5,500
Total common fixed costs			$ 50,000
Operating income			**$ 90,000**

Custom Monitoring Division Segment Margin

	Design	Install	Monitor	Total
Service revenue	$50,000	$ 25,000	$ 25,000	$100,000
Less variable costs	50,000	10,000	10,000	70,000
Contribution margin	**$ 0**	**$15,000**	**$15,000**	**$ 30,000**
Less direct fixed costs	8,000	13,000	13,000	34,000
Segment margin	**($8,000)**	**$ 2,000**	**$ 2,000**	**($4,000)**

Required:

1. How will the segment margin be affected if the Custom Monitoring division is dropped?
2. How will the segment margin be affected if the Design segment of Custom Monitoring is dropped?
3. Provide a recommendation to the manager for whether to drop the entire Custom Monitoring division or drop only the Design segment of the Custom Monitoring division.

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ANSWERS TO SELF-STUDY QUESTIONS

1. C 2. D 3. B 4. C 5. C 6. B 7. D 8. A 9. B 10. A 11. C 12. C 13. B 14. C 15. C 16. B