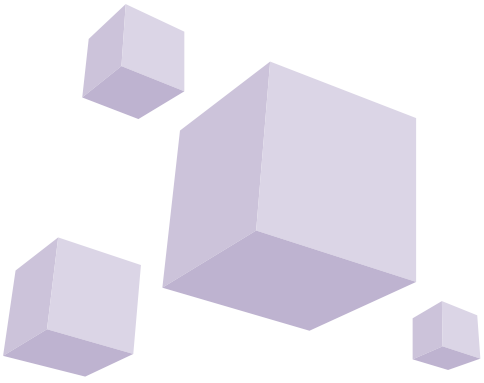
Level Up

Through **Digital Discoveries** 9

Mc Graw Hill

binarylogic

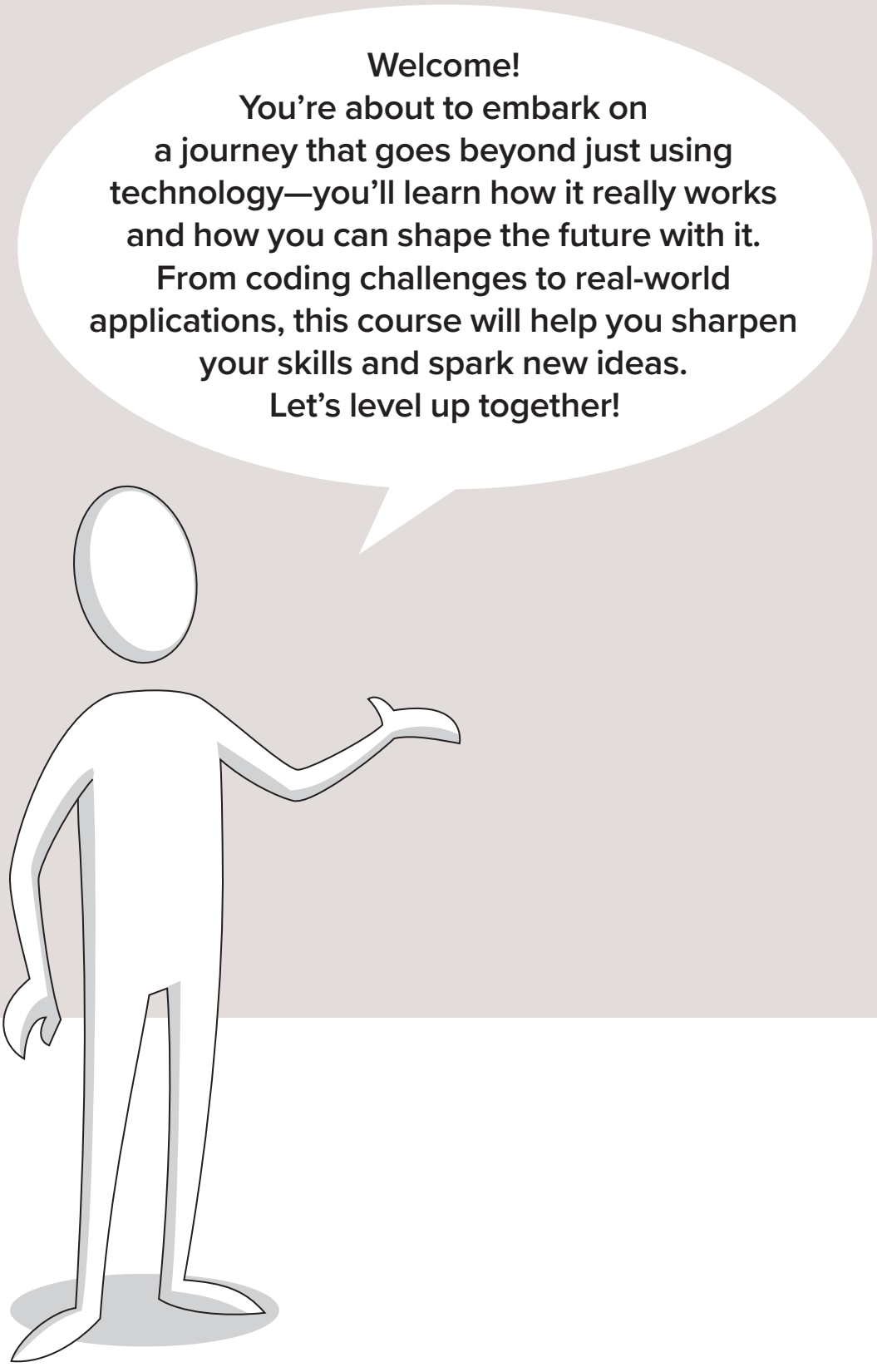


Level Up

Through **Digital Discoveries**

9

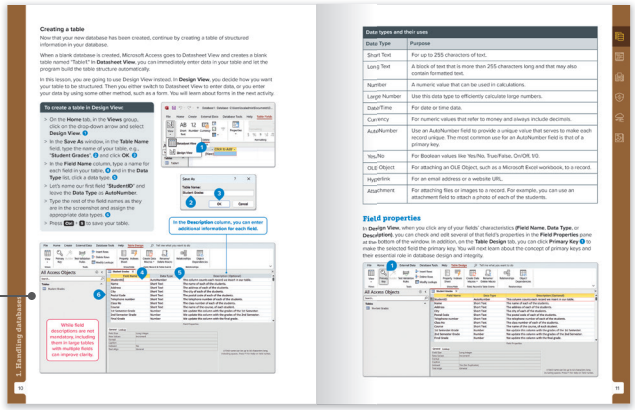
Contents



Key Features

An innovative approach to building digital competencies, developed by expert educators.

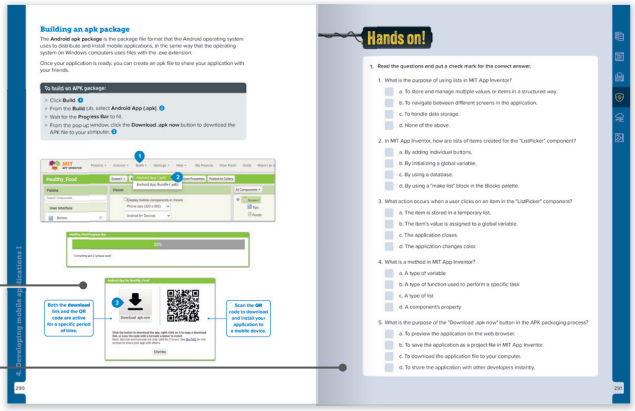
Each unit offers straightforward explanations and contemporary examples, making technology concepts accessible and relevant.



Curriculum aligns with the latest industry standards, preparing students for certifications and future careers.

Every unit includes a variety of tasks and activities designed to help students build essential digital competencies.

Projects and exercises throughout the course reinforce students' understanding and practical application of digital skills in real-world scenarios.



Well-defined learning goals and hands-on, applicable digital skills.

Students learn about platform diversity, expanding their digital toolkit and adaptability.

Each unit organizes key terms that are crucial for digital literacy, equipping students for today's technology-driven workplace.

1. Handling databases

Managing structured data ensures information is organized and accessible for decision-making and problem-solving. This unit covers organizing data using tables in a database, creating forms and reports for inputting and sharing data, and extracting specific information to gain valuable insights.

Learning Objectives

In this unit, you will:

> describe structured data, its importance, and how to manage it effectively in database management systems.

> create a database by defining tables and fields in a database management tool.

> input, organize, and manage different data types in a table using appropriate data types, field properties, and sorting functions.

> troubleshoot common database issues by identifying and resolving errors related to data input, queries, and forms.

> create and customize a data entry form using a form creation tool, including steps to insert, edit, delete records, adjust layouts, and attach labels to fields.

> create and run queries using a query design tool, by adding tables, selecting fields, applying filters, and designing parameter queries.

> design and save custom reports using a report creation tool, including grouping data, sorting fields, and adding calculations like totals and averages.

> export data from a database system to spreadsheet or CSV file formats using export functions.

> import data from spreadsheet or CSV file formats into a database system using an import tool.

Tools

> Microsoft Access

LESSON 1

Structured information

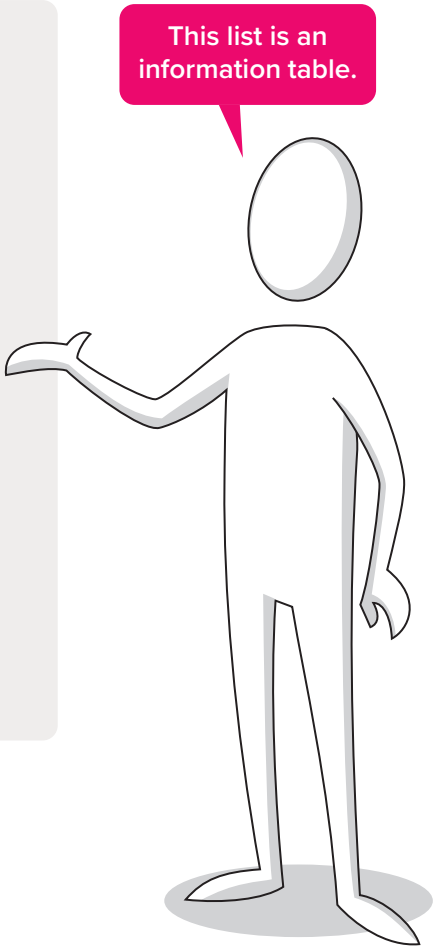
What is a database?
How do database tables simplify the process of comparing and analyzing information?

Do you make a list before you go grocery shopping? A grocery list is an example of **structured information**. The term "structured" means organized and arranged in a specific way. In particular, a simple list is usually divided into rows and columns. In this example, the grocery list could be structured like a table, where each row represents a product and the following columns contain its details:

1. Product name
2. Quantity
3. Estimated price (to help you estimate the total cost of all the products)

Grocery list

Product name	Quantity	Est. price
Apples	5	$5.5
Yogurt	3	$3
Bags of rice	2	$2.5
Bottles of milk	4	$3.5
Bottle of orange juice	1	$2.5
Shampoo	1	$6
Cereal	1	$4
Total		$27

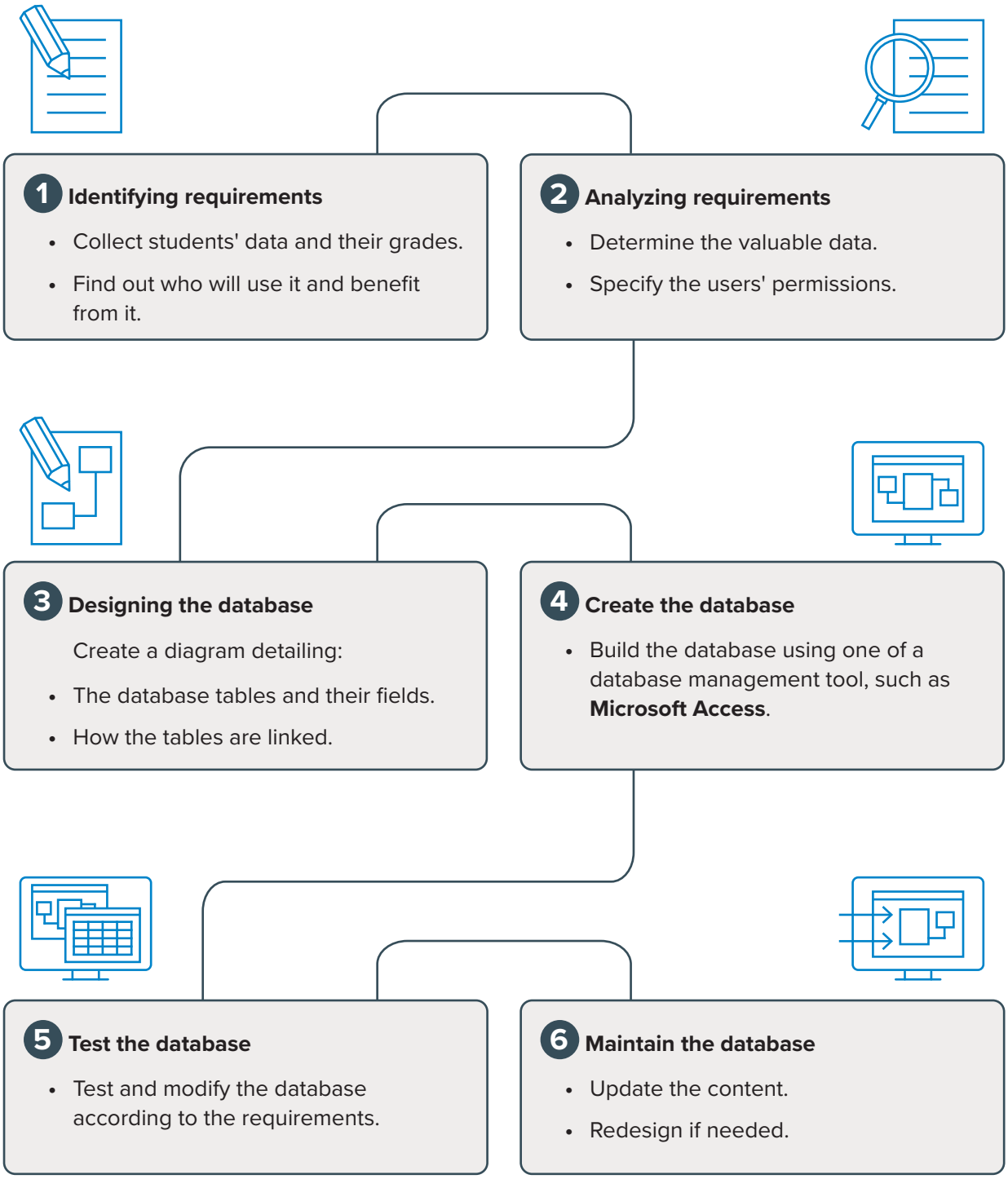


Structured information always consists of rows (records) and columns (fields), like a table. Each column has its own title that defines the column data.

Databases and structured information

A **database** stores and organizes structured information, such as data arranged in rows and columns within tables. For example, in a student management system, the database could include tables for storing student details, course information, and grades. Building such a database is essential to ensure that the data is well-organized, readily accessible, and reliable.

The following diagram details the stages of building a student management system database:



Create a database

In this unit, you will focus on setting up a database. You will create and develop a student management system database using **Microsoft Access**.

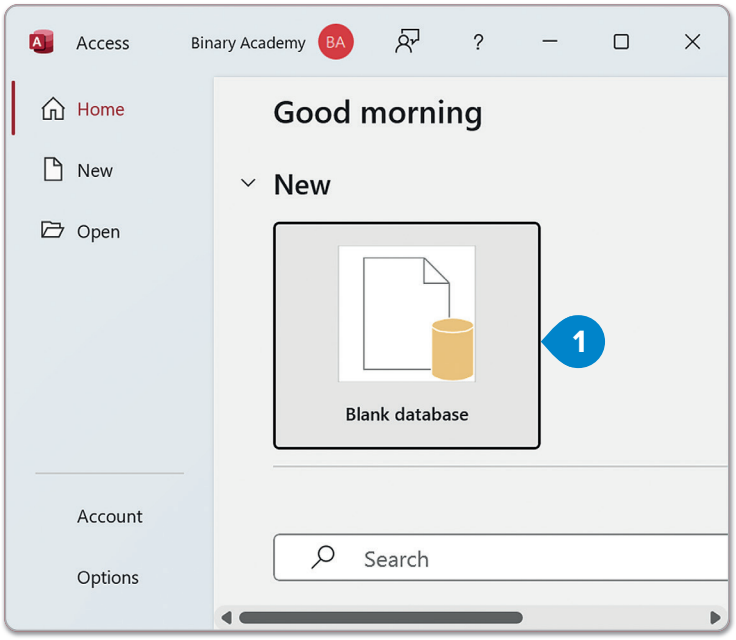
To create your database:

> Open **Microsoft Access**.

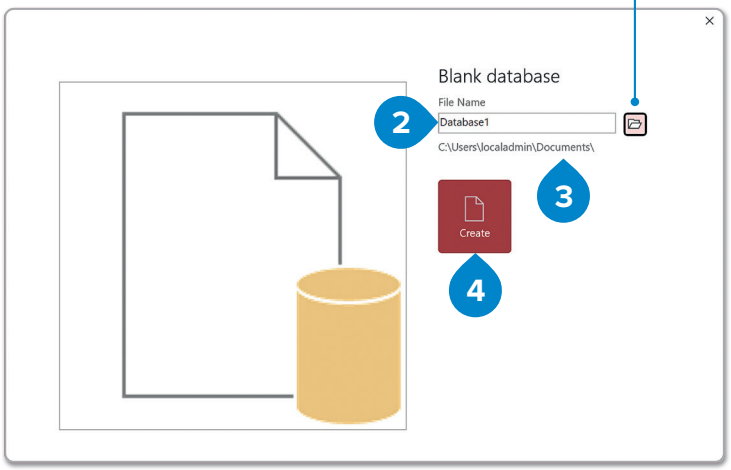
> From the available templates, click **Blank database**. 1

> In the pop-up window, type a file name for your new database in the **File Name** field. 2 Your database file will be saved to the location indicated below the **File Name** field. 3

> Click **Create**. 4



Optionally, click the Browse button next to the File Name box and browse to a different location in which to save the database.



Creating a table

Now that your new database has been created, continue by creating a table of structured information in your database.

When a blank database is created, Microsoft Access goes to Datasheet View and creates a blank table named "Table1." In **Datasheet View**, you can immediately enter data in your table and let the program build the table structure automatically.

In this lesson, you are going to use Design View instead. In **Design View**, you decide how you want your table to be structured. Then you either switch to Datasheet View to enter data, or you enter your data by using some other method, such as a form. You will learn about forms in the next activity.

To create a table in Design View:

> On the **Home** tab, in the **Views** group, click on the drop-down arrow and select **Design View**. 1

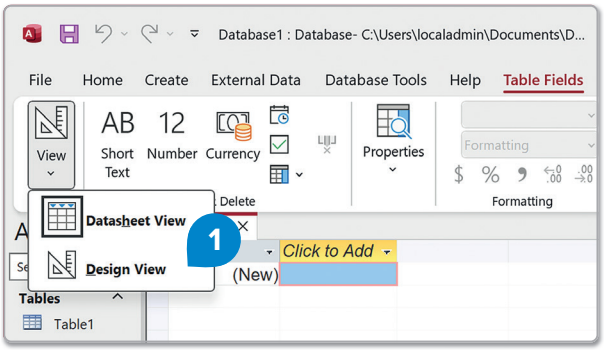
> In the **Save As** window, in the **Table Name** field, type the name of your table, e.g., "**Student Grades**", 2 and click **OK**. 3

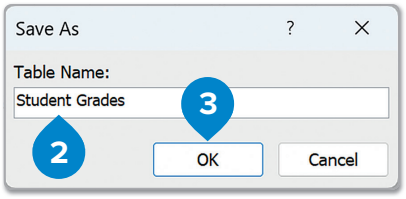
> In the **Field Name** column, type a name for each field in your table, 4 and in the **Data Type** list, click a data type. 5

> Let's name our first field "**StudentID**" and leave the **Data Type** as **AutoNumber**.

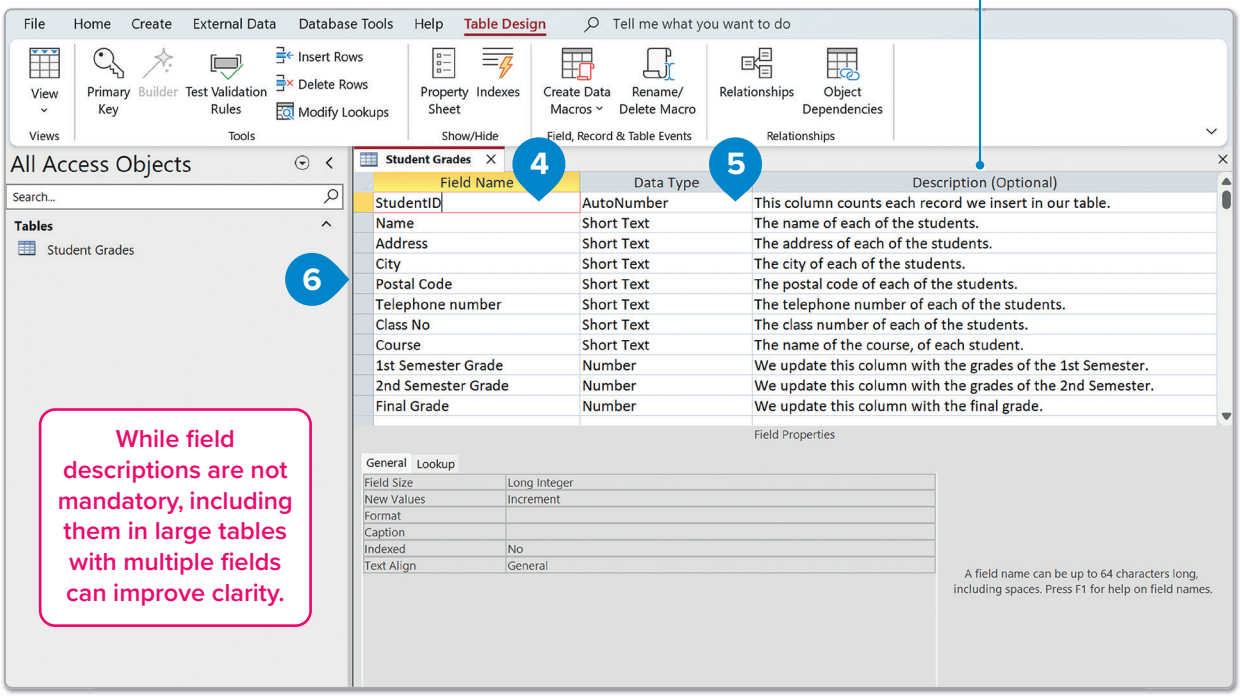
> Type the rest of the field names as they are in the screenshot and assign the appropriate data types. 6

> Press **Ctrl** + **S** to save your table.





In the **Description** column, you can enter additional information for each field.

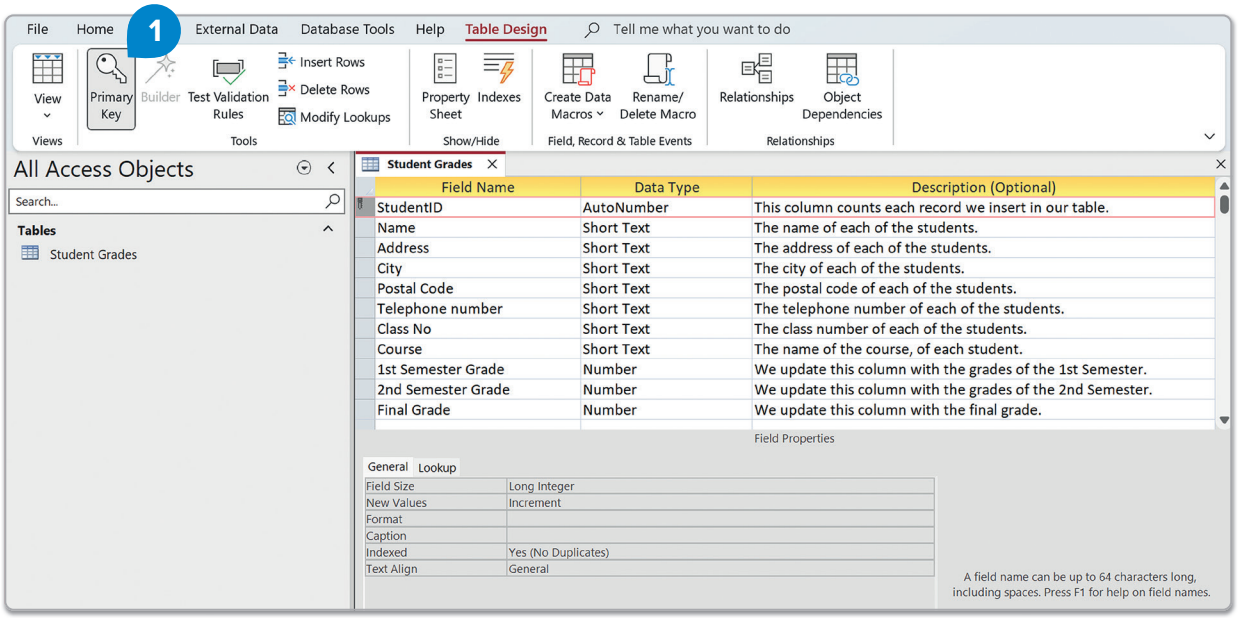


While field descriptions are not mandatory, including them in large tables with multiple fields can improve clarity.

Data types and their uses	
Data Type	**Purpose**
Short Text	For up to 255 characters of text.
Long Text	A block of text that is more than 255 characters long and that may also contain formatted text.
Number	A numeric value that can be used in calculations.
Large Number	Use this data type to efficiently calculate large numbers.
Date/Time	For date or time data.
Currency	For numeric values that refer to money and always include decimals.
AutoNumber	Use an AutoNumber field to provide a unique value that serves to make each record unique. The most common use for an AutoNumber field is that of a primary key.
Yes/No	For Boolean values like Yes/No, True/False, On/Off, 1/0.
OLE Object	For attaching an OLE Object, such as a Microsoft Excel workbook, to a record.
Hyperlink	For an email address or a website URL.
Attachment	For attaching files or images to a record. For example, you can use an attachment field to attach a photo of each of the students.

Field properties

In **Design View**, when you click any of your fields' characteristics **(Field Name**, **Data Type**, or **Description)**, you can check and edit several of that field's properties in the **Field Properties** pane at the bottom of the window. In addition, on the **Table Design** tab, you can click **Primary Key** 1 to make the selected field the primary key. You will next learn about the concept of primary keys and their essential role in database design and integrity.



Field properties overview	
Property	**Use**
Field Size	The maximum size of your field's data. For example, Short Text fields can range from 1 to 255 characters. It's recommended to use the smallest field size sufficient for the data to ensure better performance. Some data types have a fixed field size, for example, date/time or currency.
Input Mask	This displays editing characters to guide data entry. For example, an input mask for a field with an amount of money might display the dollar currency symbol ($) at the beginning of the field and allow only numbers to be typed.
Caption	This is the label text that is displayed by default for this field in forms, reports, and queries. If this property is empty, the name of the field is used. An effective caption is usually brief.
Default Value	The specified value is automatically assigned to the field when a new record is added.
Validation Rule	An expression that must be true whenever you add or change the value in this field.
Validation Text	A message that is displayed when a value that is entered violates the validation rule.
Required	This property requires that data must be entered in the field. Use this for fields that are required, such as Name.
Allow Zero Length	This allows entry (by setting it to Yes) of a zero-length string ("") in a Hyperlink, Short Text, or Long Text field.
Indexed	This specifies whether the field has an index. Use indexes on fields that are frequently used to make the operations involving that field faster.

Simplifying database structure

The structure of a database table can be simplified by separating this table into smaller related tables. This is helpful for keeping the data organized and manageable. For example, by separating student details, course information, and grades into separate tables, we can avoid repeating personal information for every course a student takes.

So, let's divide the "Student Grades" table into three separate tables, as we describe below.

Students

StudentID, Name, Address, City, Postal Code, Telephone number, Class No

Courses

CourseID, Course Name, Class, Teacher

Grades

StudentID, CourseID, 1st Semester Grade, 2nd Semester Grade, Final Grade

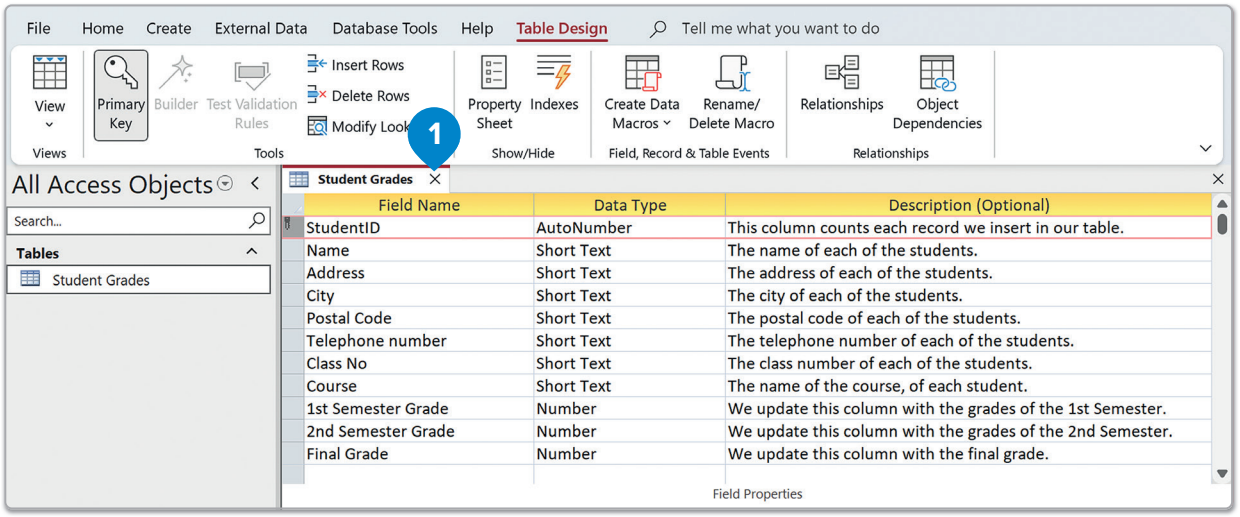
Let's make these changes to our database and then relate the tables to each other.

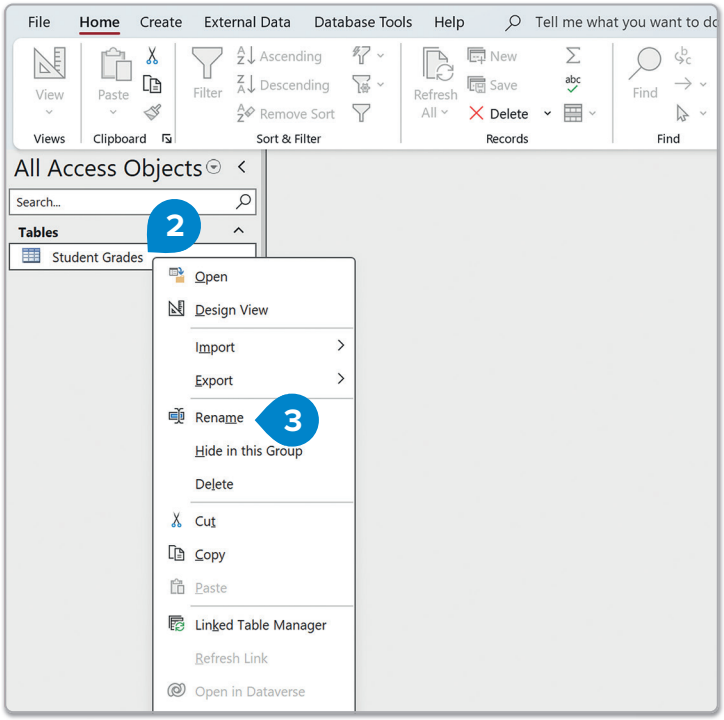
To rename a table:

> Click the **Close** button, 1 to close the **Student Grades** table.

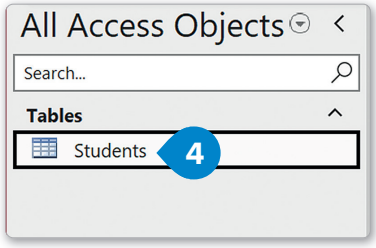
> In the **Navigation pane**, right-click the **Student Grades** table, 2 and click **Rename**. 3

> Type "**Students**" and press **Enter** ↵. 4





Did you notice the small key next to the StudentID field name? The key tells you that the StudentID field is the primary key. The primary key is unique and cannot be the same in two records.



Smart Tip

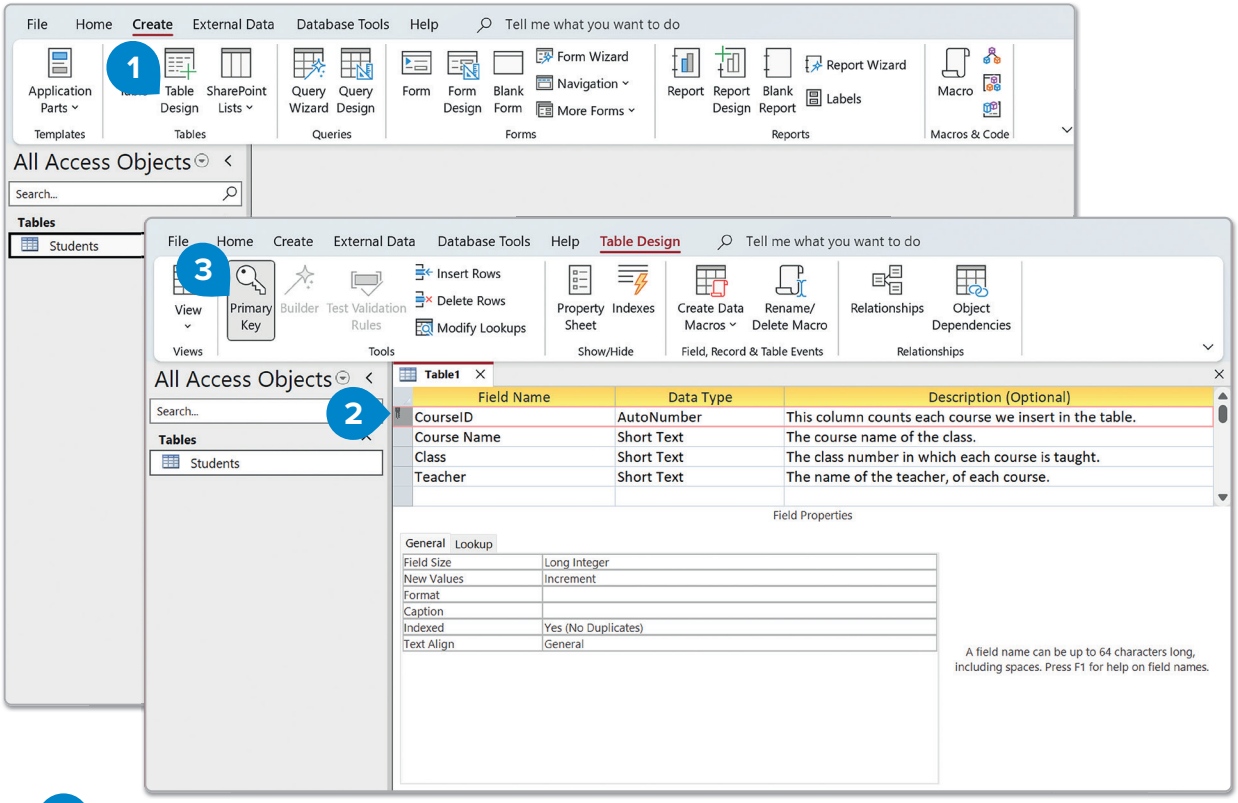
Give a relevant name to each field so that you can tell what it contains without having to check the data.

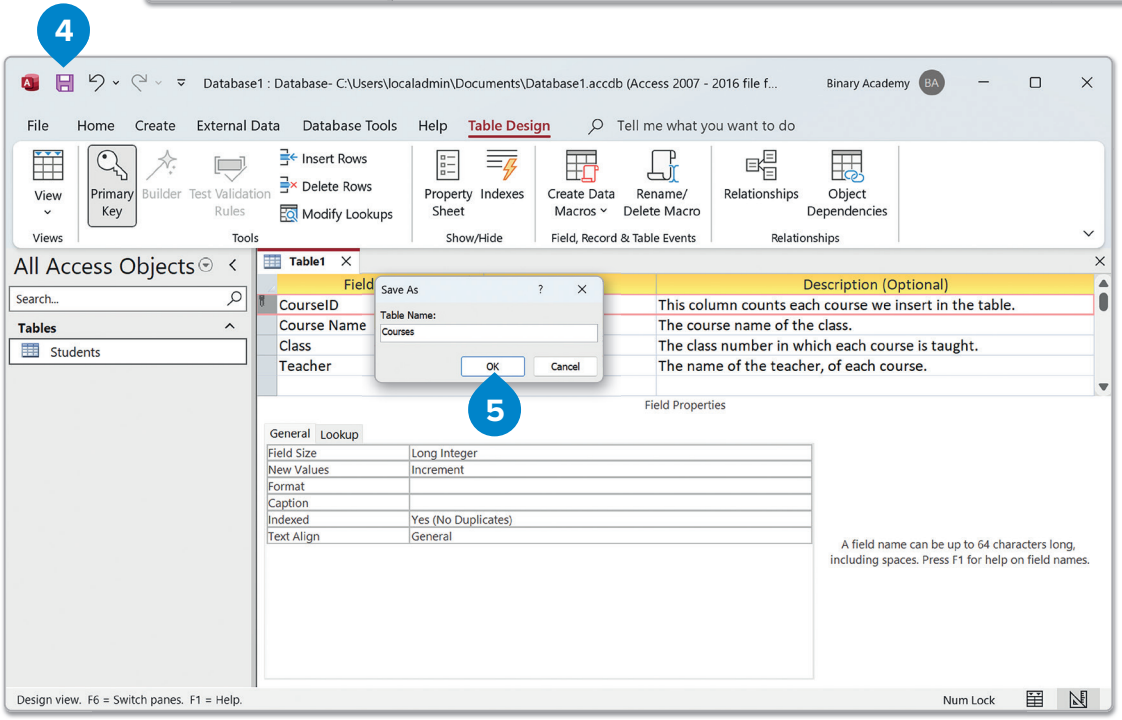
To set up a new table structure:

> On the **Create** tab, in the **Tables** group, click **Table Design**. 1

> Type the field names given in the screenshot with the appropriate data types. 2 Make sure to set the **CourseID** field as the **Primary Key**. 3

> Click the **Save** button. 4 This will be the **Courses** table. The program will ask you to name your table. Type "**Courses**" and click **OK**. 5





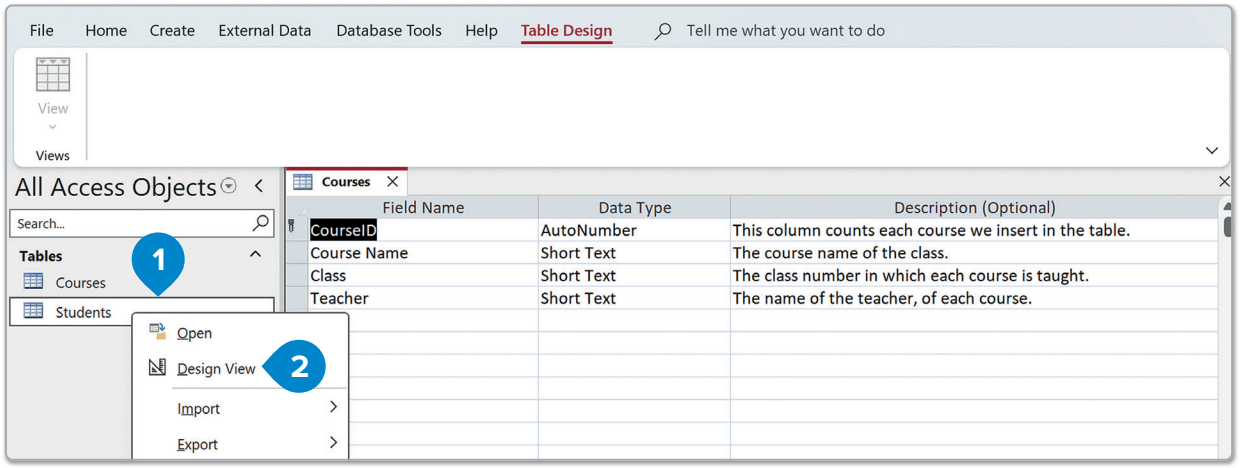
To modify an existing table structure:

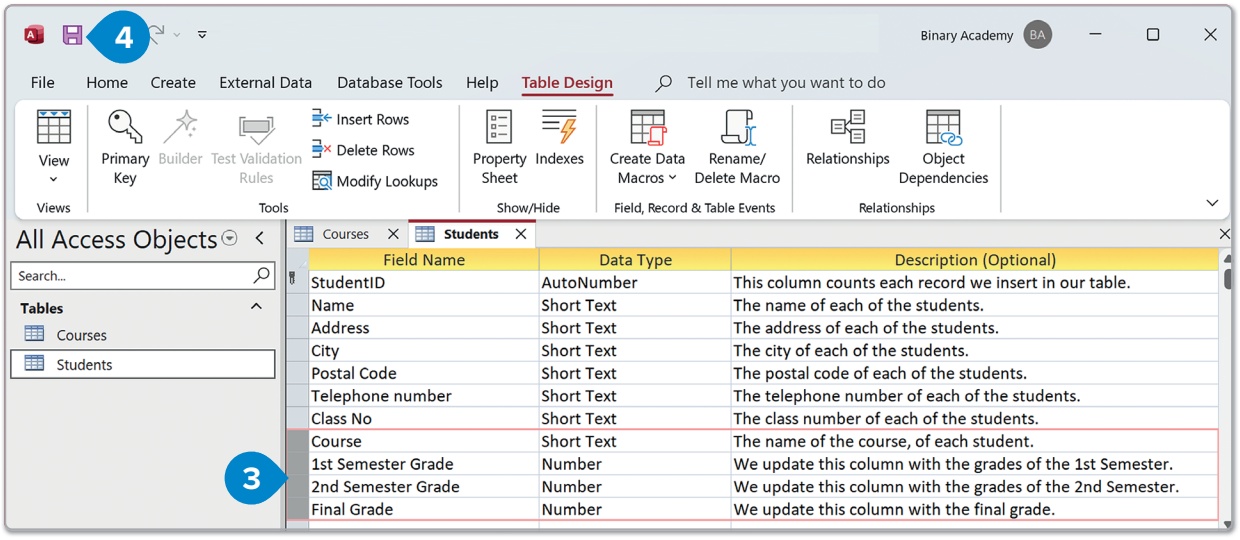
> In the **Navigation pane**, right-click the **Students** table, 1 and click **Design View**. 2

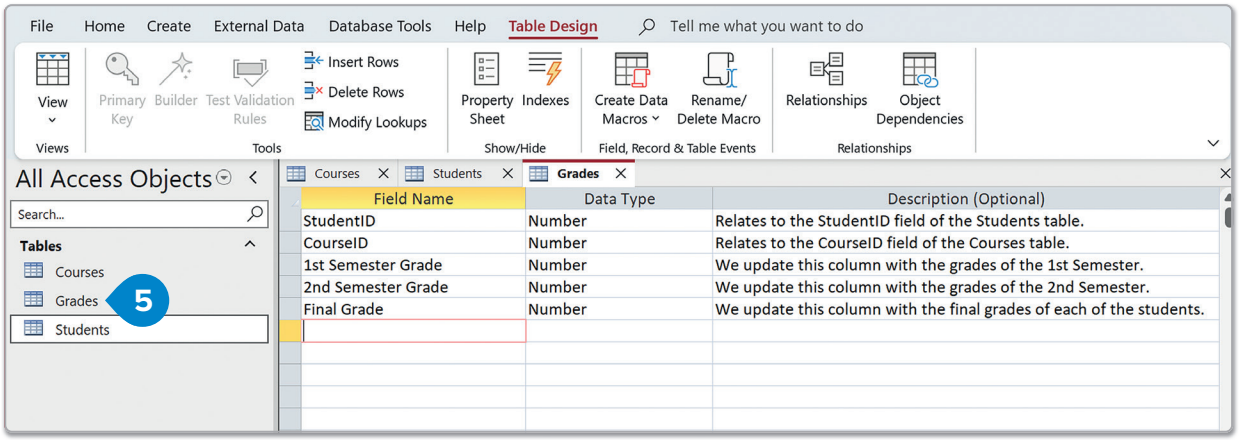
> Select all the extra fields that are not needed in this table, 3 and press **Delete**.

> Click the **Save** button. 4

> Now create the **Grades** table on your own and type the appropriate fields. No **Primary Key** is required here. 5







Keys and relationships

Each record must be unique to ensure accurate data management when working with databases. For example, each person is unique. Even when two people have the same name, they have different emails or telephone numbers. In a database about people, such as friends, each record needs to describe a unique person.

Primary key

A **primary key** consists of one or more fields that can uniquely identify each record in your database table. For example, if you know that there cannot be two people with the same email address in your friends database, you can use the Email Address field as the primary key. Similarly, if you are sure that the combination of name and email address is unique for your friends, then the Name and Email Address fields can be the primary keys.

Students

StudentID	Name	Telephone Number	Email Address
1	Tom	212 500 202	tom.bacademy@outlook.com
2	Tom	212 500 202	tomas.bacademy@outlook.com

Why primary keys matter:

If no field is unique, you create an ID field (e.g., 1, 2, 3...) to identify records efficiently.

They keep records unique and avoid duplicates.

They save space and make databases work faster.

The ID field

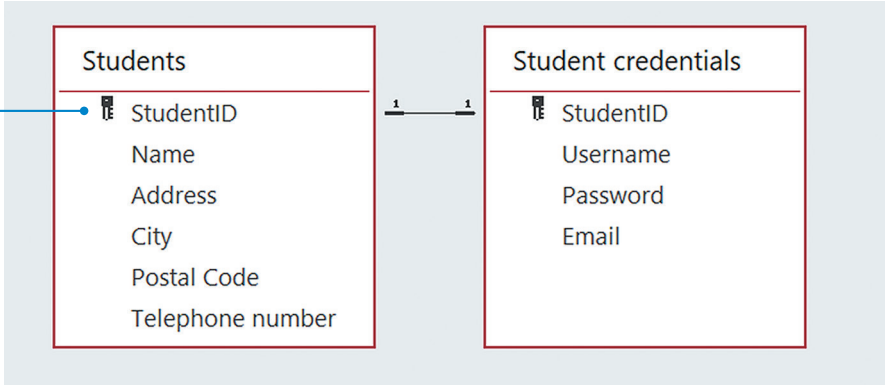
Sometimes, you cannot find a good primary key even if you include all the fields. Occasionally, you may need to include so many fields in your primary key to make it unique that it becomes too large, taking up too much space. So, what do you do in such cases? You can create a new one if you cannot find a primary key in your existing fields. We usually refer to that as the **ID field**. ID comes from the word "identity," a very fitting name since this field identifies each record. For example, StudentID in the "Students" table is a primary key because it uniquely identifies each student.

Table relationships

In databases, relationships are connections between tables that allow you to combine data from different tables to extract useful information. Databases have the following relationship types between tables:

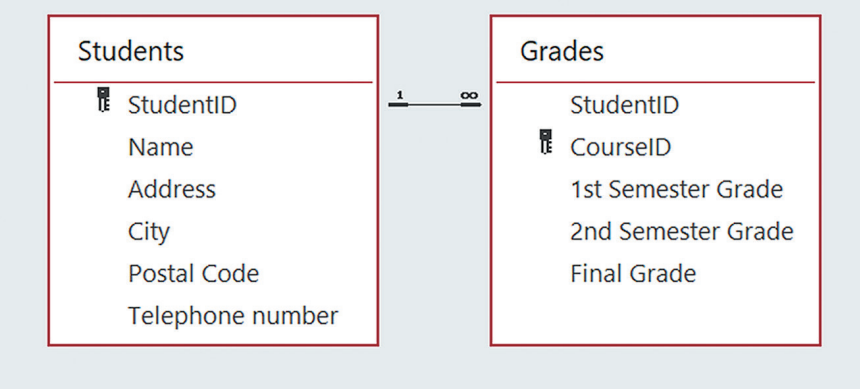
1. **One-to-One:** Each record links to only one record in another table. For example, a table of student profiles could be linked one-to-one with a table of student login credentials.

This is the primary key symbol.

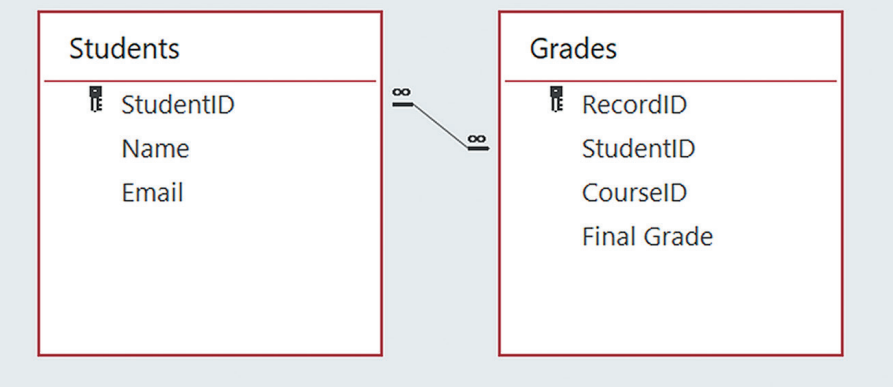


The simplest way to create a one-to-one relationship is to split an existing table in a database into two tables and link them using the same primary key.

2. **One-to-Many:** One record links to many records. For example, one student can have grades for multiple courses.



3. **Many-to-Many:** Records in both tables link to multiple records. For example, a student can take many courses, and a course can have many students enrolled.



To create relationships between tables:

> On the **Database Tools** tab, in the **Relationships** group, click **Relationships**. 1

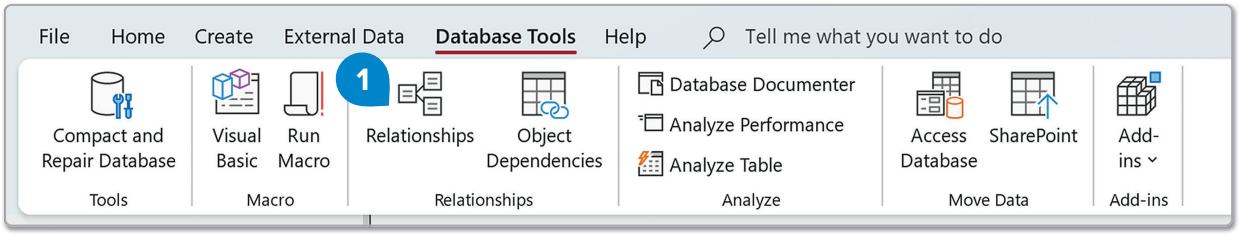
> In the **Add Tables** pane, select all the tables, 2 click **Add Selected Tables**, 3 and then click the **Close** button at the top corner of the pane. 4

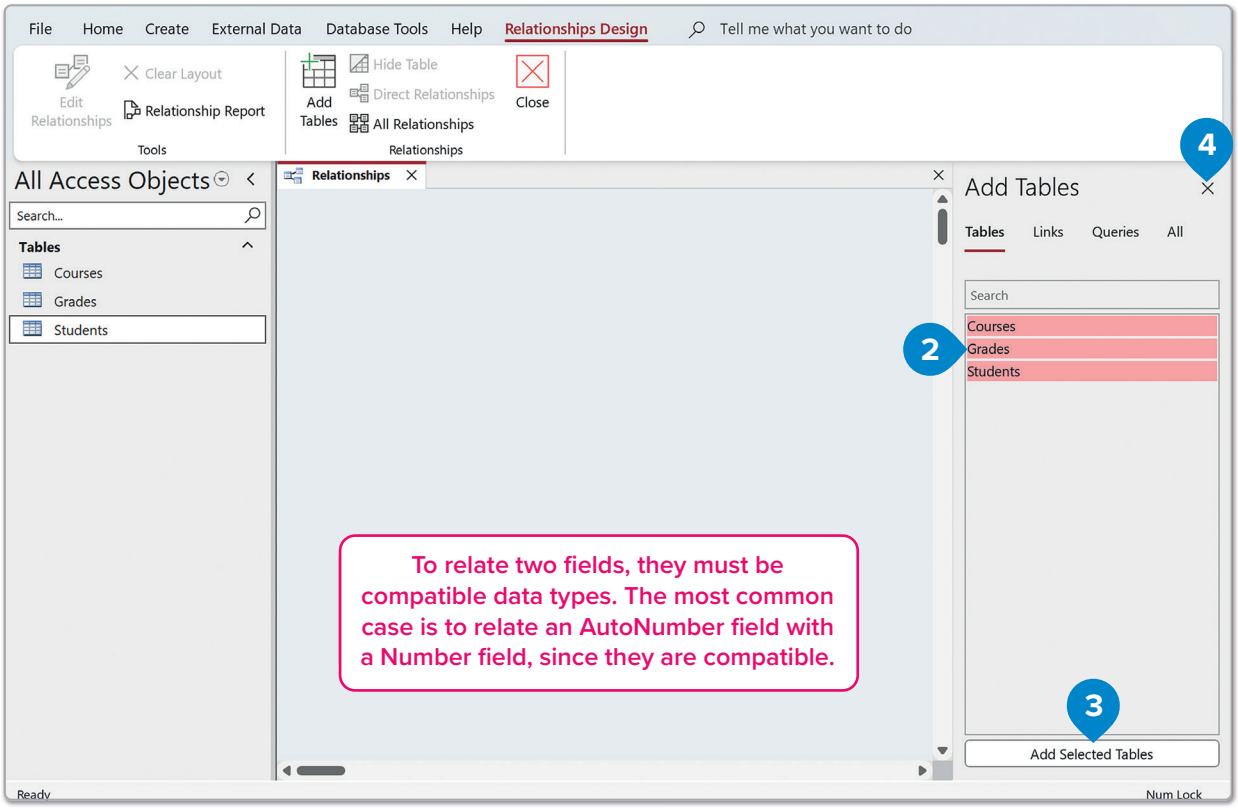
> Drag the **StudentID** field from the **Students** table and drop it on the **StudentID** field of the **Grades** table. 5

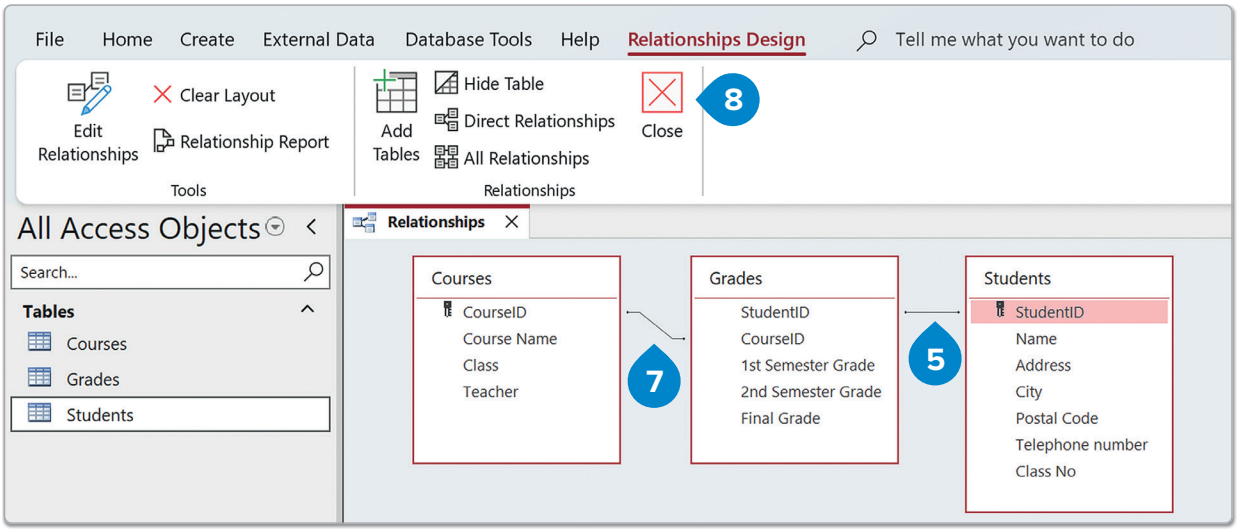
> In the **Edit Relationships** window, click **Create** to establish the relationship. 6

> In the same way, drag the **CourseID** field from the **Courses** table and drop it on the **CourseID** field of the **Grades** table. 7

> Click **Close**. 8 If prompted, save your changes. Your tables are now successfully related.



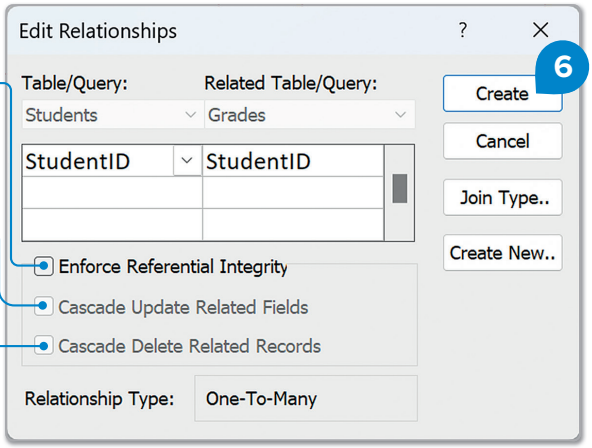




Enforce Referential Integrity prevents "orphan" records and keeps references synchronized so that you won't have any records that reference other records that no longer exist.

Cascade Update Related Fields updates all the related records if a primary key changes in a table.

Cascade Delete Related Records deletes all the related records, if a record is deleted. This way, you avoid orphan records in your tables and records not connected to anything else in your database.



Hands on!

1. Read the following sentences and put a check mark for True or False.

	True	False
1. Structured information is always displayed in rows and columns.		
2. In Microsoft Access, a table created in "Datasheet View" allows you to immediately enter data.		
3. In "Design View," the table structure is automatically built by the program.		
4. The "Primary Key" ensures that every record in a table is unique.		
5. The "Data Type Currency" can include decimals for numeric values.		

2. Read the questions and put a check mark for the correct answer.

1. Which of the following is the first step to create a blank database in Microsoft Access?
   - a. Click on "Create Table" under "Table Tools."
   - b. Open Microsoft Access and choose "Blank Database."
   - c. Select an existing template for tables.
   - d. Enter data directly in "Datasheet View."

2. What is the purpose of an "AutoNumber" data type?
   - a. To allow numeric values used for calculations
   - b. To attach files or images to a record
   - c. To provide a unique value for each record automatically
   - d. To store "Yes/No" values for a record

3. In the "Field Name" column of a table, what is "StudentID" typically used for?

- a. To identify each student uniquely in the table
- b. To record the student's grade for a semester
- c. To list the student's telephone number
- d. To describe the table structure

4. Which property specifies whether a field is optimized for faster searching and sorting within a database?

- a. Input Mask
- b. Indexed
- c. Validation Rule
- d. Default Value

3. Match the data types and their uses.

1. Short Text	For a file or image
2. AutoNumber	For numeric values including money
3. Currency	For up to 255 characters of text
4. Attachment	To create a unique record ID
5. Yes/No	For Boolean values like True/False

4. Complete with the missing word.

1. In Microsoft Access, structured information is typically arranged in rows, called _____, and columns, called _____.

2. The "Field Properties" pane allows users to edit a field's size, data type, and _____ for additional details.

3. The most common use of the "AutoNumber" field is to set a _____ for each record, ensuring uniqueness.

4. "Table Relationships" can combine data from multiple tables. The most common type of relationship is _____, where one record links to many records.

5. The "Primary Key" is important because it prevents _____ and ensures every record is unique.

5. You have to create a library inventory database to manage information about authors and the books they have written.

1. Open Microsoft Access and create a blank database. Name the database "LibraryInventory."

2. Create a new table to store authors' details including the following fields:
   - AuthorID (AutoNumber, Primary Key)
   - Author Name (Short Text)

3. Save the table as "Authors."

4. Create a new table to store book details including the following fields:
   - BookID (AutoNumber, Primary Key)
   - Title (Short Text)
   - AuthorID (Number)

- Author (Short Text)
- Genre (Short Text)
- Year Published (Number)

5. Save the table as "Books."

6. Enter the following records in Datasheet View:

   - Authors Table:
     > Record 1: AuthorID: Auto-generated, Author Name: Antoine de Saint-Exupéry
     > Record 2: AuthorID: Auto-generated, Author Name: Roald Dahl
   - Books Table:
     > Record 1: BookID: Auto-generated, Title: The Little Prince, AuthorID: 1, Genre: Fiction, Year Published: 1943.
     > Record 2: BookID: Auto-generated, Title: Charlie and the Chocolate Factory, AuthorID: 2, Genre: Fiction, Year Published: 1964.

7. Create relationships between "Books" and "Authors" tables.

8. What type of relationship exists between tables?

---

9. Save and close the database.

LESSON 2

Data entry forms

Why might it be helpful to use a tool to add or edit one record at a time instead of scrolling through a large table? How can a simple, organized interface facilitate the entry of details such as name, address, and telephone number?

Now that tables have been created in the database, a **data entry form** can be created. This form helps add information or edit existing data. Data can always be added from the tables. Forms serve as the interface created for users, providing a simple way to enter data without directly editing the tables or understanding how the database is structured.

Forms also allow control over which data the user can access, ensuring that only specific fields or records in the database can be checked or edited.

For this activity, you will work on the "Students" table that you created in the previous lesson.

To create a form using the Form Wizard:

> Make sure all database objects are closed, and select the **Students** table, 1 from the **Navigation pane**.

> On the **Create** tab, in the **Forms** group, click **Form Wizard**. 2

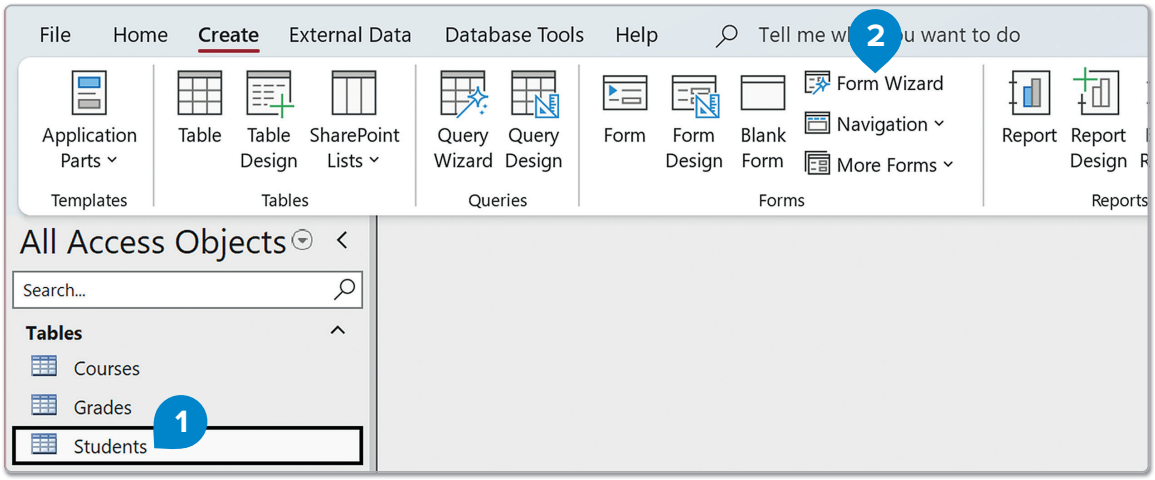
> In the **Form Wizard** window, click the >> button, 3 to include all the fields in the form.

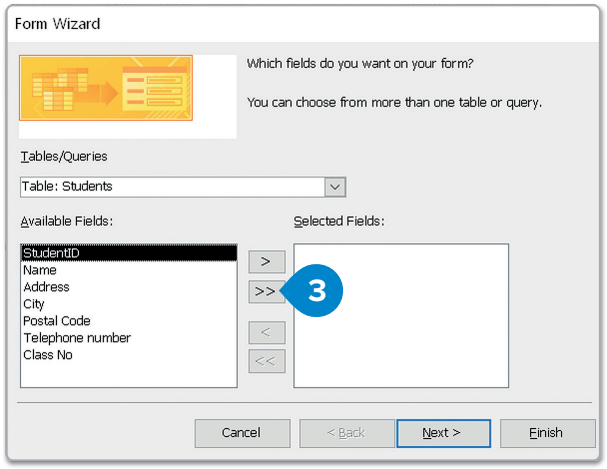
> The **StudentID** field is excluded from the form, as it contains no relevant data for the user and is updated automatically. To remove it, click it in the **Selected Fields** list, 4 and click the < button. 5

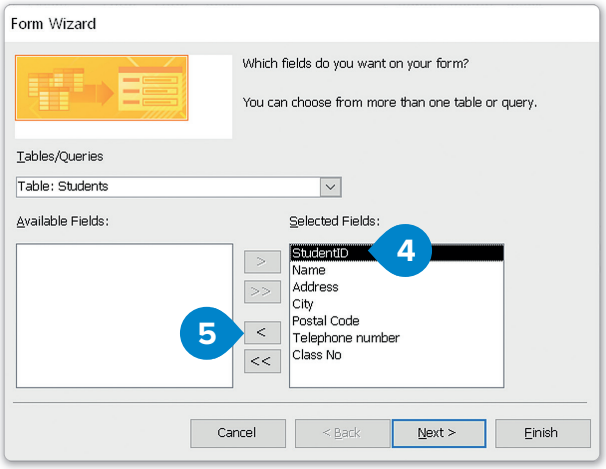
> Click **Next**. 6

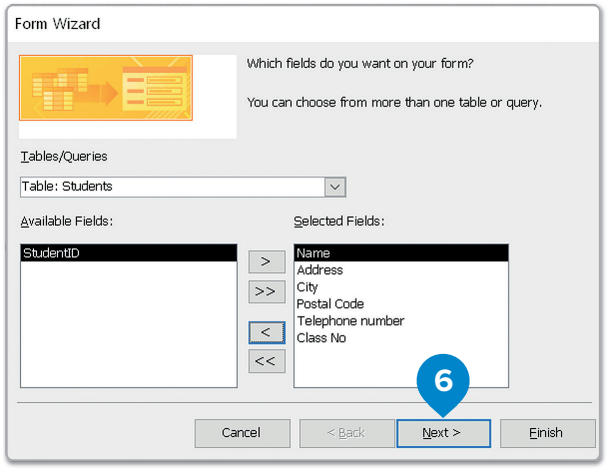
> In the next screen leave **Columnar** layout selected and click **Next**. 7

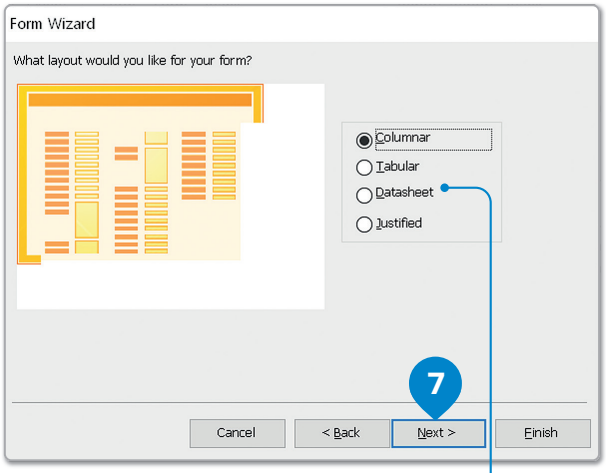
> Click **Finish**. 8



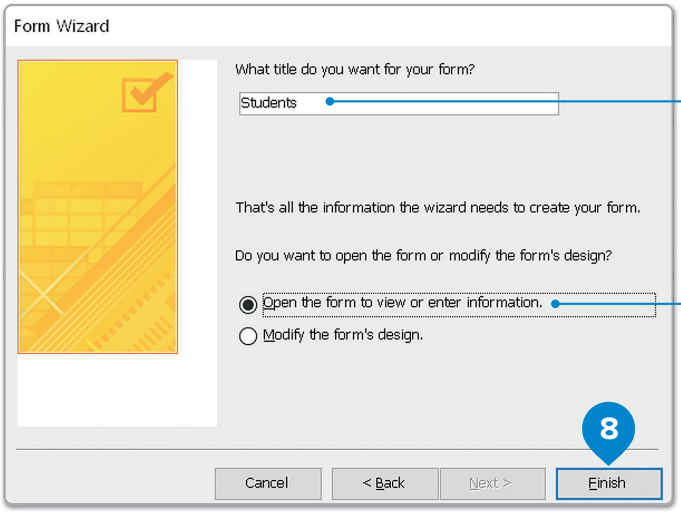








Alternatively, you can choose another layout which suits your personal taste.



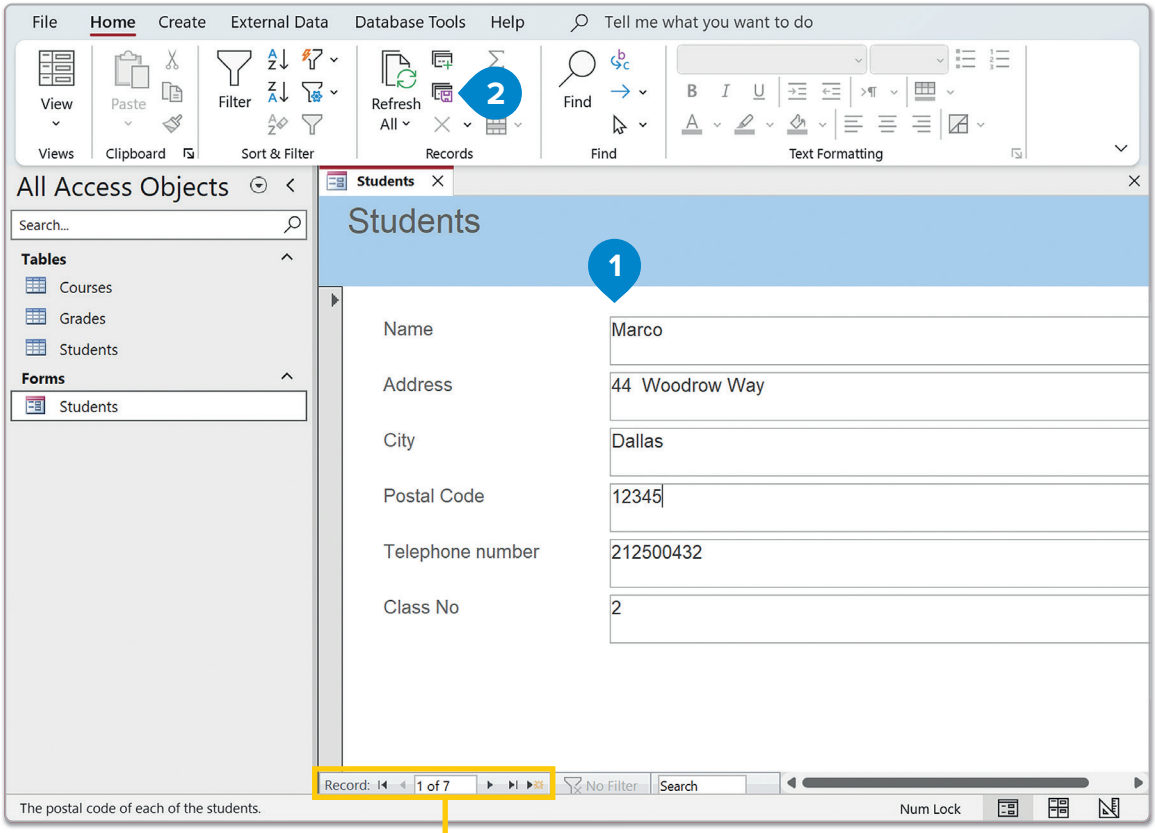
You can change the name of your form.

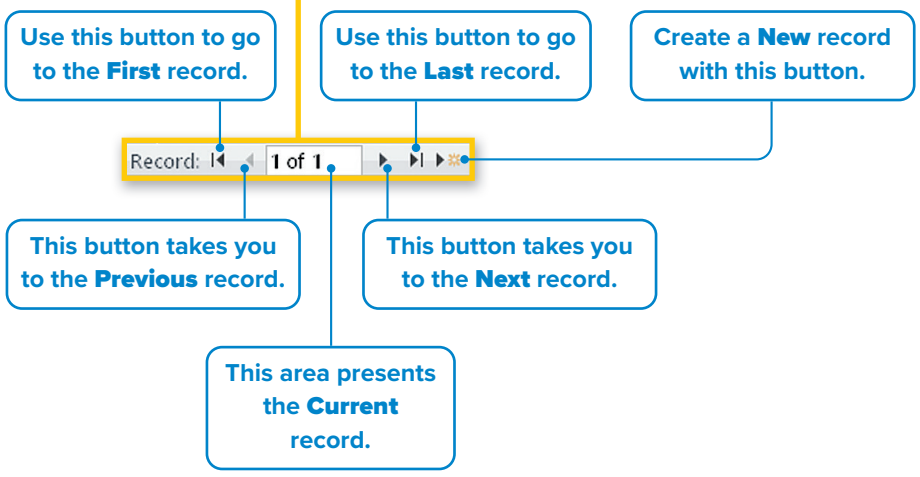
This option opens the form in **Form View** and lets you type data.

To insert records in your form:

> Simply fill in the form you have already created. 1

> When you are done, on the **Home** tab, in the **Records** group, click **Save**. 2





In the same way, you enter data into a form, you can also enter data into a table. Open the "Students" table and type these records.

Students

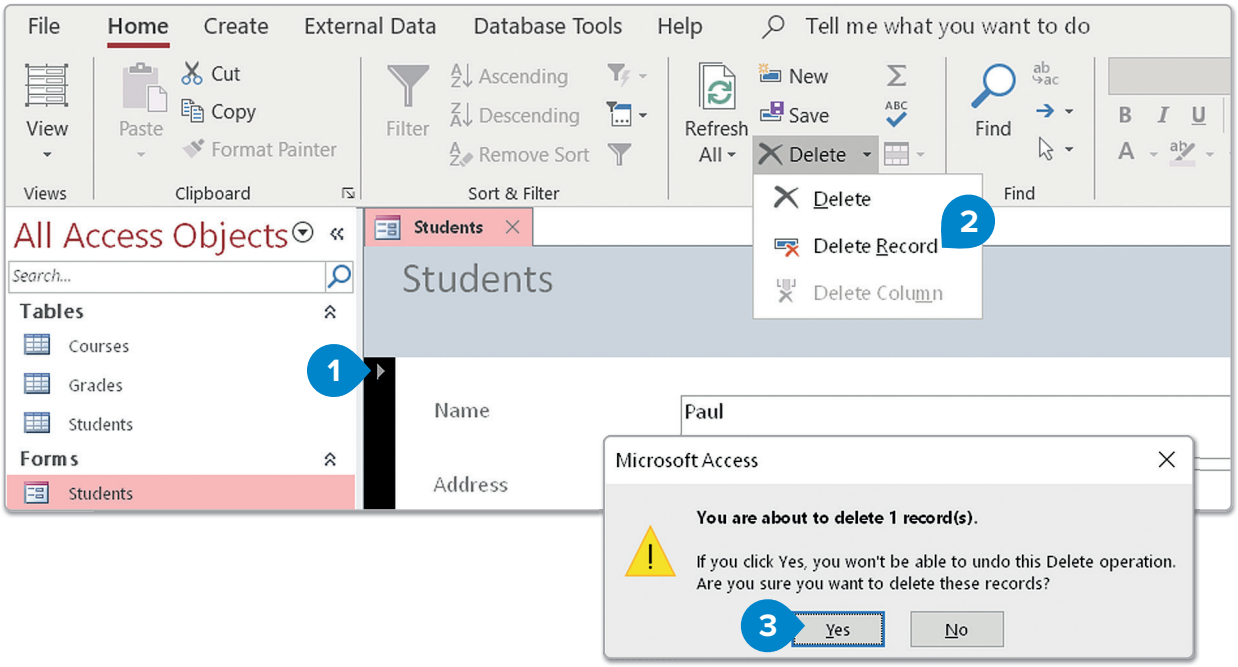
Student ID	Name	Address	City	Postal Code	Telephone number	Class No	Click to Add
1	Marco	44 Woodrow Way	Dallas	12345	212500432	2	
2	Lisa	36 Cambridge Court	Dallas	12346	212500202	1	
3	Kim	22 Alfred Drive	London	12347	212500441	2	
4	Tom	36 Cambridge Court	Dallas	12346	212500202	3	
5	Alex	202 Newport Lane	London	12348	212500516	3	
6	Stella	2048 Central Avenue	London	12349	212500123	3	
7	Paul	43 Oxford Street	London	12341	212500526	1	
(New)							

To delete a record:

> Navigate to the record you want to delete, e.g., the **7th record**, and click the **record selector** next to the record. 1

> On the **Home** tab, in the **Records** group, click the drop-down arrow next to **Delete**, and then click **Delete Record**. 2

> In the warning message box, click **Yes**. 3



Because the StudentID field is auto-numbered, when you delete a record, its StudentID number is not replaced. If you delete the last record, e.g., No 6, the StudentID for the next new record will be 7.

Smart Tip

To fill in a form faster, you can press Tab ↹ after typing each field to move to the next one. If you press Tab ↹ while working on the last field of a form, you move to the next page to insert another record.

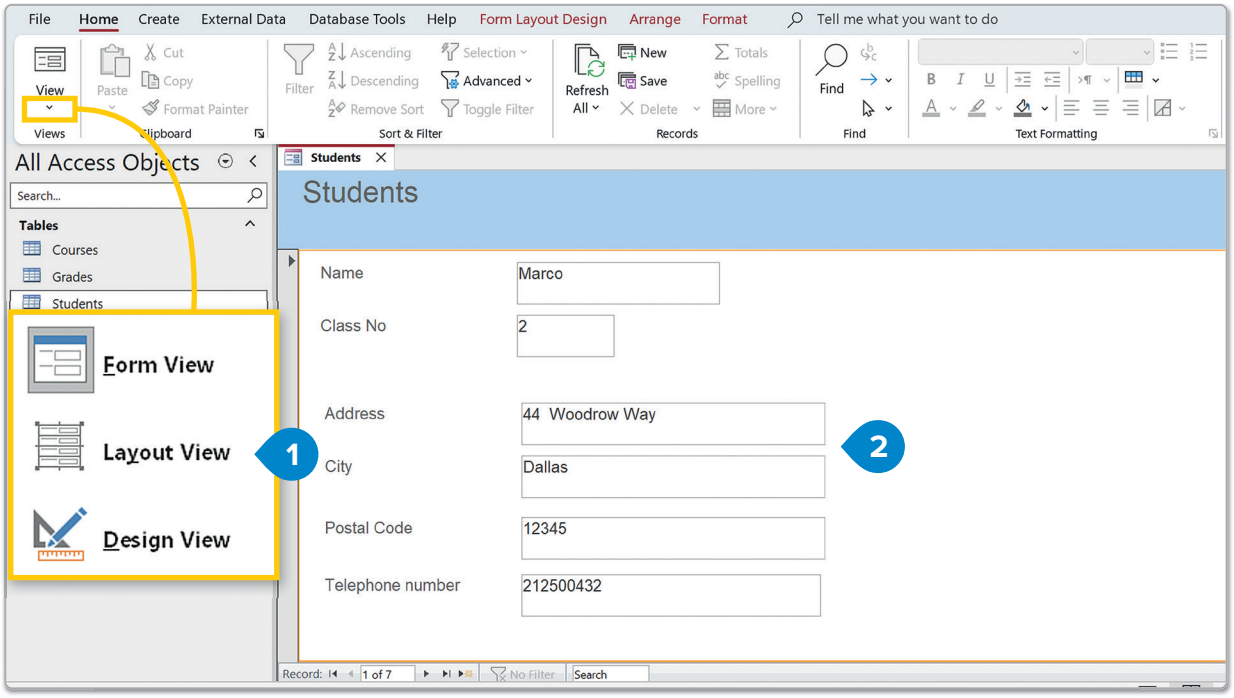
Personalize your forms

You can customize your form in various ways. For instance, you can add or change fields and labels.

To change the layout of your form:

> On the **Home** tab, in the **Views** group, click on the drop-down arrow and select **Layout View**. 1

> In **Layout View**, you can resize and drag all the fields and put them in the order you prefer. 2



Change the data source

You can also change the **Data Source** of your **text boxes**. This means that you can choose a specific field in your table, so that the text you type in the text box is saved in it.

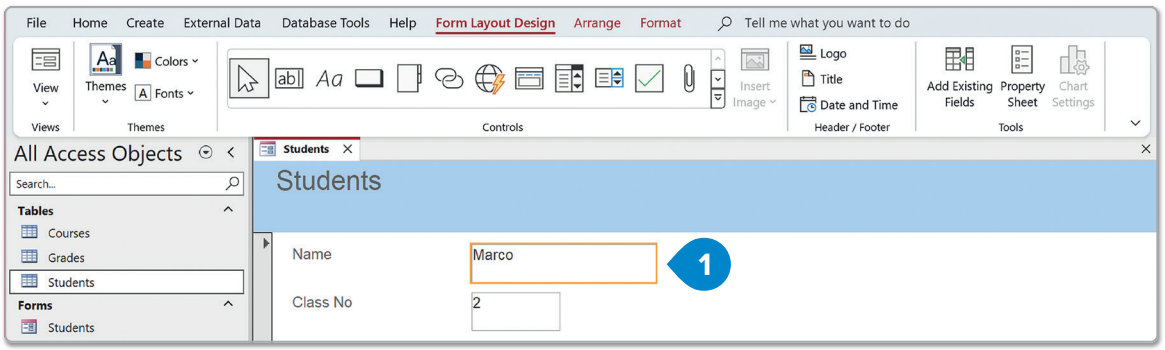
To change the data source of a text box:

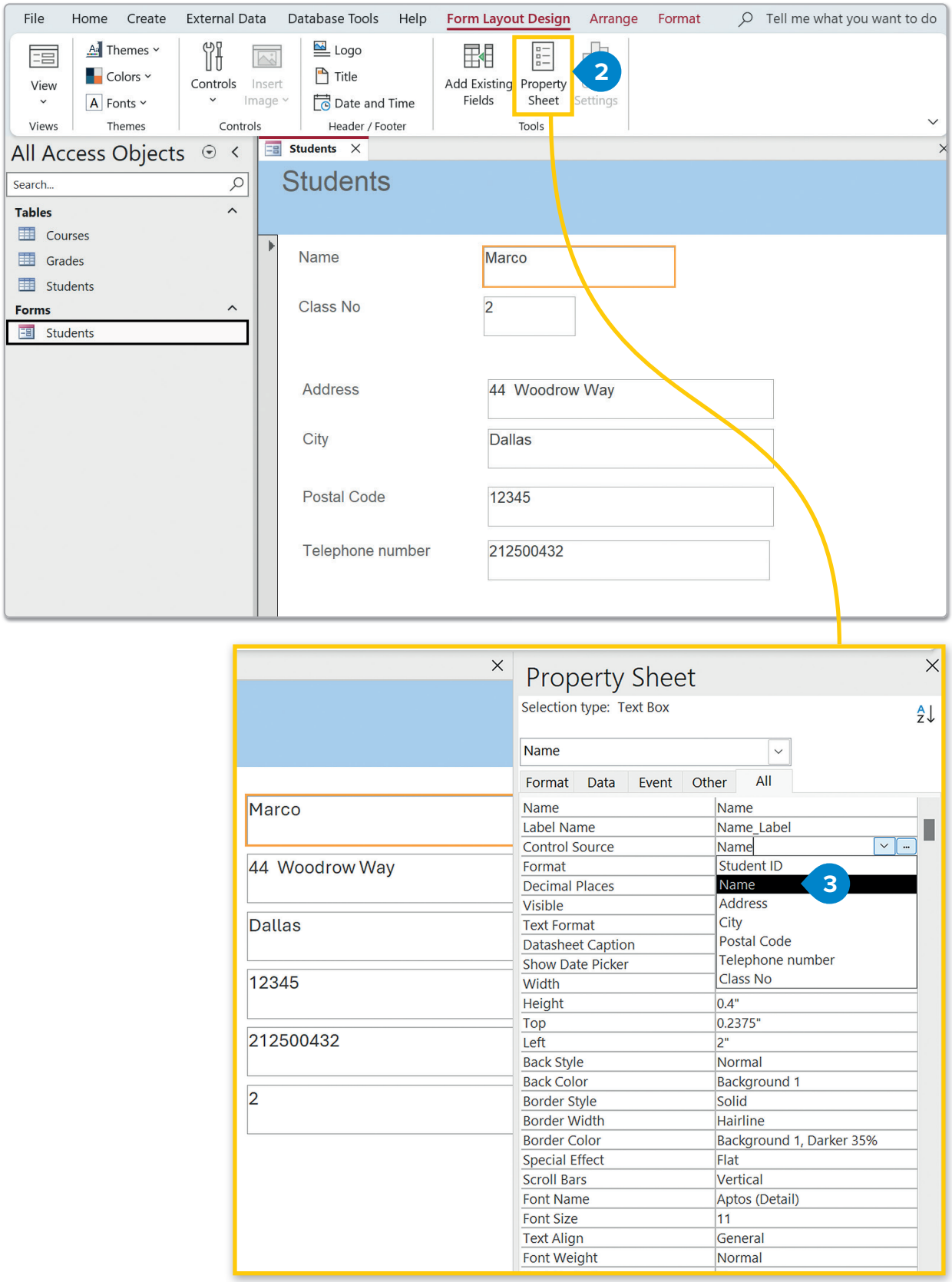
> Click a text box to select it, e.g., the text box that contains the name **Marco**. 1

> On the **Form Layout Design** tab, in the **Tools** group, click **Property Sheet**. 2

> In the **Property Sheet** pane, on the **All** tab, click the **Control Source** list and click a field to link to that text box, e.g., **Name**. 3

> Now, whatever you write in that text box will be saved in the field you selected.





To attach a label:

> On the **Form Layout Design** tab, in the **Controls** group, click the **Label** button. 1

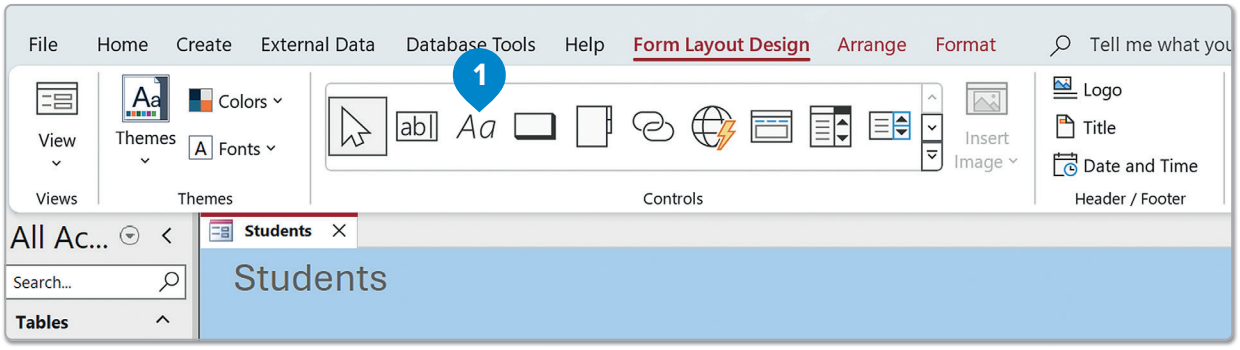
> Click anywhere inside your form. A new **Label Box** will be on your screen. Type "**Contact Information**". 2

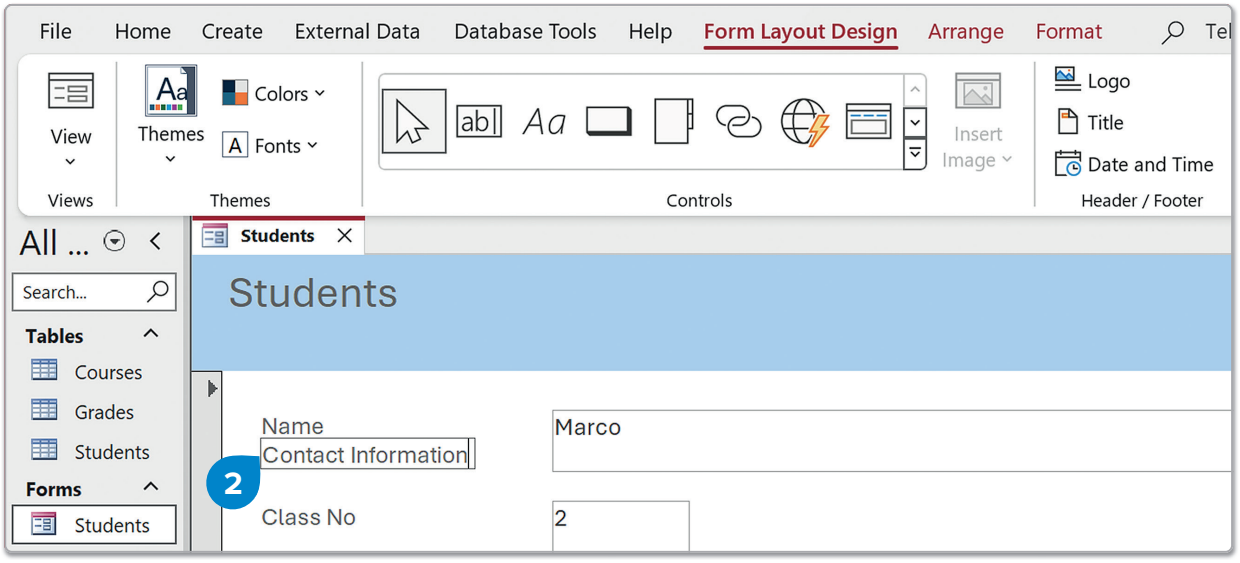
> Drag the **Label Box** above the **Contact Information** data. 3

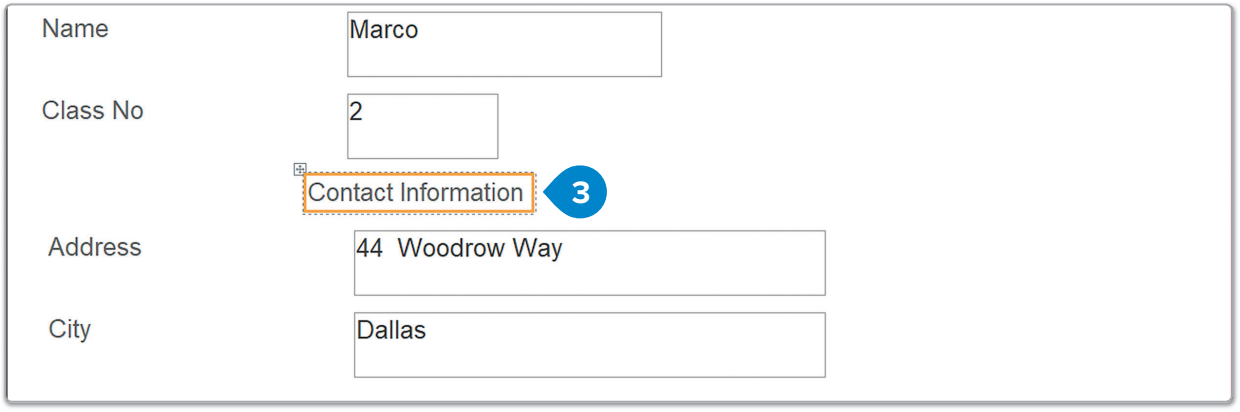
> With the **Label Box** selected, on the **Form Layout Design** tab, in the **Tools** group, click **Property Sheet**. 4

> In the **Property Sheet pane**, change **Font Size** to "**18**". 5

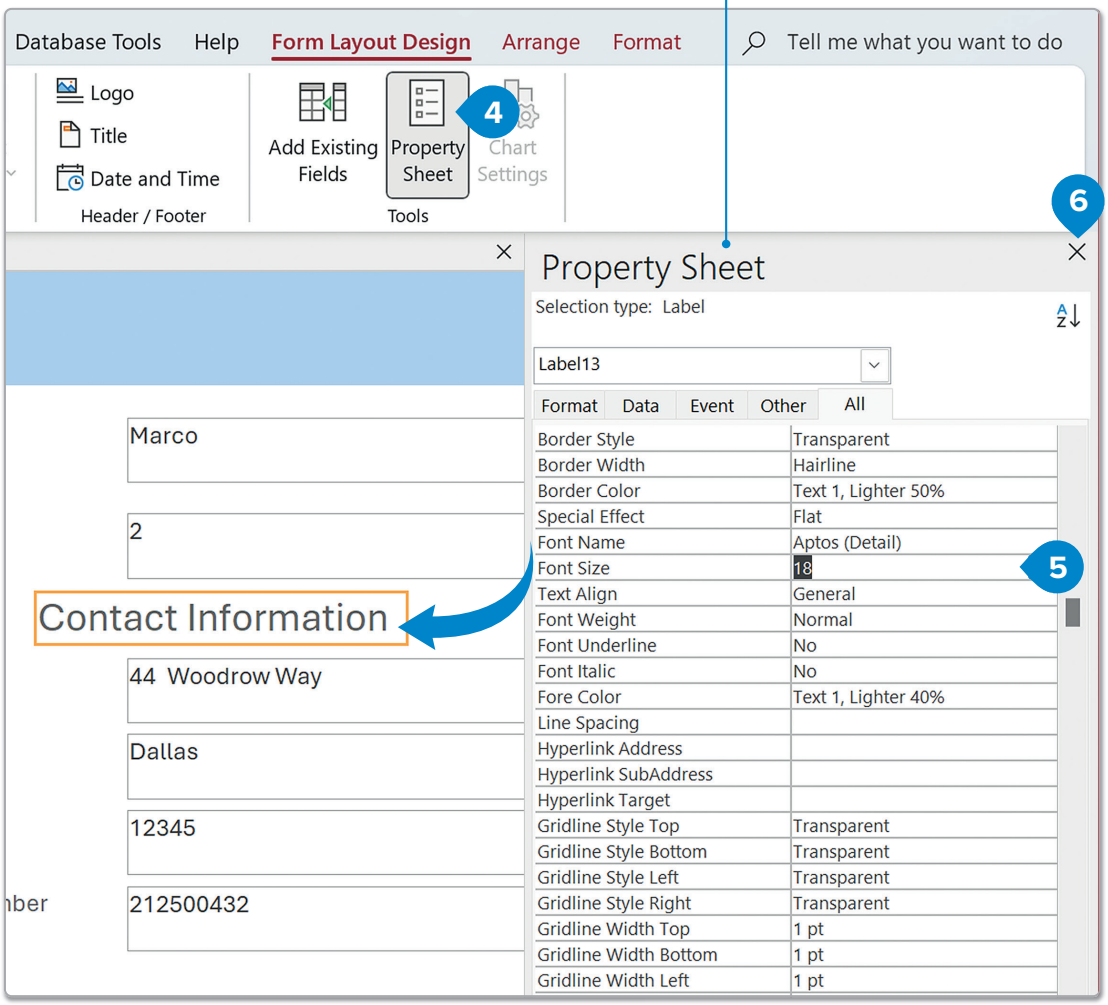
> Close the **Property Sheet** pane, 6 and save your form.



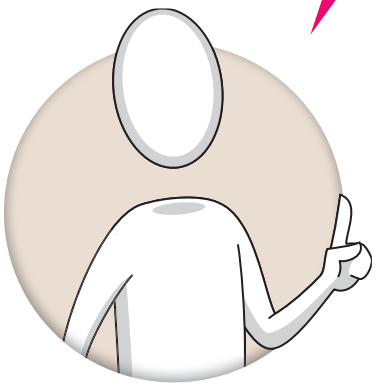




You can experiment and change some of the other properties and check what happens. The changes will be in the **Layout View**.



It's very important for your forms to be simple. Most often, people who work on a database mainly focus on the forms, because it's the interface of the database.



Hands on!

1. Read the following sentences and put a check mark for True or False.

	True	False
1. A "data entry form" allows users to add or edit data in a table without directly opening it.		
2. The "Form Wizard" allows you to choose only one field to display in a form.		
3. The "StudentID" field is automatically updated in a form because it uses the "AutoNumber" data type.		
4. The "Columnar layout" displays all the fields of a form in a vertical order on one page.		
5. You can use the "Property Sheet" to resize and move fields in "Layout View."		

2. Read the questions and put a check mark for the correct answer.

1. What is the purpose of a data entry form in Microsoft Access?
   - a. To print the records in a table.
   - b. To create an automatic backup of a table.
   - c. To add, edit, or access records in a simple way.
   - d. To delete all fields in a table.

2. In the "Form Wizard," how do you include all the fields in your form?
   - a. Click the ">" button.
   - b. Click the ">>" button.
   - c. Click the "<" button.
   - d. Click the "<<" button.

3. Why is the "StudentID" field not included in the form by default?

- [ ] a. It is not an important field for users.
- [ ] b. It is automatically updated and does not require manual input.
- [ ] c. It is a text field and cannot be added.
- [ ] d. It can only be added through "Design View."

4. What button would you use to ensure that changes made to a record in a form are stored and not lost?

- [ ] a. The "Save" button, on the "Home" tab, in the "Records" group
- [ ] b. The "More" button, on the "Home" tab, in the "Records" group
- [ ] c. The "New" button, on the "Home" tab, in the "Records" group
- [ ] d. The "Refresh All" button, on the "Home" tab, in the "Records" group

3. **Forms are often called the interface of a database because they help users interact with the data.**

Why is it important to make forms that are straightforward and user-friendly? Can you think of a real-life example, like an online form, and explain what makes it easy to use or challenging to use?

4. **Open Microsoft Access and navigate to the "Authors" table and "Books" table you created in the previous lesson.**

    1. Use the Form Wizard to create forms for the following:

        - From the "Authors" table include the fields: AuthorID and Author Name.
        - From the "Books" table include the fields: AuthorID, BookID, Title, Genre, and Year Published.
        - Use the Columnar Layout for both forms.

    2. Once the forms are created, insert new records. More specifically:

        - On the "Authors" form, add the following data: AuthorID: Auto-generated, Author Name: Shel Silverstein.
        - On the "Books" form, add the following data: AuthorID: 3, BookID: Auto-generated, Title: The Giving Tree, Genre: Literature, Year Published: 1964.

    3. Save and close the database.

LESSON 3

Queries

How can you quickly find books by a specific author from a list of titles, authors, and publication years? Why is this helpful for organizing your reading list?

Database tables can store vast amounts of records, sometimes millions or even billions. Therefore, when searching for specific information, it's necessary to filter the records and choose which ones to display. This is done by creating a query. A **query** is a request made to the database to retrieve particular data and obtain the information needed. For this lesson, let's continue working with the "Students" table from earlier.

To create a query:

> On the **Create** tab, in the **Queries** group, click **Query Design**. 1

> In the **Add Tables** pane, click the **Students** table, 2 and click **Add Selected Tables**. 3

> Then click the **Close** button to close the pane. 4

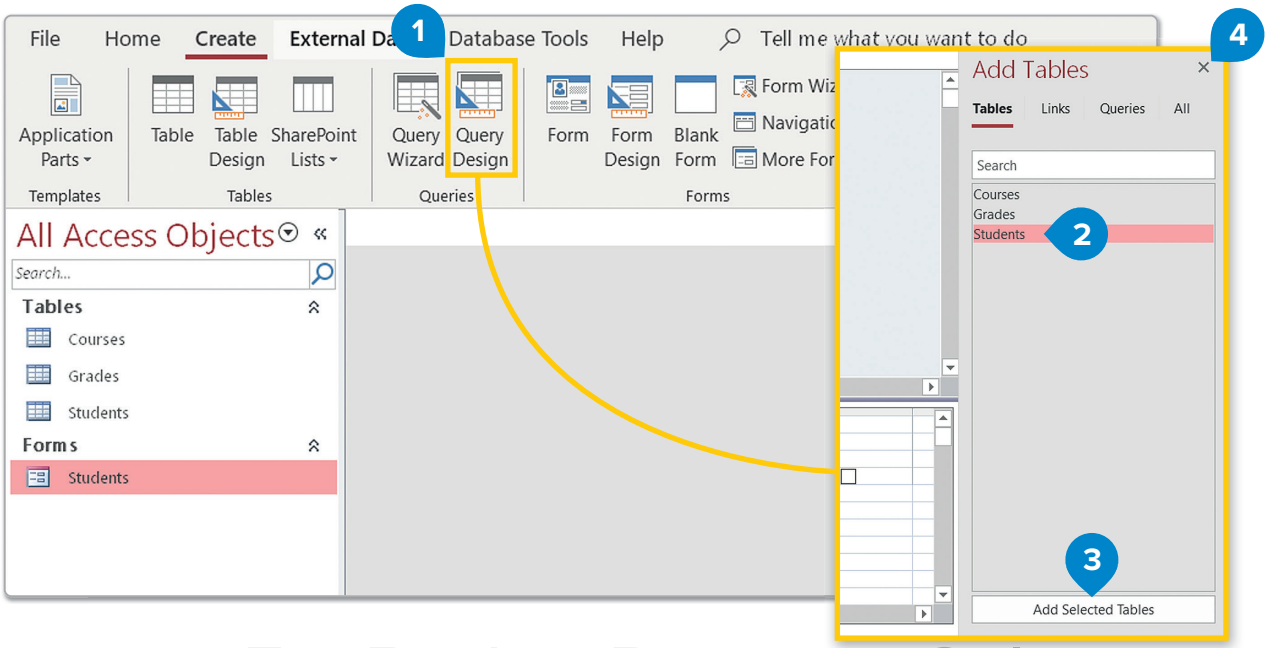
> The **Query Design** tab will be on your screen, along with your table. Double-click the fields of the **Students** table that you want to display **(Name**, **Class No**, **Telephone number**, and **City)**. 5

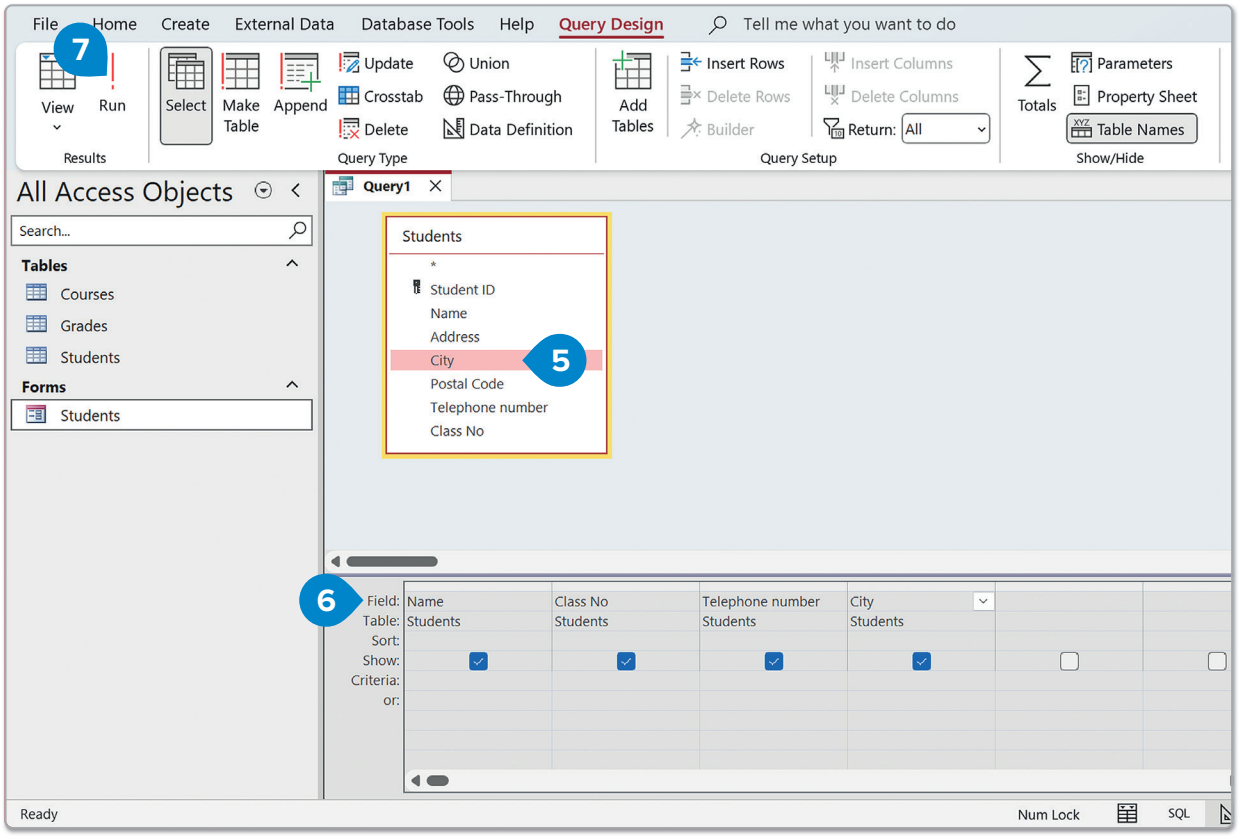
> The fields you selected will be on your screen at the bottom of the window. 6

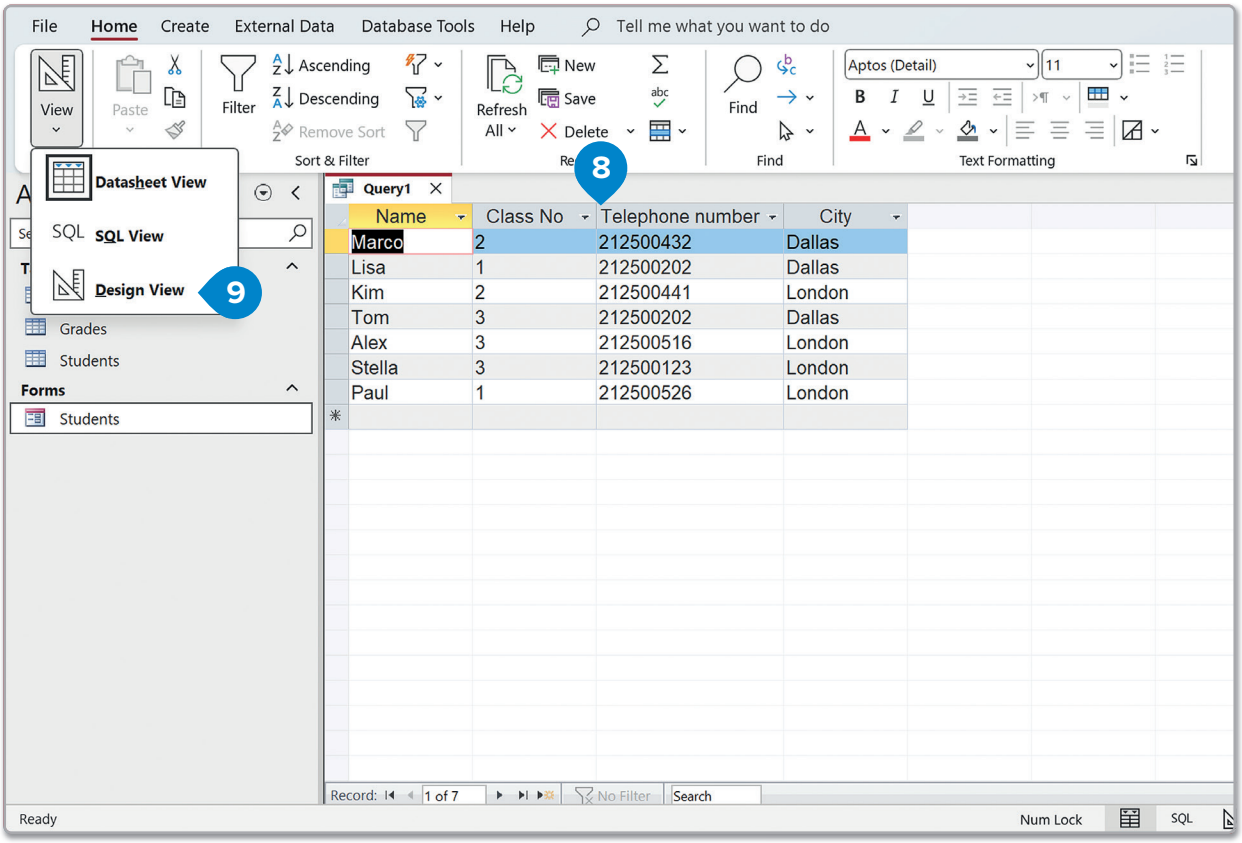
> On the **Query Design** tab, in the **Results** group, click **Run**. 7

> The results of your query will be in **Datasheet View**. 8

> On the **Home** tab, in the **Views** group, click on the drop-down arrow and select **Design View**, 9 to switch back to the **Query Design View**. Here, you can continue to tweak your query in more ways.







Add criteria

Now choose some of your data to display in response to your query. Let's ask your database a question.

To choose some of your data:

> In **Query Design View**, locate the **City** field column and in the **Criteria** row, type "**Dallas**". 1

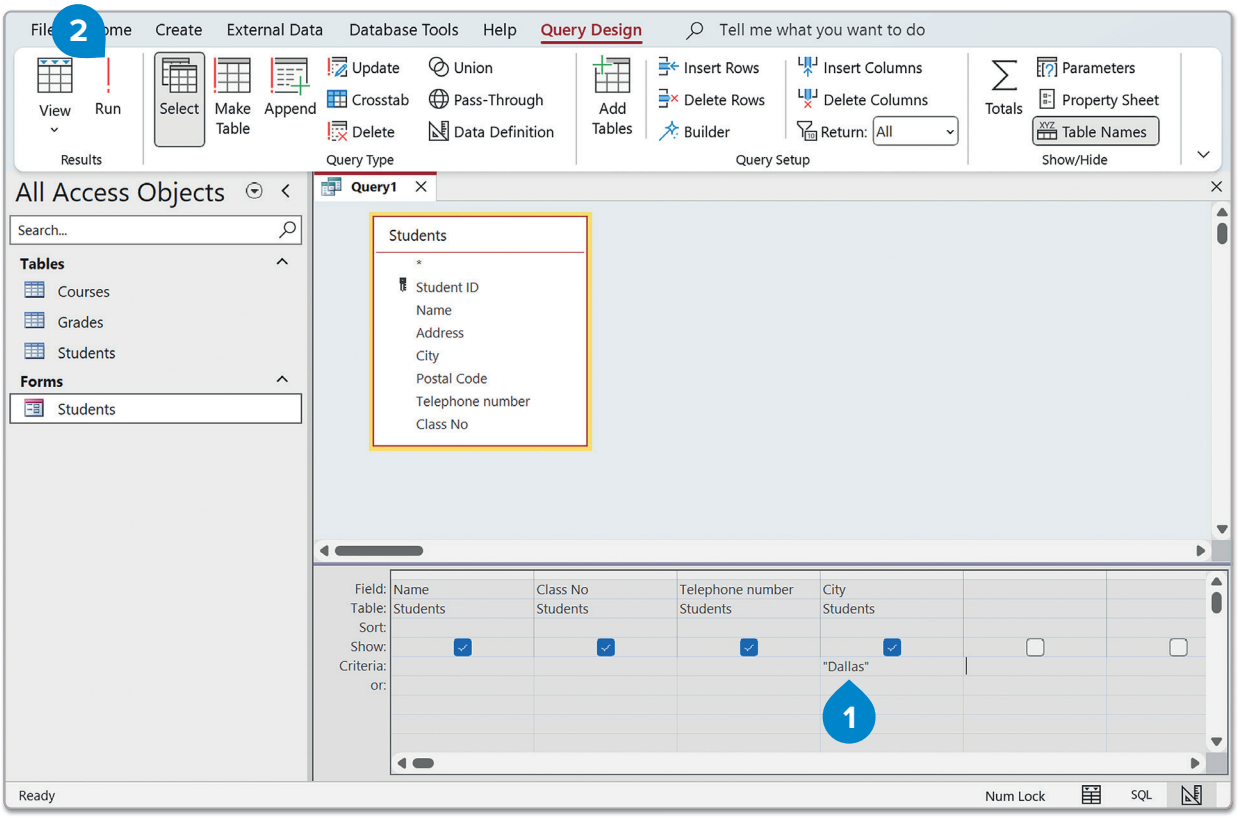
> On the **Query Design** tab, in the **Results** group, click **Run**. 2

> As you can notice from the results, 3 the query that you created ordered your database to select and display only the records which contained the word Dallas in the City field.

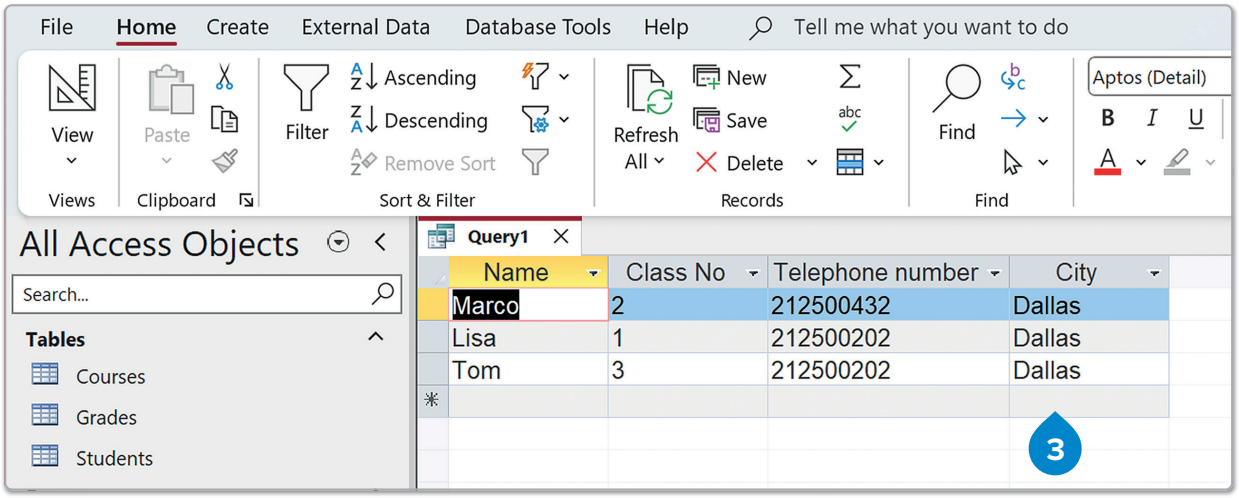
> You can save your query at any point, preferably after you run it and check that it displays the desired results. To save it, right-click the query tab and click **Save**. 4

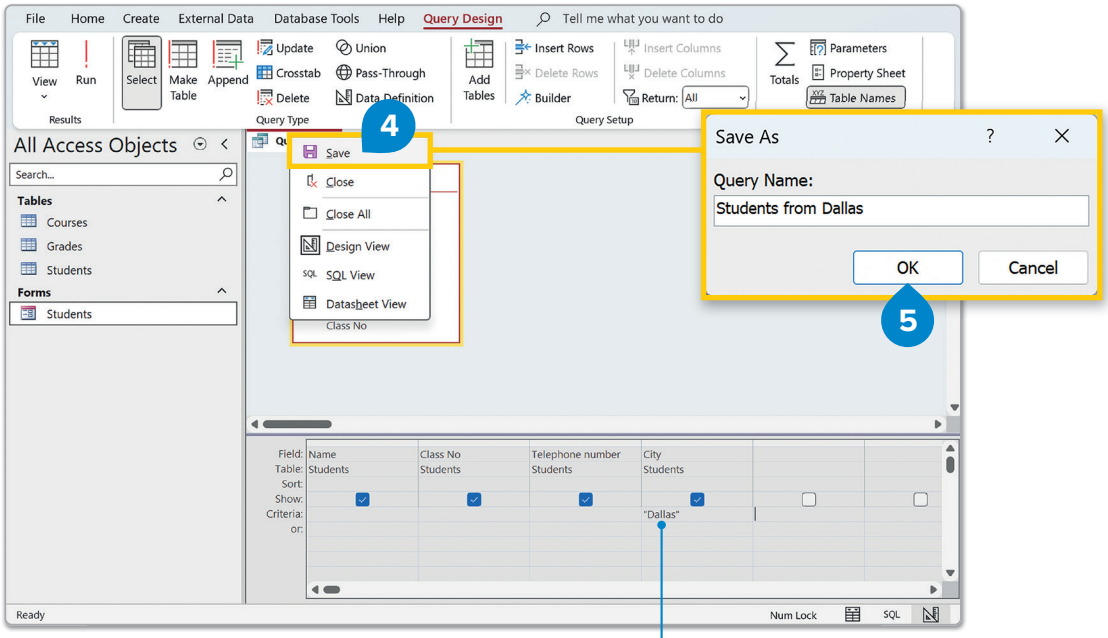
> Type a name, e.g., "**Students from Dallas**", and click **OK**. 5

> Your query is in the **Navigation pane** on the left. 6

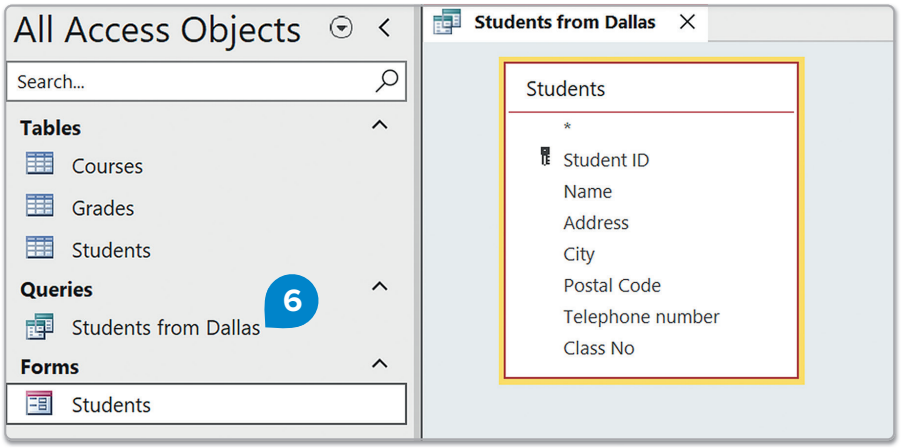


The aim of this activity is to ask the program: "What are the names, classes, and telephone numbers of all students who live in Dallas?"





Note that the quotes here are not necessary, but it's a good practice to wrap any text in the Criteria row in quotes. That way, the program understands that you mean the word "Dallas" and not something else, e.g., a field named Dallas.



Complex criteria

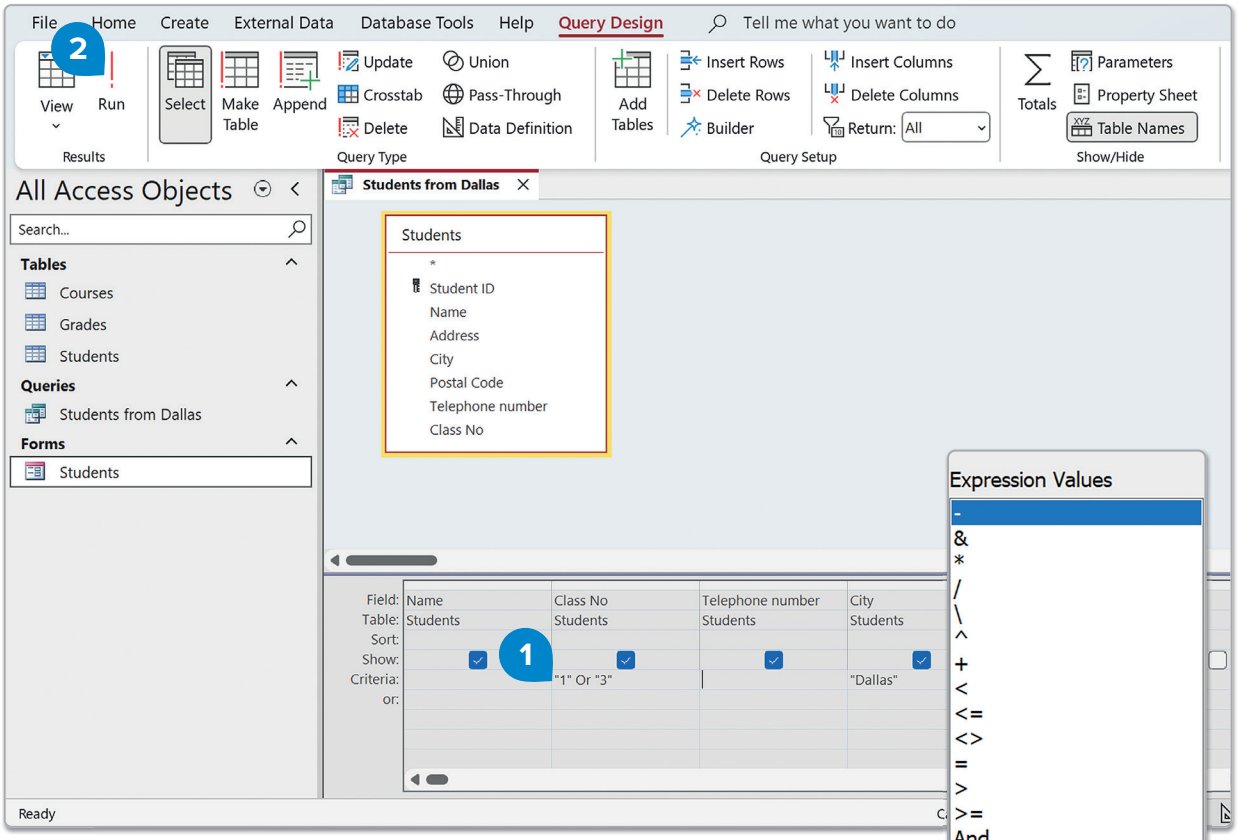
You can narrow down your results even more by applying more **complex criteria** to more than one field.

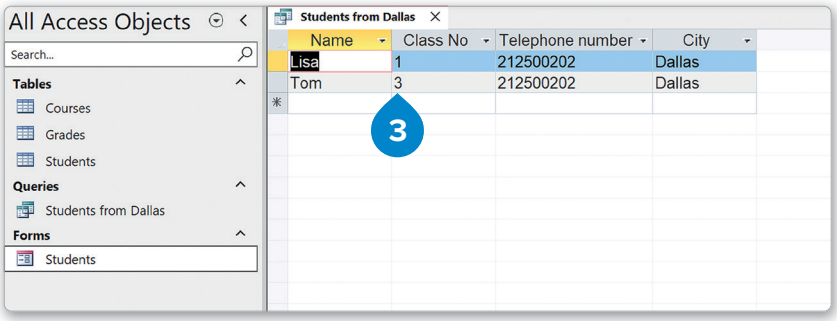
To apply complex criteria:

> In **Query Design View**, locate the **Class No** field column and on the **Criteria** row, type "**1**" **Or** "**3**". 1

> On the **Query Design** tab, in the **Results** group, click **Run**. 2

> Check the results. 3





The question asked here is "What are the names, classes, telephone numbers, and cities of all students who live in Dallas and are in class 1 or 3?"

Operators, such as "**Or**," can be used to refine query **criteria** expressions. By combining them, you can create anything from simple to very **Complex criteria**.

Parameter queries

Let's say you want to create a query that will give you the contact information of a specific student. You can simply type the name of the student in the **Criteria** row of the **Name** field. But what if you had a big database with hundreds of students? It's not practical to create a new query every time you want to search for a different student. In this case, you can use **parameter queries**.

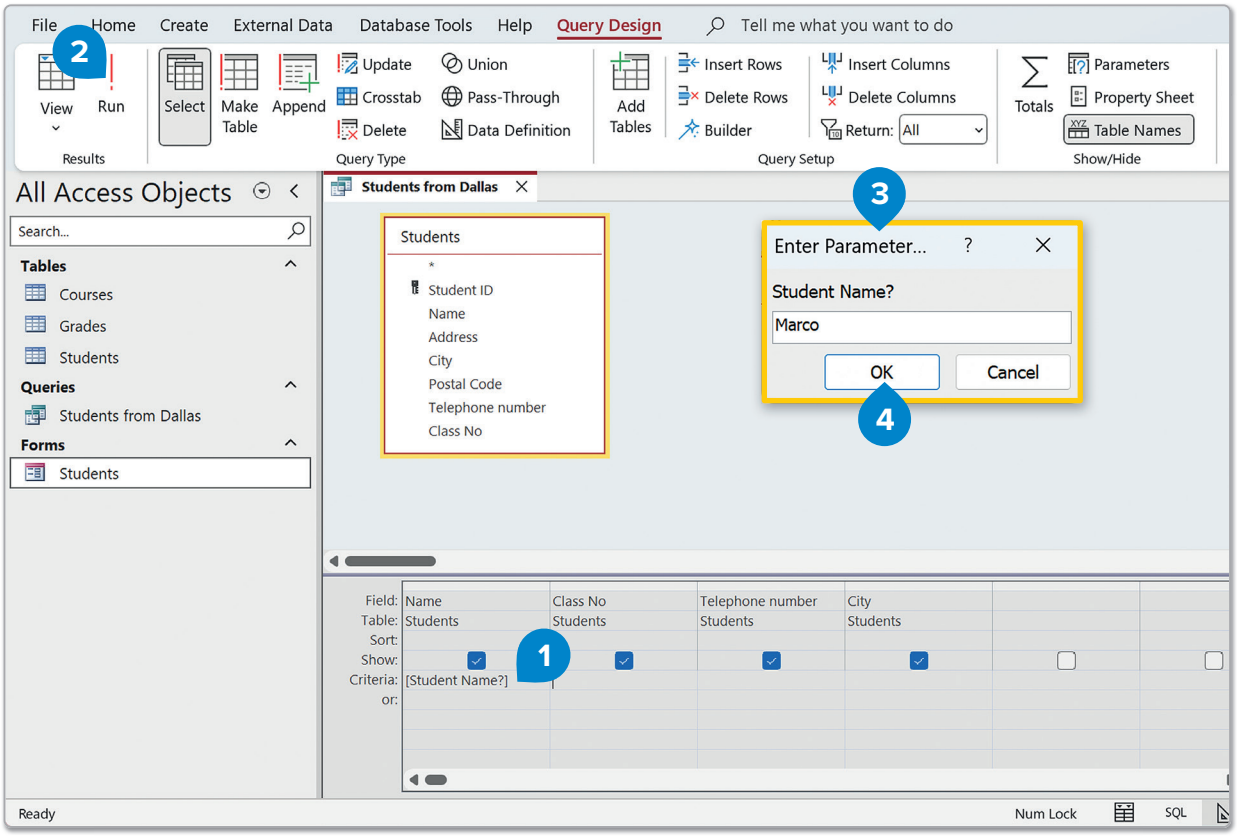
To create a parameter query:

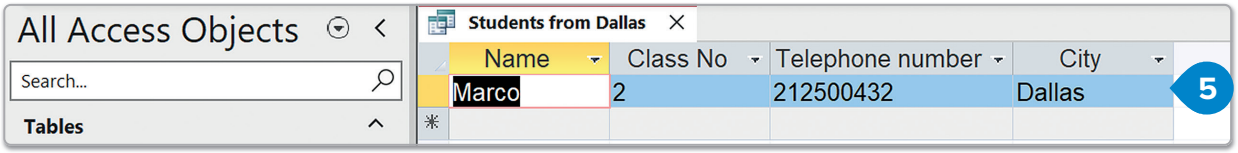
> In **Query Design View**, locate the **Name** field column, and in the **Criteria** row, type "**[Student Name?]**". 1 Clear any other **Criteria**, if any.

> On the **Query Design** tab, in the **Results** group, click **Run**. 2

> There is a message box, displaying your message and asking for a student's name. 3 Type a name, e.g., "**Marco**", and click **OK**. 4

> You can use the same query and type different student names without changing anything or creating a new query. 5



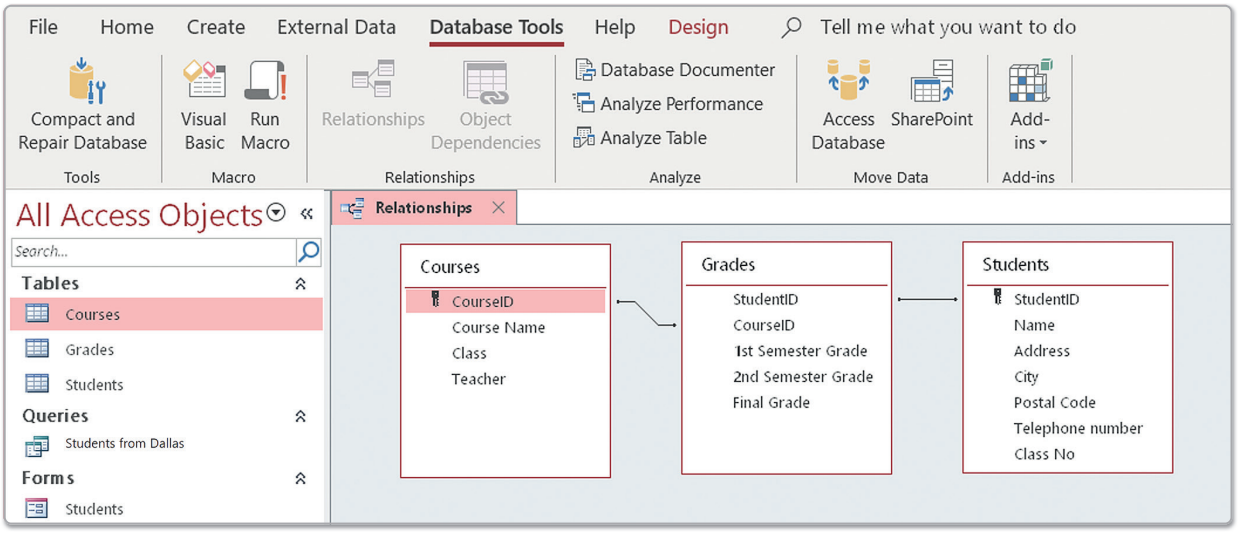


Queries on tables with relationships

So far, creating queries to ask questions about a single table in the database has been covered. However, most databases contain multiple tables that relate to each other in specific ways. It is now time to learn how to create queries for such databases and ask questions about data from multiple tables simultaneously.

In this example, you will use all three related tables from our database: "Courses", "Grades" and "Students."

Based on what you have learned so far, fill in the rest of the tables as the example below.



Grades

StudentID	CourseID	1st Semester Grade	2nd Semester Grade	Final Grade
1	4	85	89	95
1	5	90	92	94
1	6	73	75	80
2	1	79	83	85

Courses

CourseID	Course Name	Class	Teacher	Click to Add
1	Science	1	Mr Smith	
2	Math	1	Mrs Taylor	
3	History	1	Mrs Jones	
4	Science	2	Mr Smith	

If the relationships in your tables need adjustment, you can delete and redefine them as necessary. You can even create relationships between tables only for a specific query.

Students

Student ID	Name	Address	City	Postal Code	Telephone number	Class No
1	Marco	44 Woodrow Way	Dallas	12345	212500432	2
2	Lisa	36 Cambridge Court	Dallas	12346	212500202	1
3	Kim	22 Alfred Drive	London	12347	212500441	2
4	Tom	36 Cambridge Court	Dallas	12346	212500202	3
5	Alex	202 Newport Lane	London	12348	212500516	3
6	Stella	2048 Central Avenue	London	12349	212500123	3

History

IBM started research on relational databases in 1974 and its first product was SQL/DS in 1981. However, Relational Software were the first to release a commercially available Relational Database Management System with their product Oracle in 1979.

Now you have to create a query to find all the courses that a certain student has taken, along with their final grade in each course. Then, you will display the student's name and class, the course name, and the final grade for all the courses that meet the specified criteria.

To create a query on multiple tables:

> On the **Create** tab, in the **Queries** group, click **Query Design**. 1

> In the **Add Tables** pane that opens, select all the tables and click **Add Selected Tables**. 2

> Click the **Close** button at the top of the pane. 3

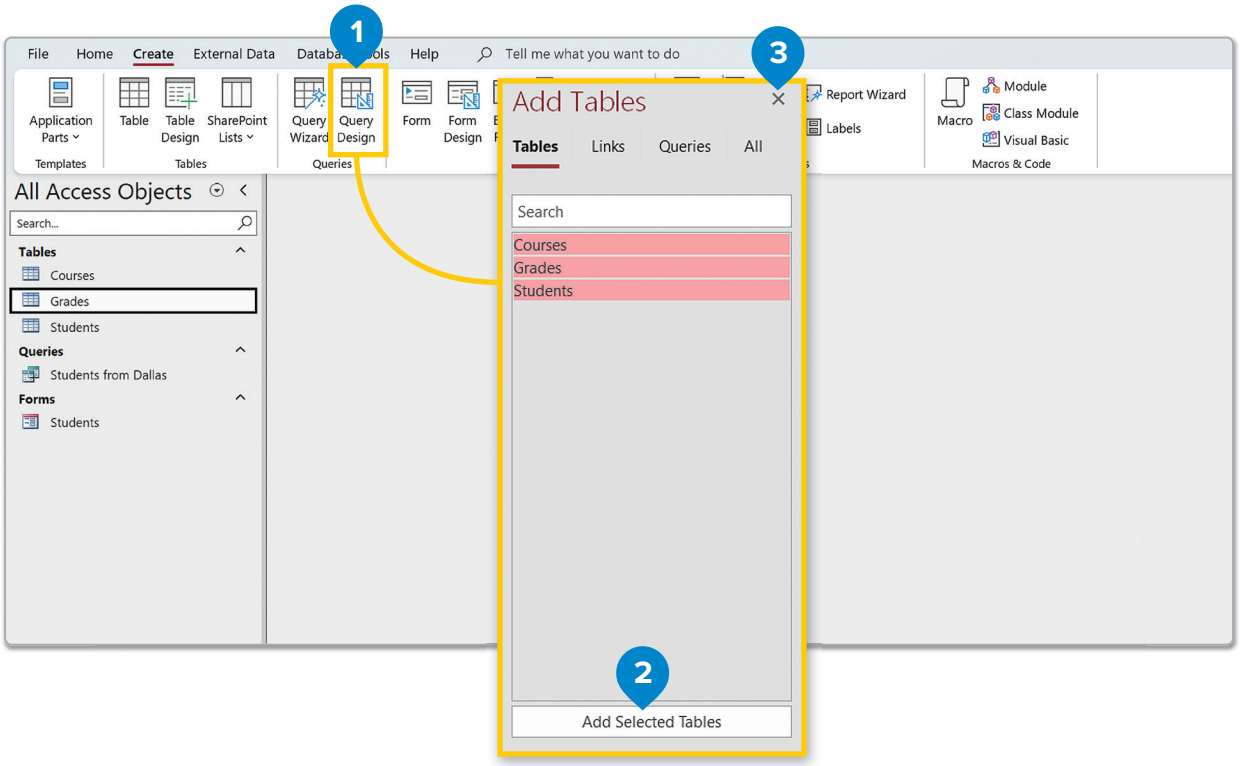
> On the **Query Design** tab, double-click the fields from the tables that you want to display (**Name**, **Class No**, **Course Name**, and **Final Grade**). 4

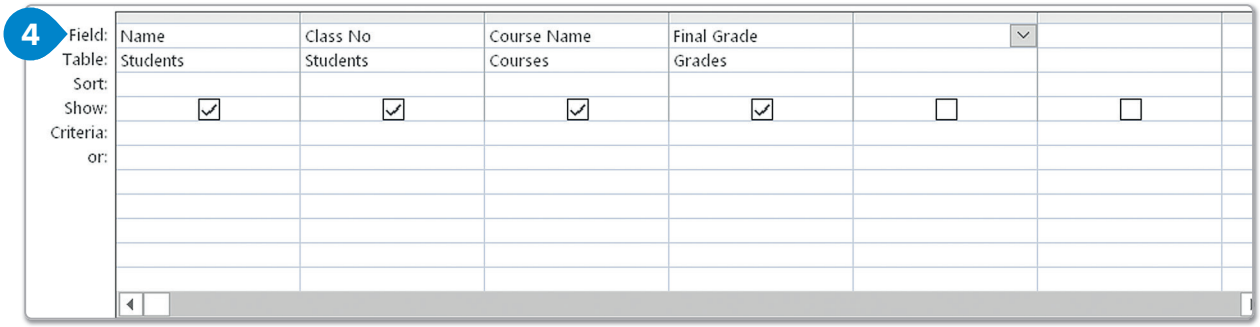
> Now you will add the parameters you want. In the **Name** field **Criteria**, type "**[Student Name?]**". 5

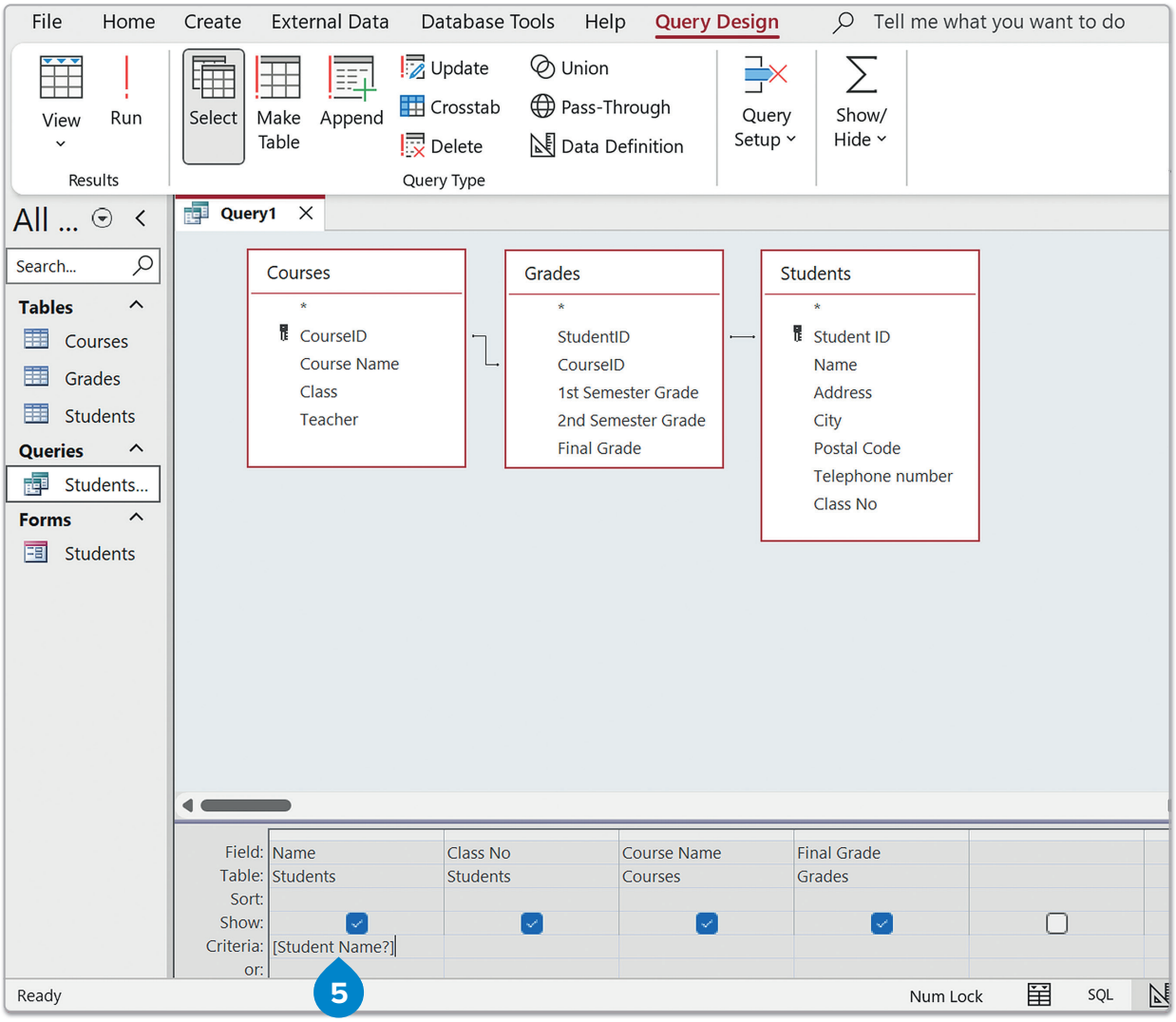
> On the **Query Design** tab, in the **Results** group, click **Run**. 6

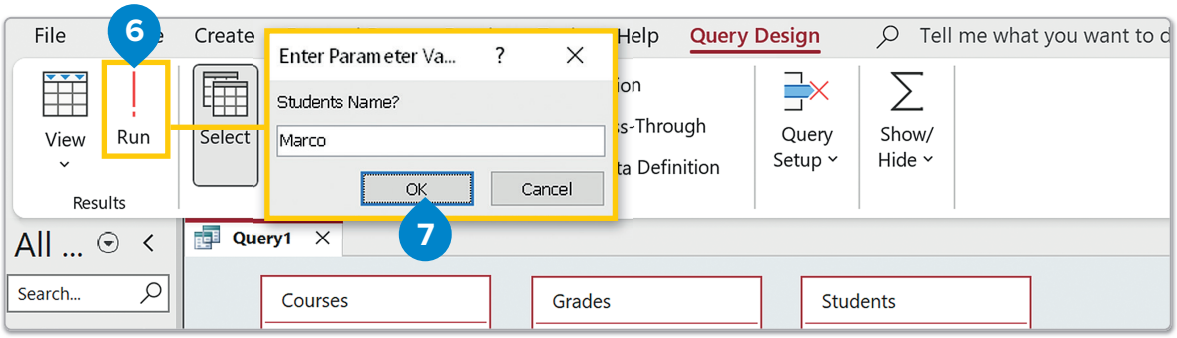
> A message box opens, displaying your message and asking for a student's name! Type a name, e.g., "**Marco**", and click **OK**. 7

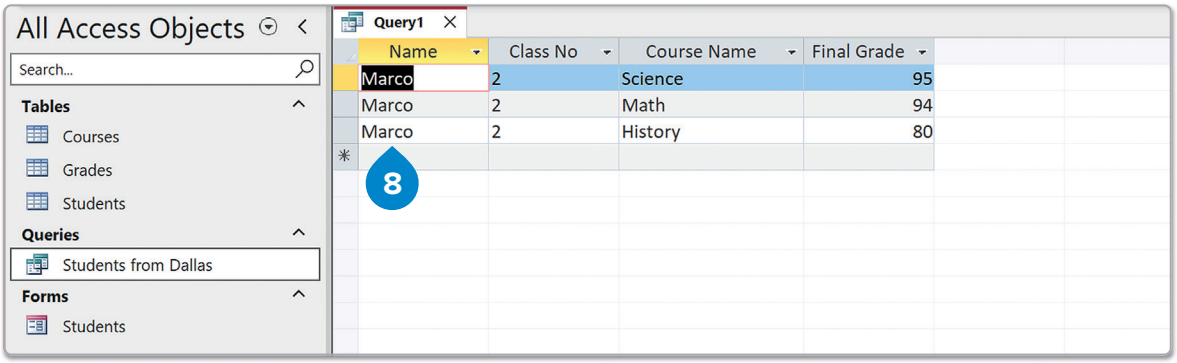
> You now have the query result, containing information on the specific student that you asked for. 8











Sort

You can choose the results of a query sorted in ascending or descending order.

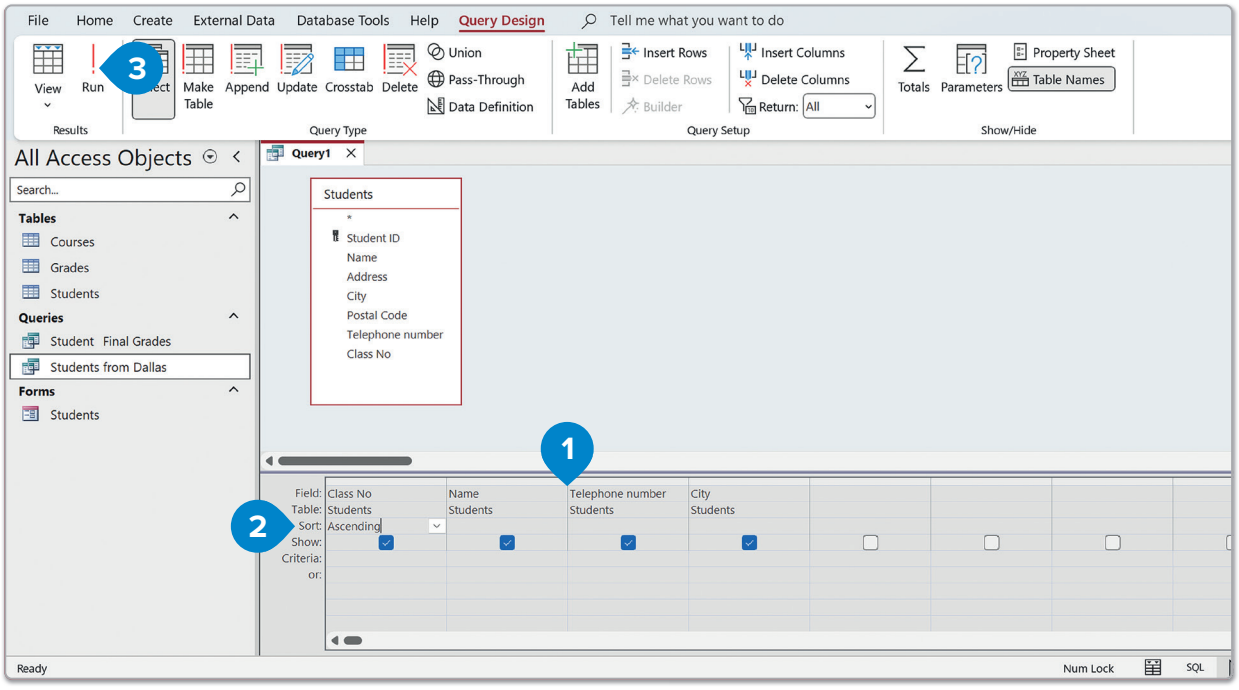
To sort the results of your query by one field:

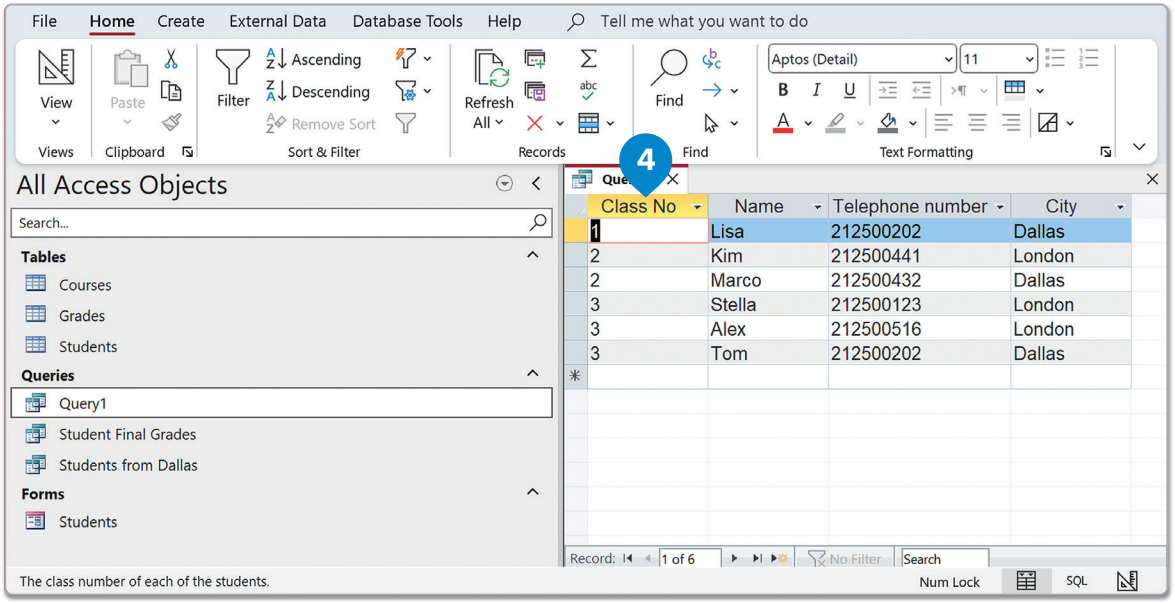
> Create a new query in **Design View** using the **Students** table and the fields: **Class No**, **Name**, **Telephone number**, and **City**. 1

> In **Query Design View**, locate the **Class No** field column and in the **Sort** row, click **Ascending** in the drop-down list. 2

> On the **Query Design** tab, in the **Results** group, click **Run**. 3

> The query records are on your screen starting with the students from class 1 and ending with the students from class 3. 4





Hands on!

1. Read the following sentences and put a check mark for True or False.

	True	False
1. A database table can hold from 0 to billions of records.		
2. With a "Query," you can add new fields to a database.		
3. In a "Query," you can apply criteria to more than one field.		
4. "Complex criteria" allow you to use multiple conditions to filter data.		
5. In the "Criteria" row, you type dates in quotes only.		

2. Complete with the missing word.

1. To start creating a query, you select the _____ option from the "Create" tab.
2. Add tables to your query using the _____ button in the "Add Tables" pane.
3. To focus on certain records in a query, type your condition in the _____ row.
4. To get the query results, click the _____ button.
5. The results of the query will be displayed in "_____ View."

3. **Why is adding criteria in the Criteria row helpful when working with a large table? How does it help you find the data you need?**

4. **Create a query using the "Books" and "Authors" tables to retrieve specific information.**

   1. Open the "LibraryInventory" database you worked on in the previous lesson.

   2. Include the following fields in your query:
      - Author Name (from the Authors table)
      - Title (from the Books table)
      - Genre (from the Books table)
      - Year Published (from the Books table)

   3. Apply complex criteria to your query:
      - Display only books in the Fiction genre AND published in 1943.

   4. Create a parameter query based on the "Books" table to ask the user to input a specific genre.
      - Use the parameter [Enter Genre:?] in the Genre field of the Criteria row.

   5. Sort the results of the query in ascending order by Title.

   6. Run the query, observe the results, and close the database.

LESSON 4

Reports

Why might presenting data in a report be more effective than displaying it directly from a table? How can grouping and sorting data in a report make the information clearer to understand?

Data can be entered, modified, and categorized with a database program, but to present this information in an easy-to-read format for others or for personal use, a report must be created. A database **report** illustrates information from a table or query in an attractive, preformatted manner.

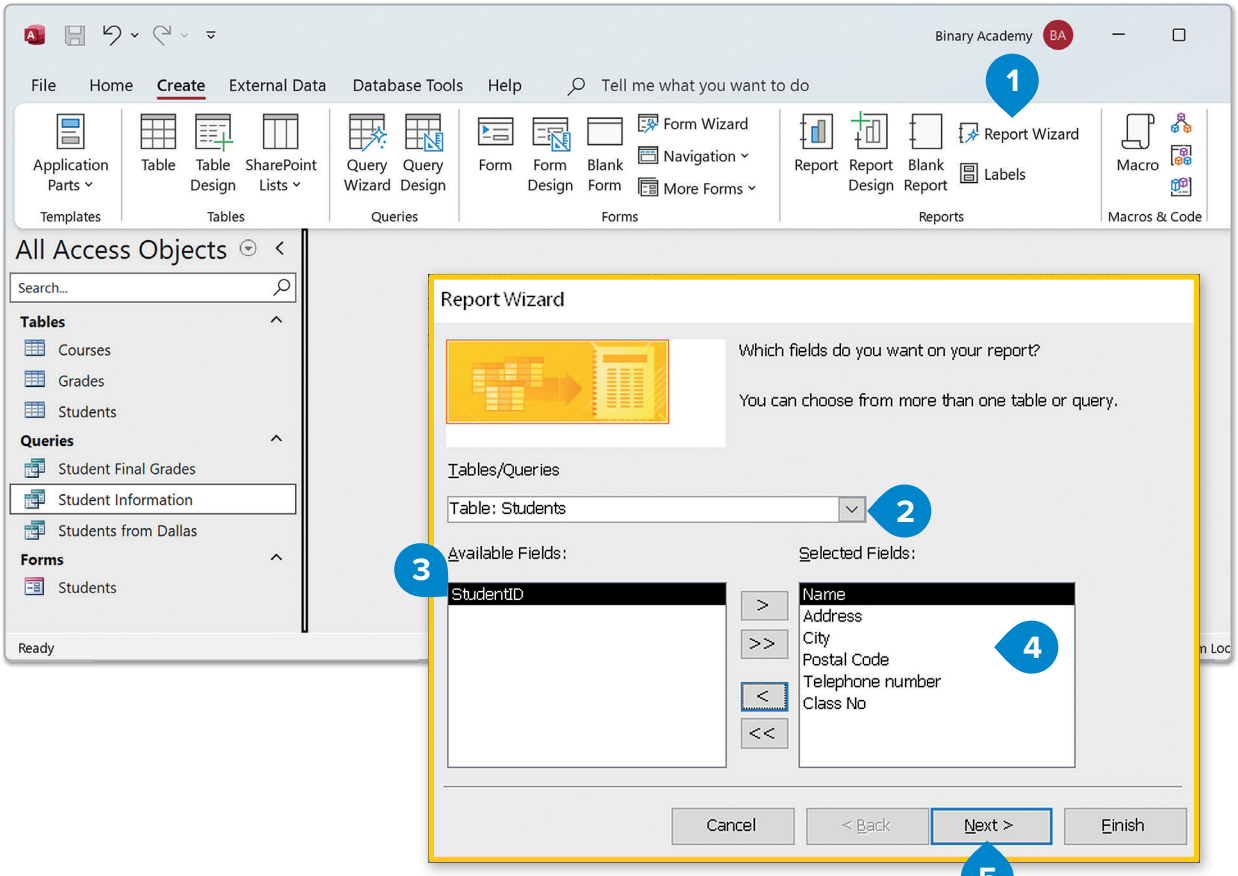
To create a report:

> On the **Create** tab, in the **Reports** group, click **Report Wizard**. 1

> When the **Report Wizard** window opens, in the **Tables/Queries** drop-down list, click **Table: Students**. 2

> Move all the fields except **StudentID**, 3 from the **Available fields** to the **Selected Fields**. 4

> Click **Next**. 5

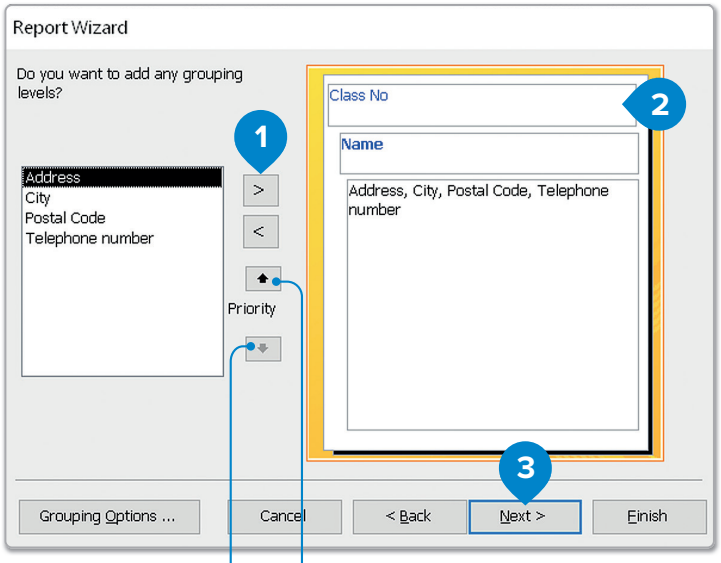


Group the data

In the next step, you can create **groups** and **subgroups** of your data.

To add grouping:

> Move all the fields which you want to create groups from to the right. 1
> Note that the order in which you move them matters: the top field has priority over the ones that follow. 2
> Click **Next**. 3



Grouping allows you to concentrate all related data, e.g., all the data for one person. This way, on one page are all the data for a specific person.

These arrows change the priority of the group.

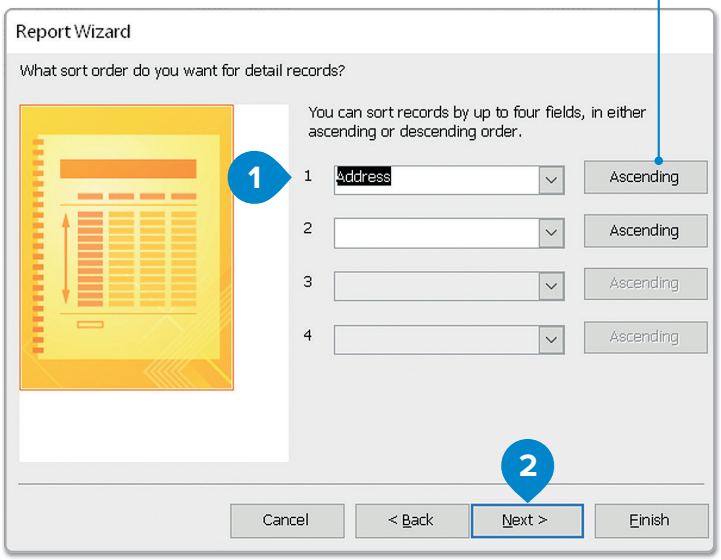
Sort the data

In the next step, you can add more fields to **sort** and define their **sort order**.

You can change the sort order from **Ascending** to **Descending** by clicking the button next to the list. You can add up to four fields.

To add sorting:

> Click a field from the first drop-down list, e.g., **Address**. 1
> Click **Next**. 2

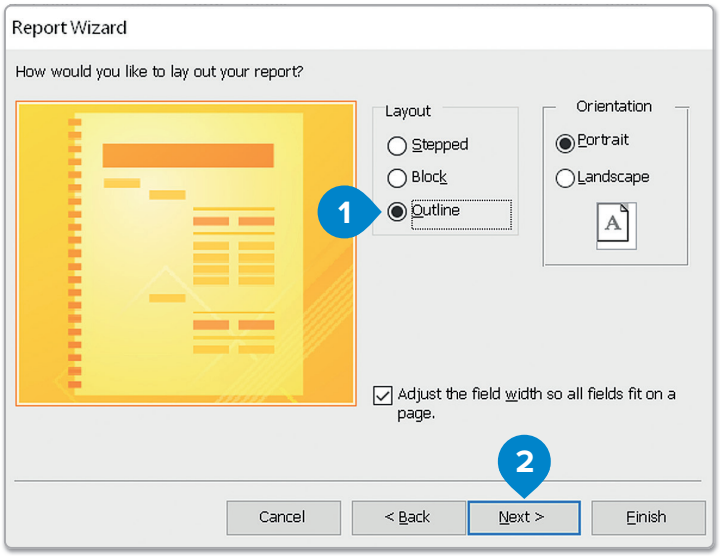


Set the layout

In the next step, you can select how your report will appear on the screen.

To set the layout:

> Under **Layout**, click **Outline**. 1
> You can experiment with the other layouts later if you want.
> Click **Next**. 2

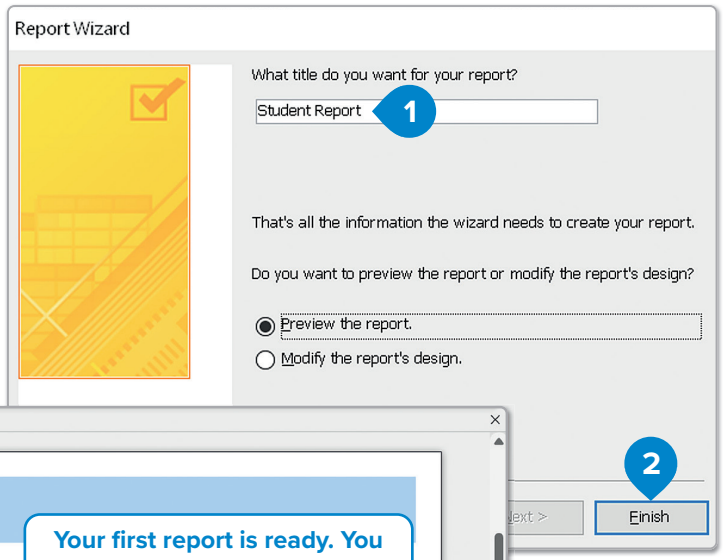


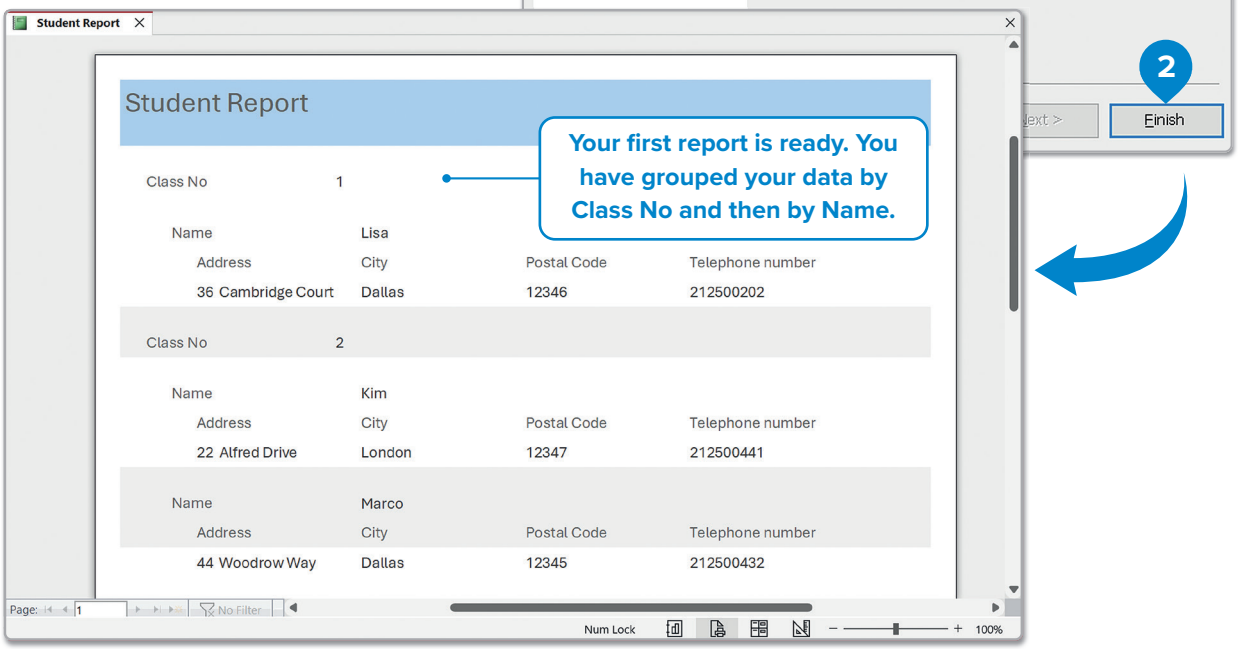
Name the report

In the final step, you can **name** your report.

To give your report a name:

> Type a name for your report in the text box, e.g., "**Student Report**". 1
> Click **Finish**. 2





To edit a report:

> Right-click the **Student Report** in the **Navigation** pane. 1

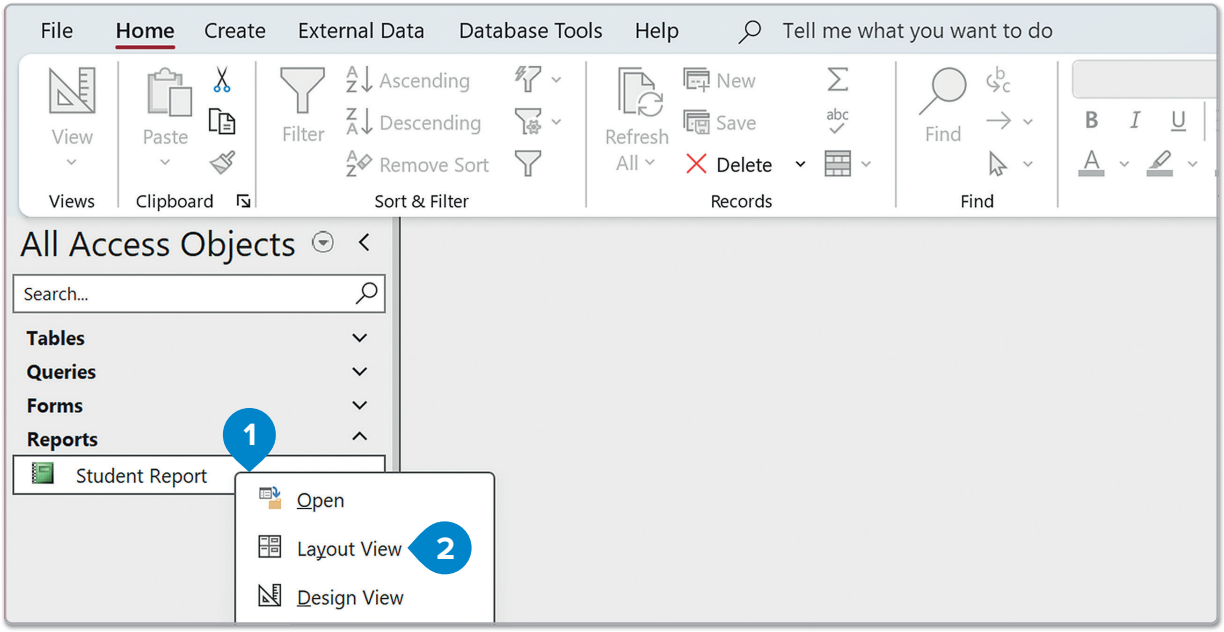
> Click **Layout View**. 2

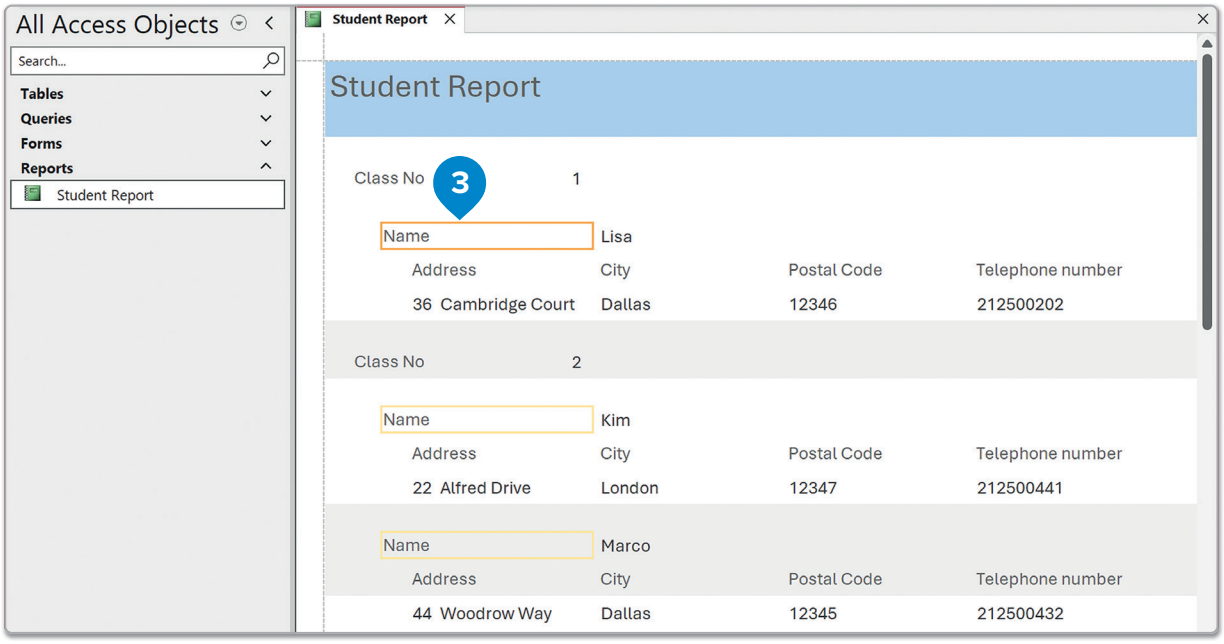
> In this window, your data is presented as it is displayed when you open the report. You can delete anything unnecessary.

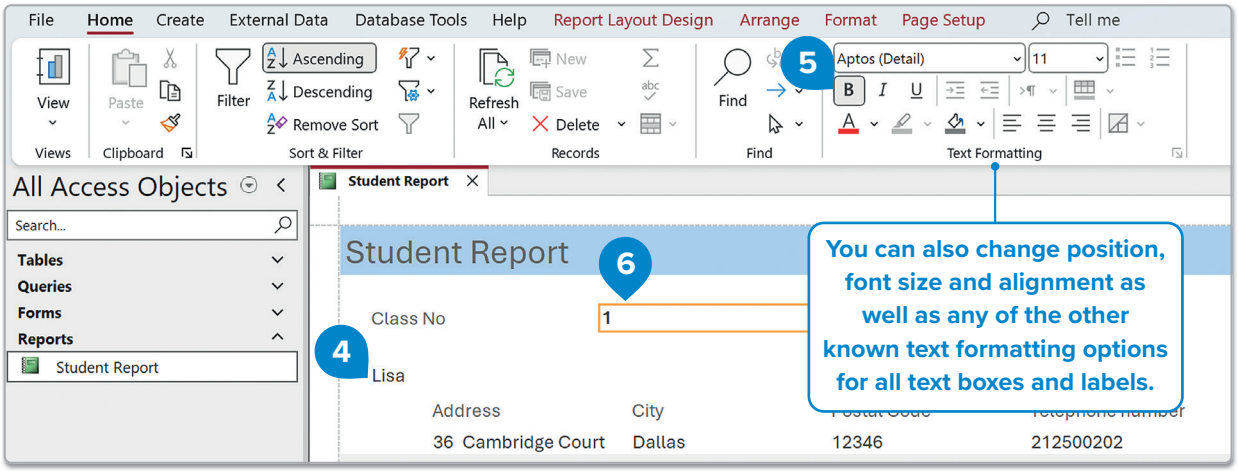
> For example, delete the **Name label**, 3 and change the position of the **Name text box**. 4

> Click the text boxes that are more important, e.g., the **Class No text box**, and on the **Home** tab, in the **Text Formatting** group, make them bold using the **Bold** button. 5

> Your report is now ready. 6







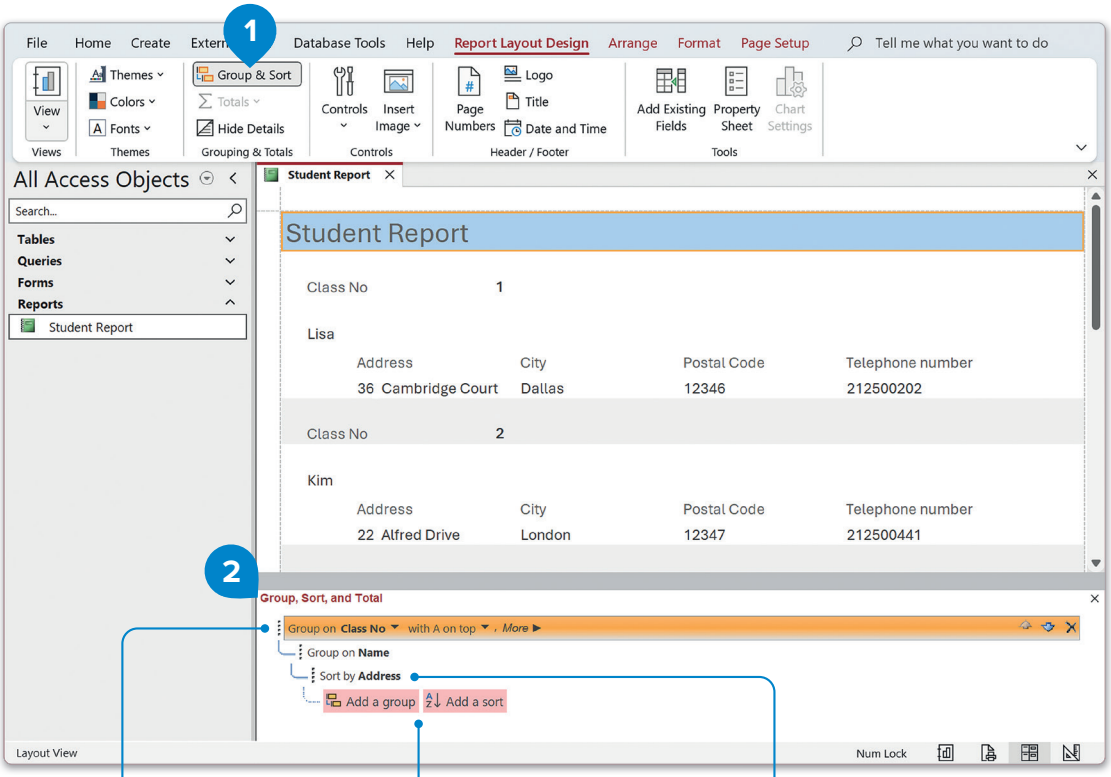
Grouping and sorting

You may want more control of the grouping and sorting options for your report than the **Report Wizard** can provide.

To change the grouping and sorting options:

> On the **Report Layout Design** tab, in the **Grouping & Totals** group, click **Group & Sort**. 1

> You can find the **Group**, **Sort**, **and Total** pane at the bottom of the screen. 2



Here, you can delete or rearrange the order of your groups and sorts.

You can also add a group or add a sort.

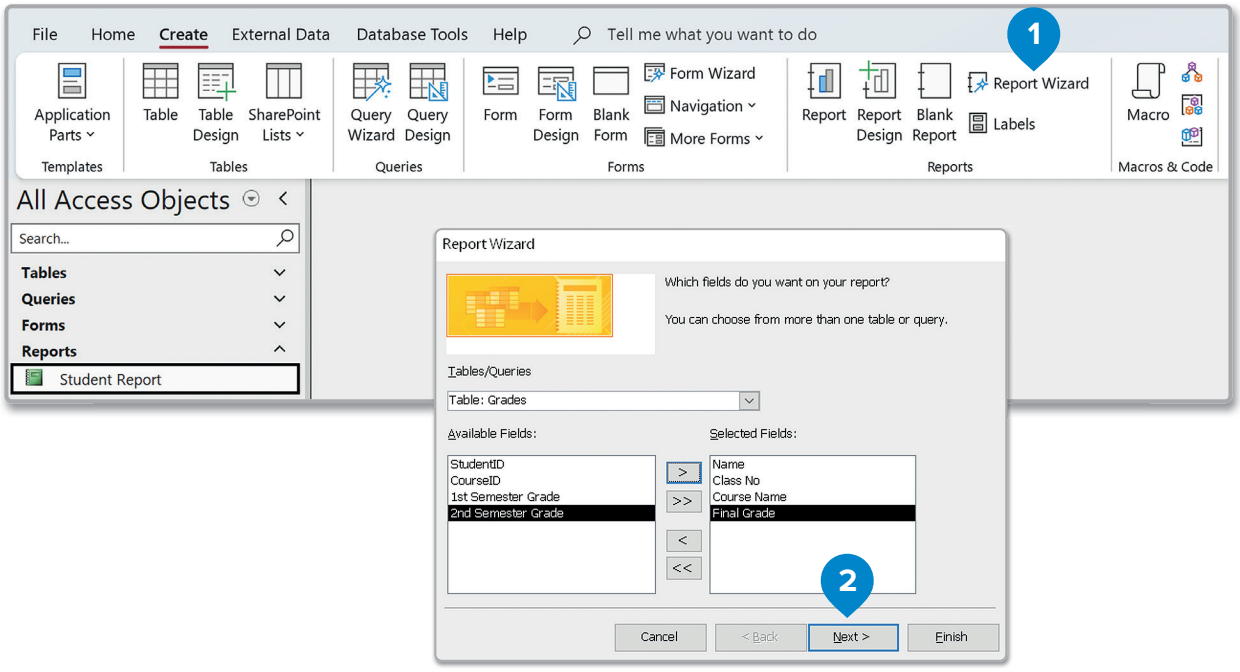
Here, you can edit the sorting order of your groups and sorts.

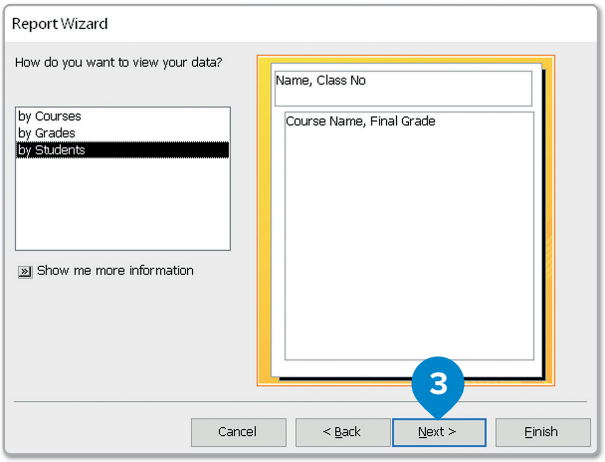
Totals

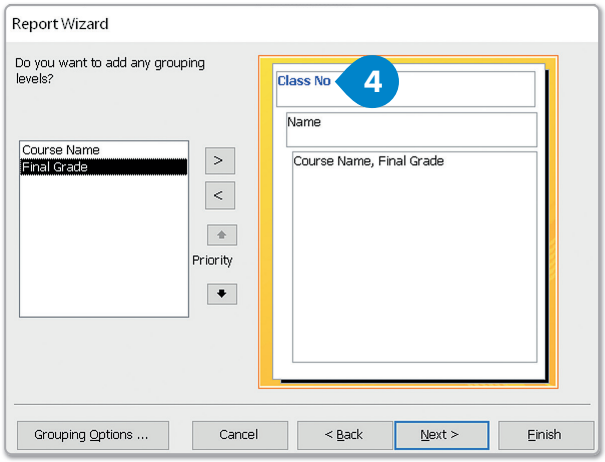
Sometimes in your reports, it is useful to include **calculations** in your data that are calculated every time someone views the report. Let's explore how you can calculate and display the average final grade of each student in a report.

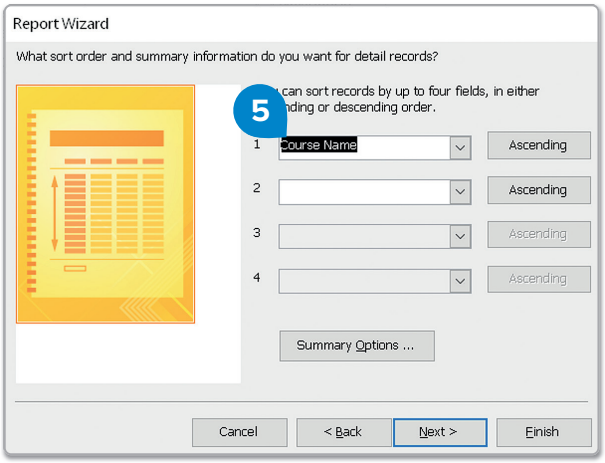
To create a report with totals:

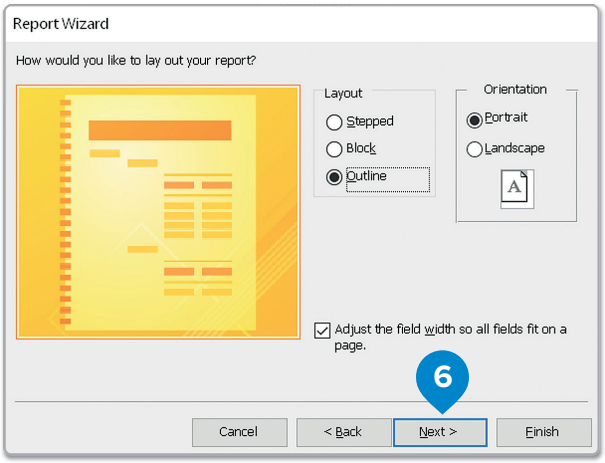
> On the **Create** tab, in the **Reports** group, click **Report Wizard**. 1
> In the **Report Wizard** window, in the **Tables/Queries** list, select **Name**, **Class No**, **Course Name**, and **Final Grade** from the relevant tables and click **Next**. 2
> In the next step, click **by Students** and click **Next**. 3
> In the next steps, group by **Class No**, 4 and sort by **Course Name**. 5
> Under **Layout**, click **Outline** and then click **Next**. 6
> Finally, name your report, e.g., "**Student Final Grades**" and click **Finish**. 7
> As a result, you have a report with the final grades of all students in all their courses. 8

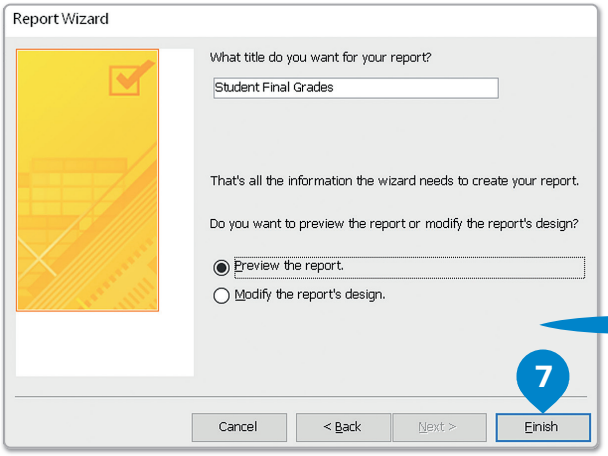


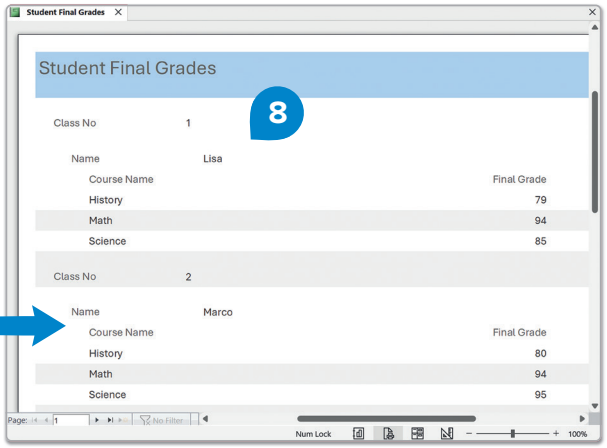






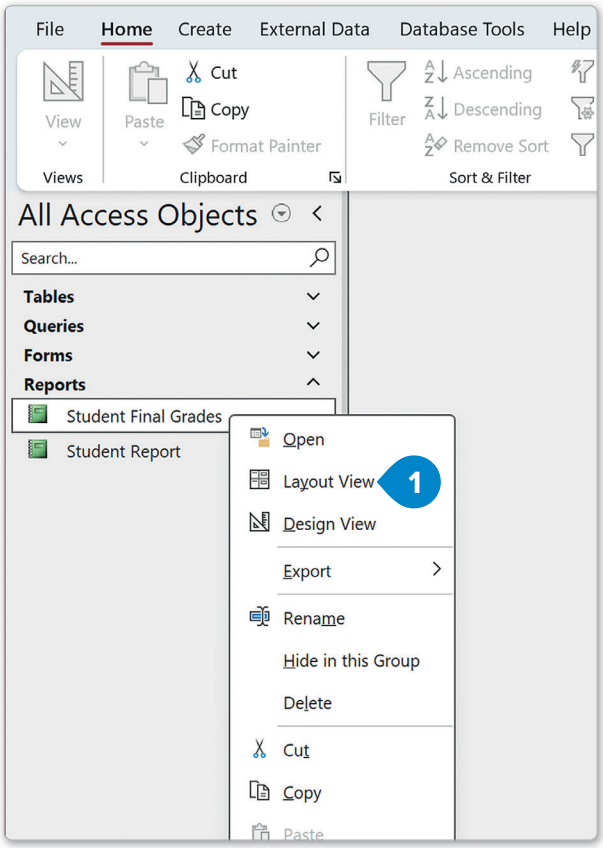


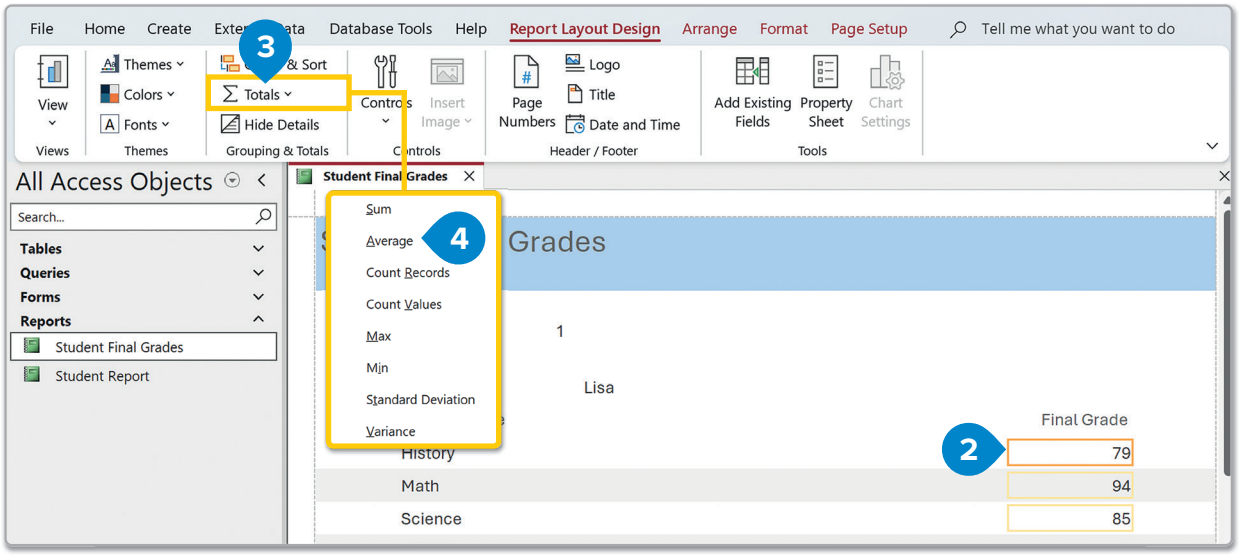


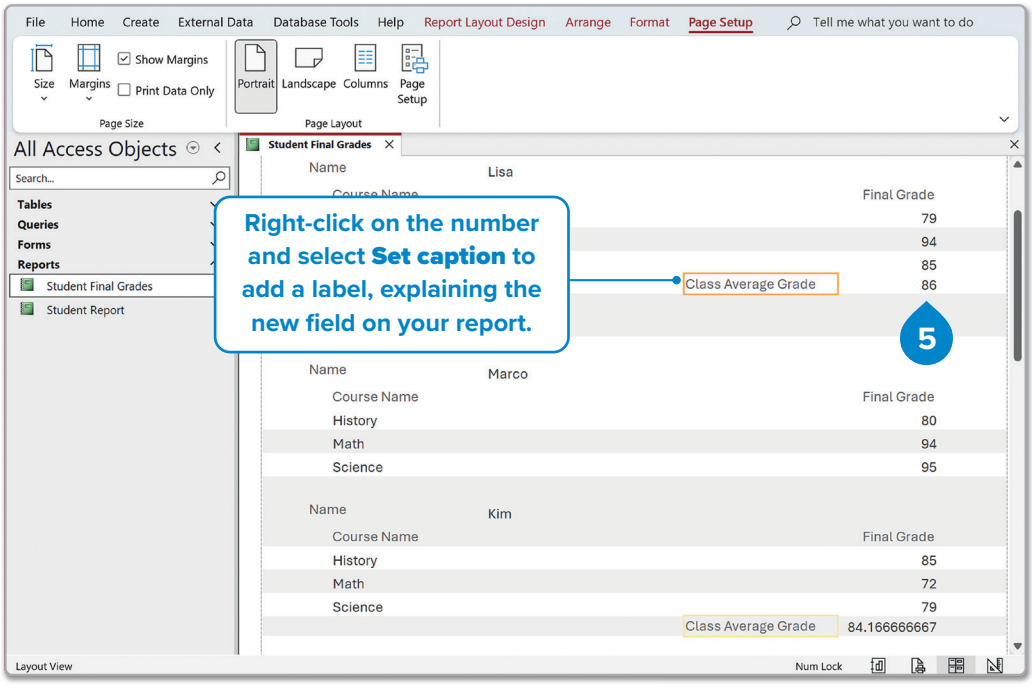


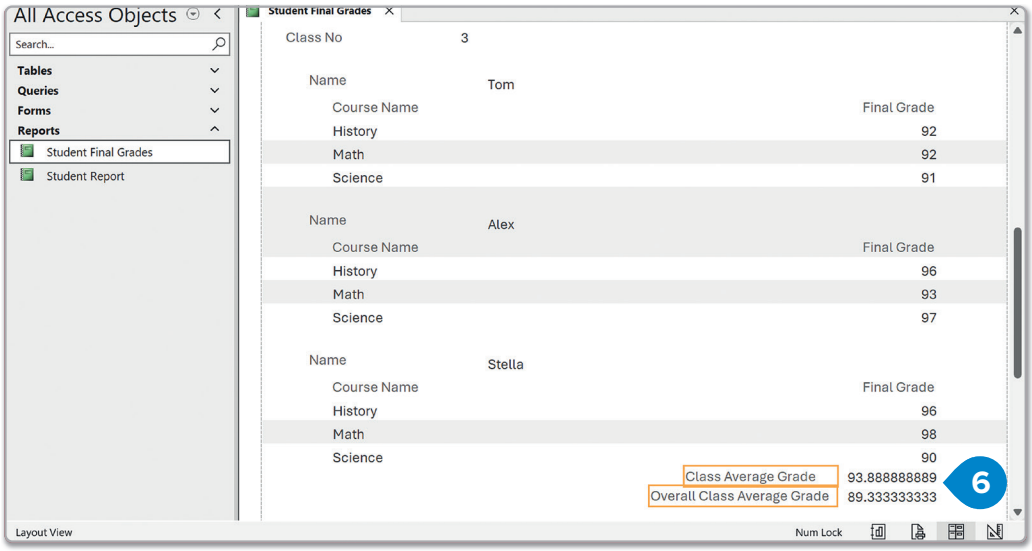
To add totals:

- > Open the **Student Final Grades** report in **Layout View**. 1
- > Click a **Final Grade** box. 2
- > On the **Report Layout Design** tab, in the **Grouping & Totals** group, click **Totals**, 3 and then click **Average**. 4
- > You can find a new text box, containing the average grade from each class group. 5
- > Finally, an average for all students of all classes is presented at the end of the report. 6









Hands on!

1. Read the following sentences and put a check mark for True or False

	True	False
1. A report is used to present information in a clear and readable format.		
2. In a report, you can change the position of the field names, the title, and the record fields.		
3. You cannot change the sorting order in a report.		
4. In a report, you can add a group, sort data, and rearrange the order of groups and sorts.		
5. If you apply totals to a report with one group, three types of text boxes will be displayed.		

2. Complete with the missing word.

1. To start creating a report, you select the _____ option from the "Create" tab.
2. Adding _____ in reports helps organize data by categories, such as Class No or City.
3. To edit the design of a report after it is created, use the _____ option.
4. To calculate and display the average grade of students in a report, use the _____ option.
5. After designing and naming your report, click the _____ button to save and view it.

3. **Why is it important to group information in a report and include calculations like averages or sums? How do these features make the report clearer to understand and more useful?**

4. **Create a report using the "Books" and "Authors" tables to display grouped information.**

    1. Open the "LibraryInventory" database you worked on in the previous lesson.

    2. Include the following fields in your report:

        - Author Name (from the Authors table)
        - Title (from the Books table)
        - Genre (from the Books table)

    3. Ensure the report groups the data by Genre.

    4. Sort the data in the report by Title in ascending order.

    5. Name the report "BooksReport."

    6. Customize the layout of the report:

        - Use Bold text for Genre and Author Name.
        - Display a summary at the end of the report that counts the total number of books.

    7. Change to Report View, to verify the output, and close the report.

    8. Close the database.

LESSON 5

Import and export data

Why is it useful to be able to export data from a database to a program like Microsoft Excel? When might importing data into a database save time compared to entering it manually?

Importing and **exporting** data are important features for any software, especially databases. These functions allow data to be transferred between different programs for further use. For example, you can export data from a database to a spreadsheet for analysis, or take an old database stored in a spreadsheet and move it into a more powerful database program to simplify updates and maintenance.

To export data to Microsoft Excel:

> In the **Navigation** pane, click the object you want to export data from, e.g., the **Students** table. 1 You can export data from any table, query, form, and report objects.

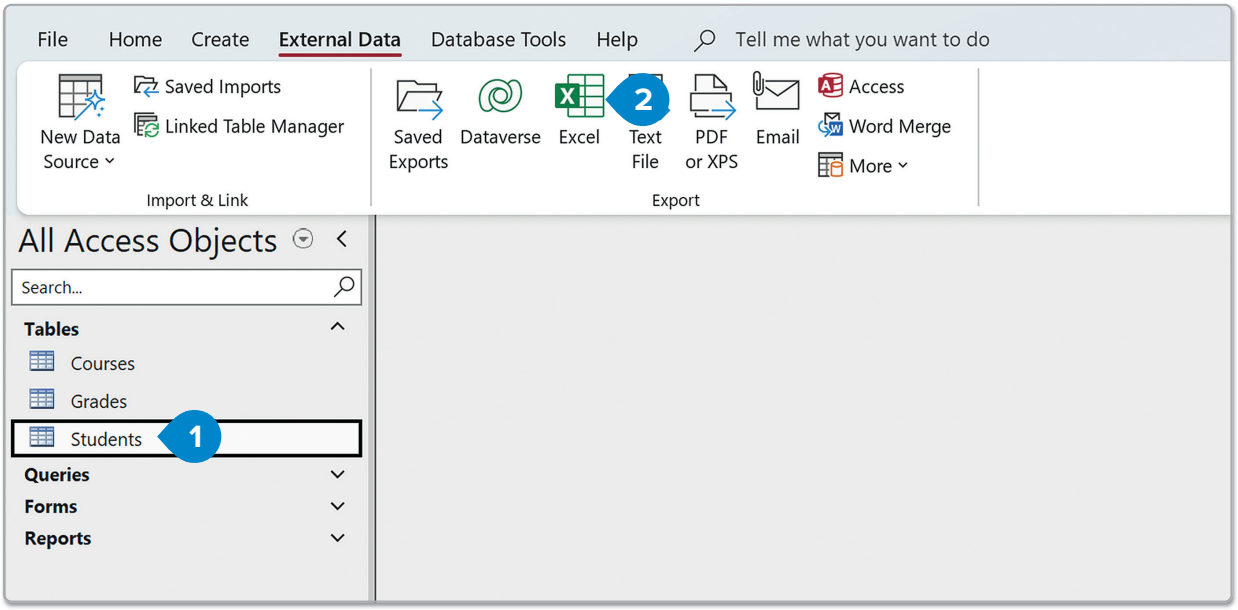
> On the **External Data** tab, in the **Export** group, click **Excel**. 2

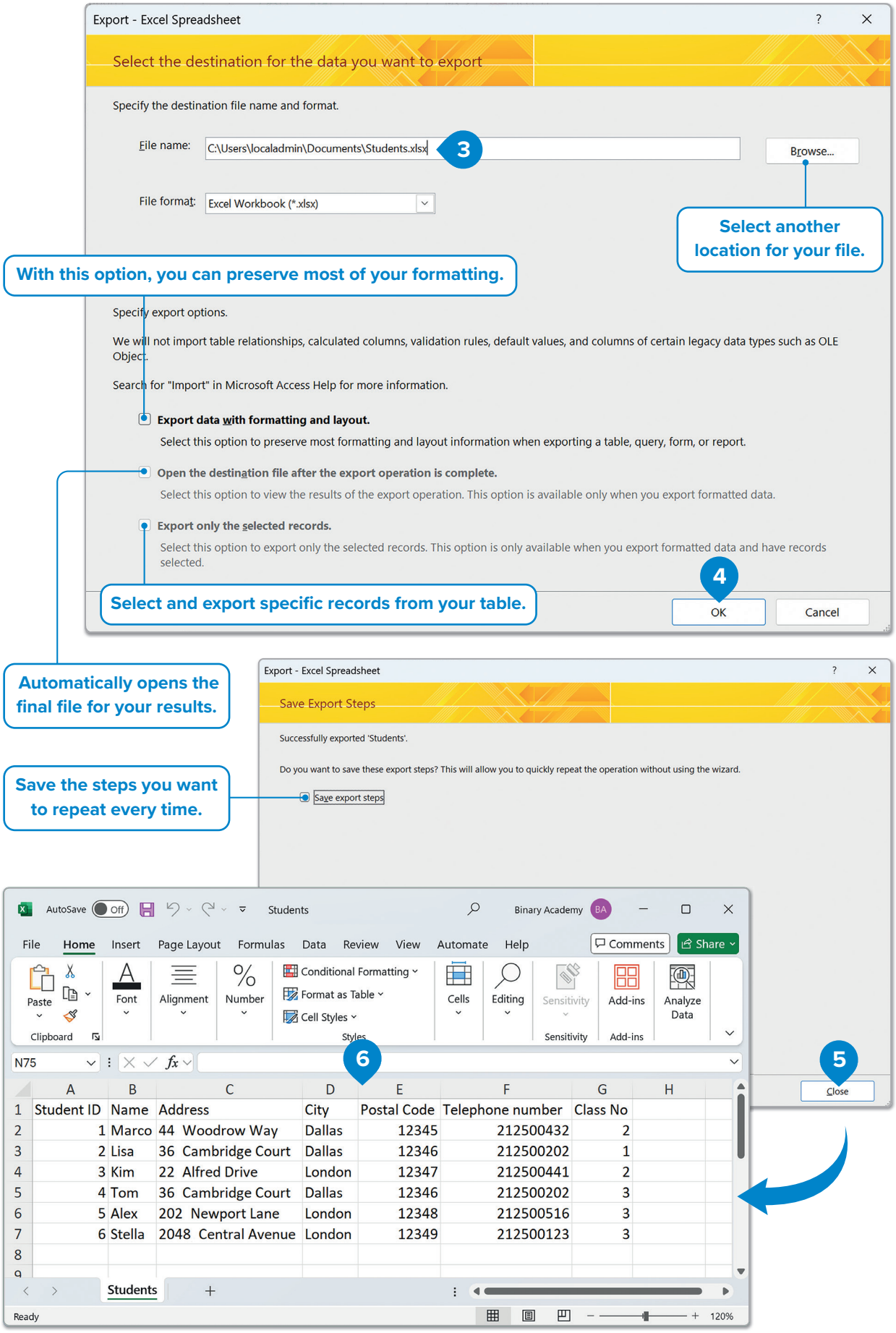
> In the **Export - Excel Spreadsheet** window, specify the destination file name and format for your **Microsoft Excel** file, e.g., "**Students.xlsx**". 3

> Click **OK**. 4

> Click **Close** on the next window. 5

> Your data has been exported to **Microsoft Excel**. 6





To export data to a text file using Comma Separated Values (CSV):

> In the **Navigation** pane, click an object which you want to extract data from, e.g., the **Students** table. 1

> On the **External Data** tab, in the **Export** group, click **Text File**. 2

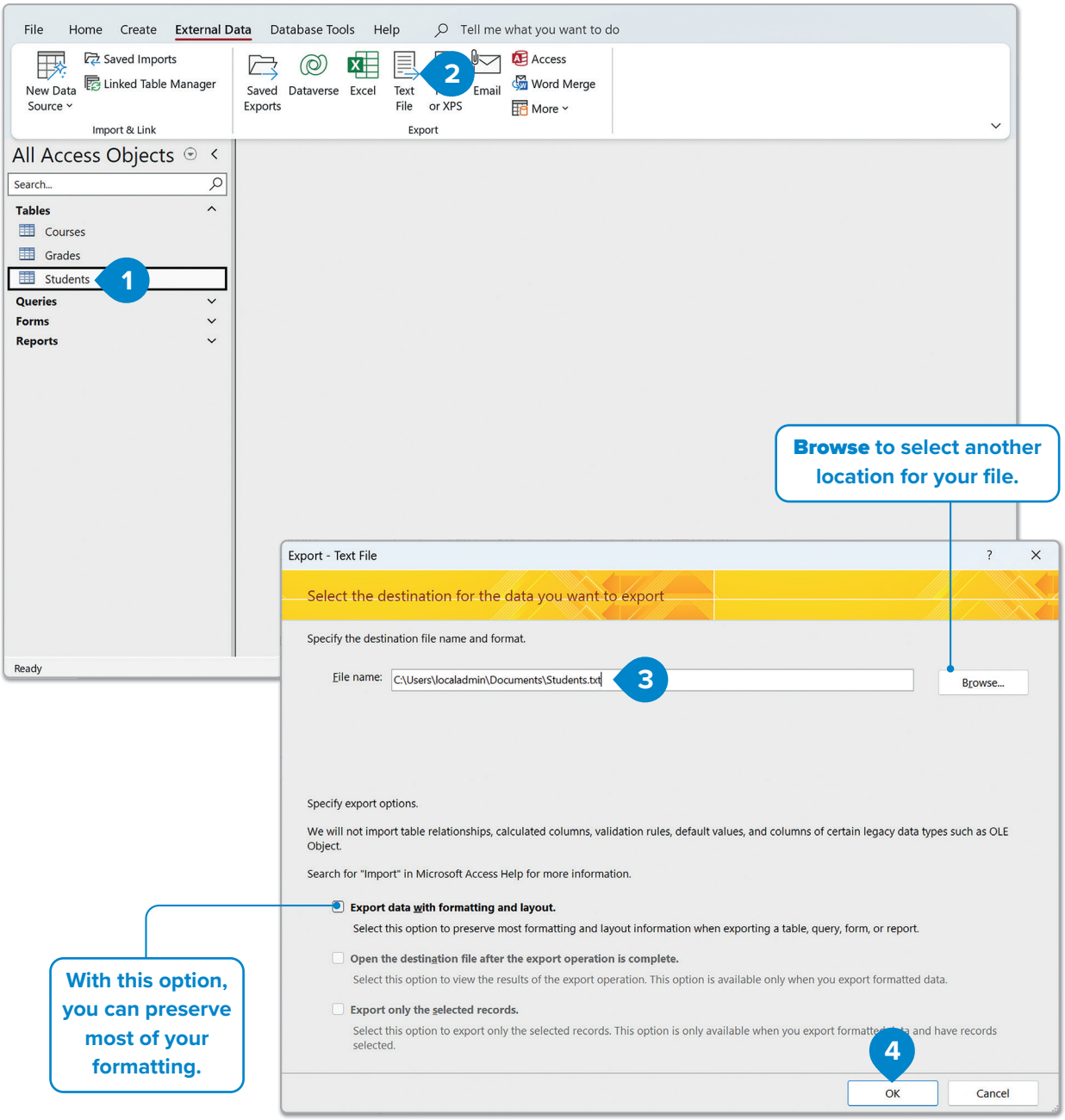
> In the **Export - Text File** window, type a file name for your text file, e.g., "**Students.txt**," 3 and click **OK**. 4

> In the next window, leave **Delimited** selected and click **Next**. 5

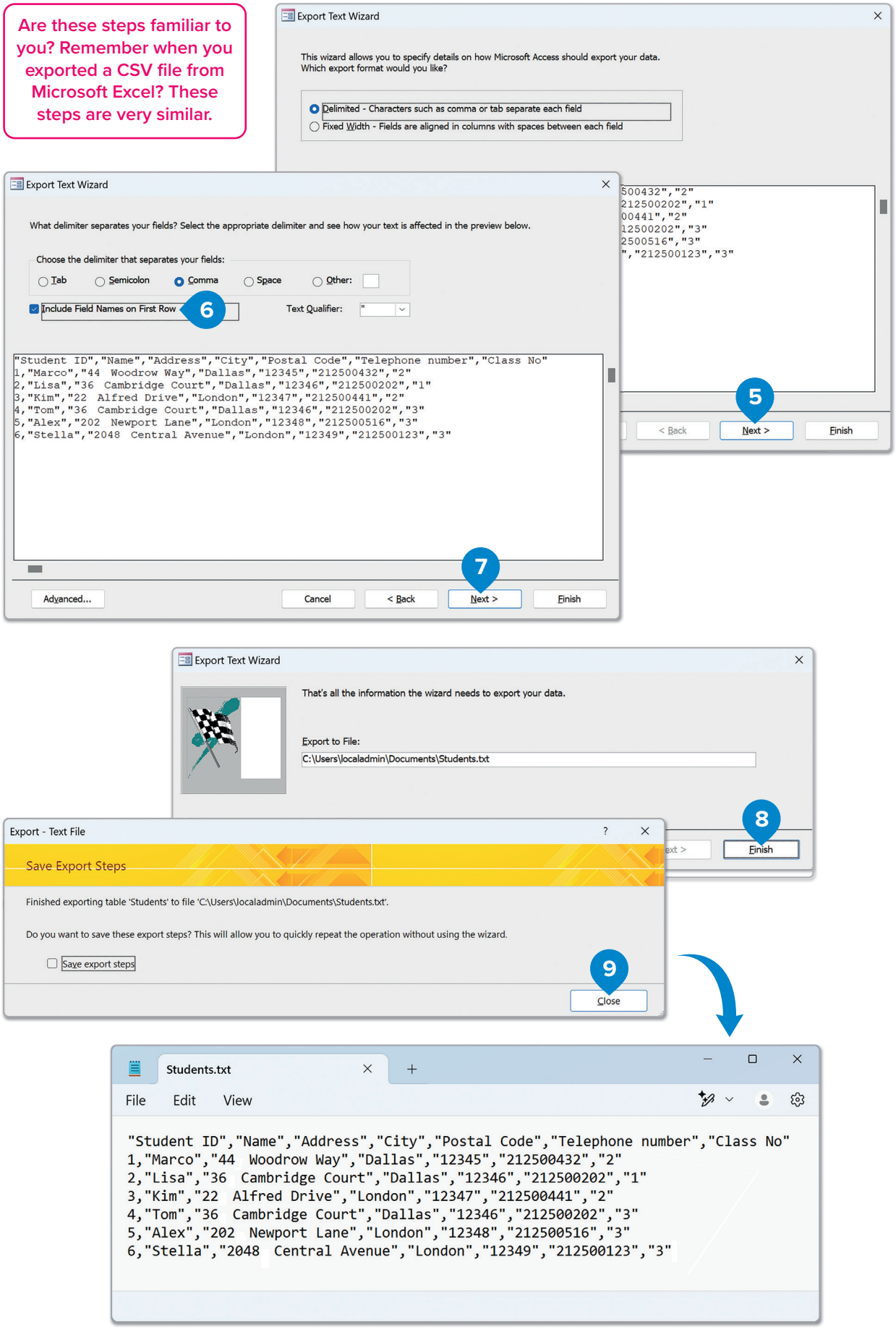
> In the next window, click **Include Field Names on First Row**, 6 and then click **Next**. 7

> In the next window, change the name of the file if you want and then click **Finish**. 8

> In the next window, click **Close**. 9



Are these steps familiar to you? Remember when you exported a CSV file from Microsoft Excel? These steps are very similar.



To import data from a Microsoft Excel file:

> Open **Microsoft Access** and create a new blank database.

> On the **External Data** tab, in the **Import & Link** group, click **New Data Source**. 1

> In the menu that opens, click **From File** and click **Excel**. 2

> In the **Get External Data - Excel Spreadsheet** window, click **Browse** to select the **Microsoft Excel** file you want to import, e.g., "**Students.xlsx**," and click **OK**. 3

> Click **Next**. 4

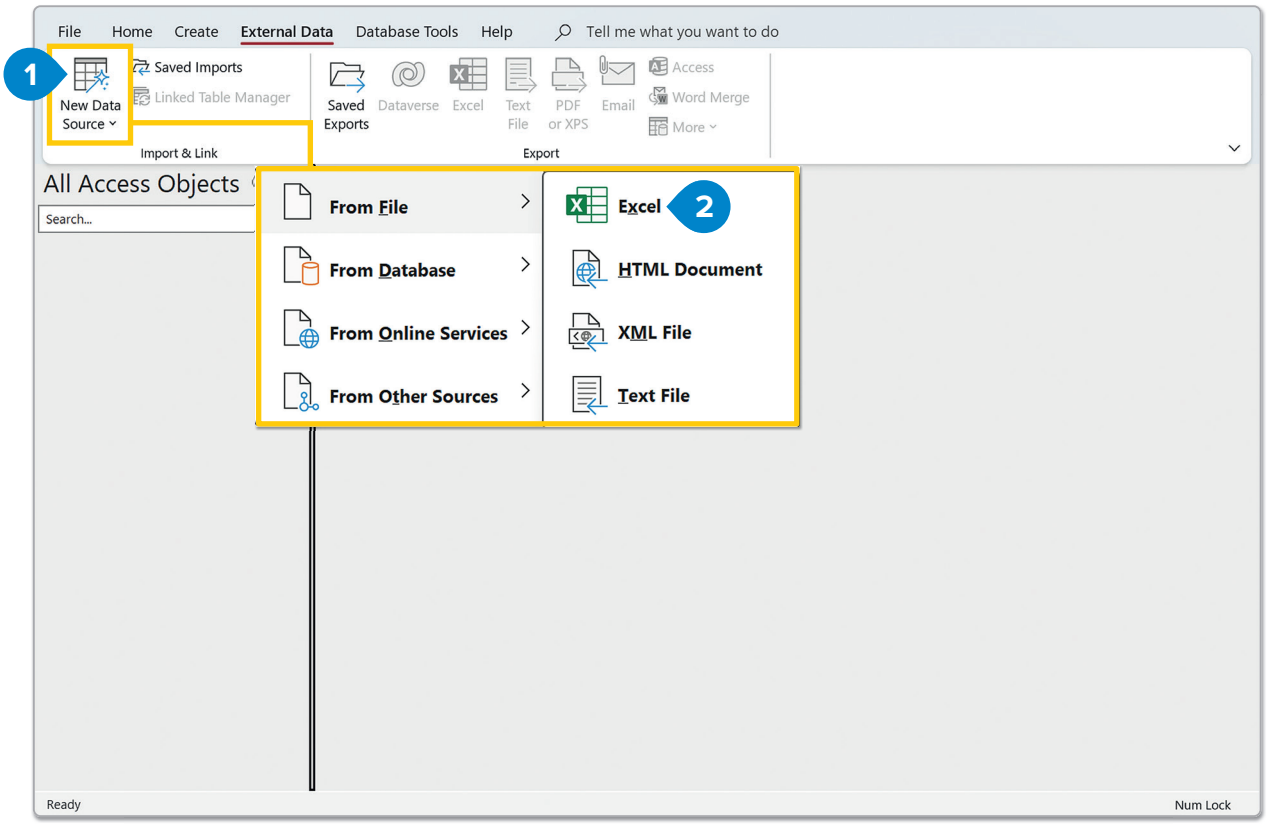
> In the next window, make sure **First Row Contains Column Headings** is checked if you have a header row in the Microsoft Excel file you are importing, and then click **Next**. 5

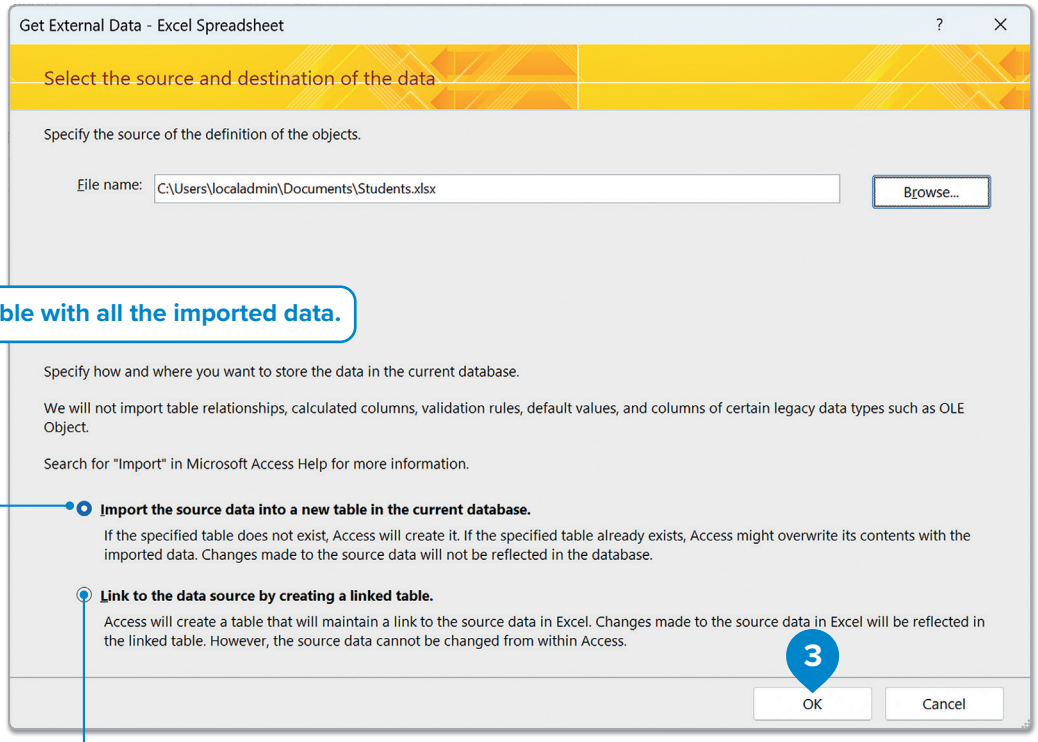
> Click each displayed field and make sure the **Data Type** is correct. If not, change it to the correct value. Then, click **Next**. 6

> In the next window, if your data from Microsoft Excel contains a field that is or can be used as a primary key in your database, click **Choose my own primary key** and click the appropriate field in the drop-down list, e.g., "**StudentID**." 7 Then, click **Next**.

> Finally, in the **Import to Table** box, type a name for the table that is going to be filled with your data, e.g., "**Students**". Then, click **Finish**. 8

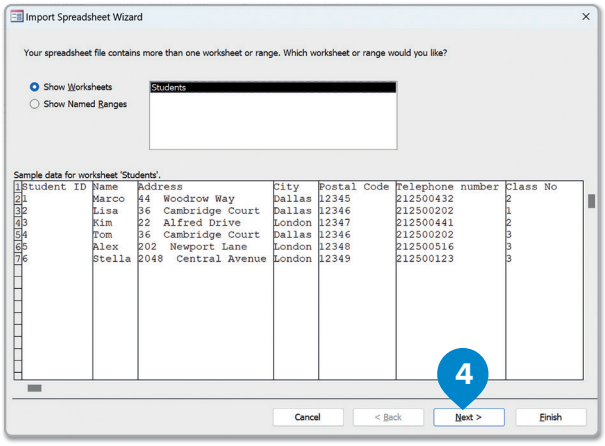
> In the next window, click **Close**. 9

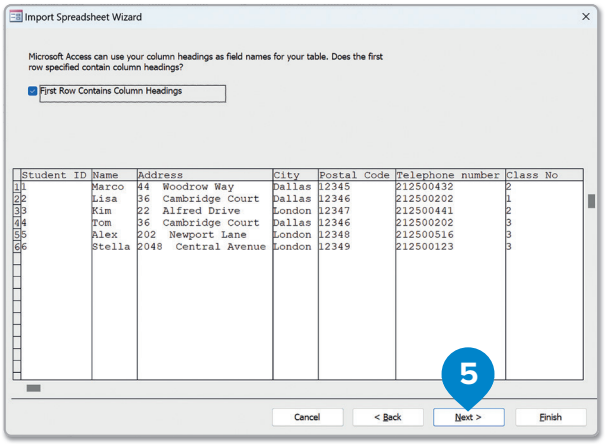


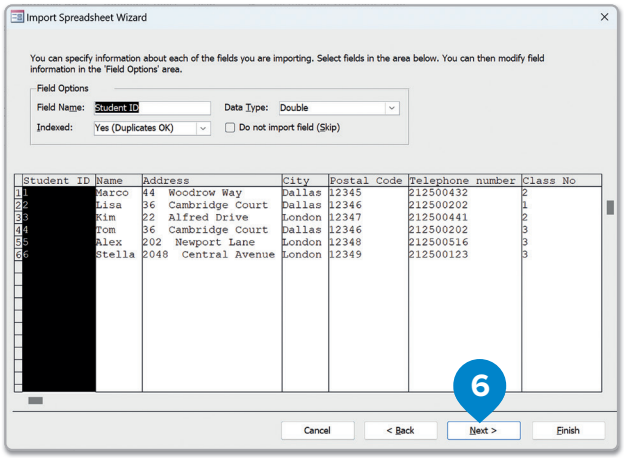


Create a new table with all the imported data.

Make a table that it is connected to Microsoft Excel. Every change that you make to Microsoft Excel will be applied to Microsoft Access but not vice versa.

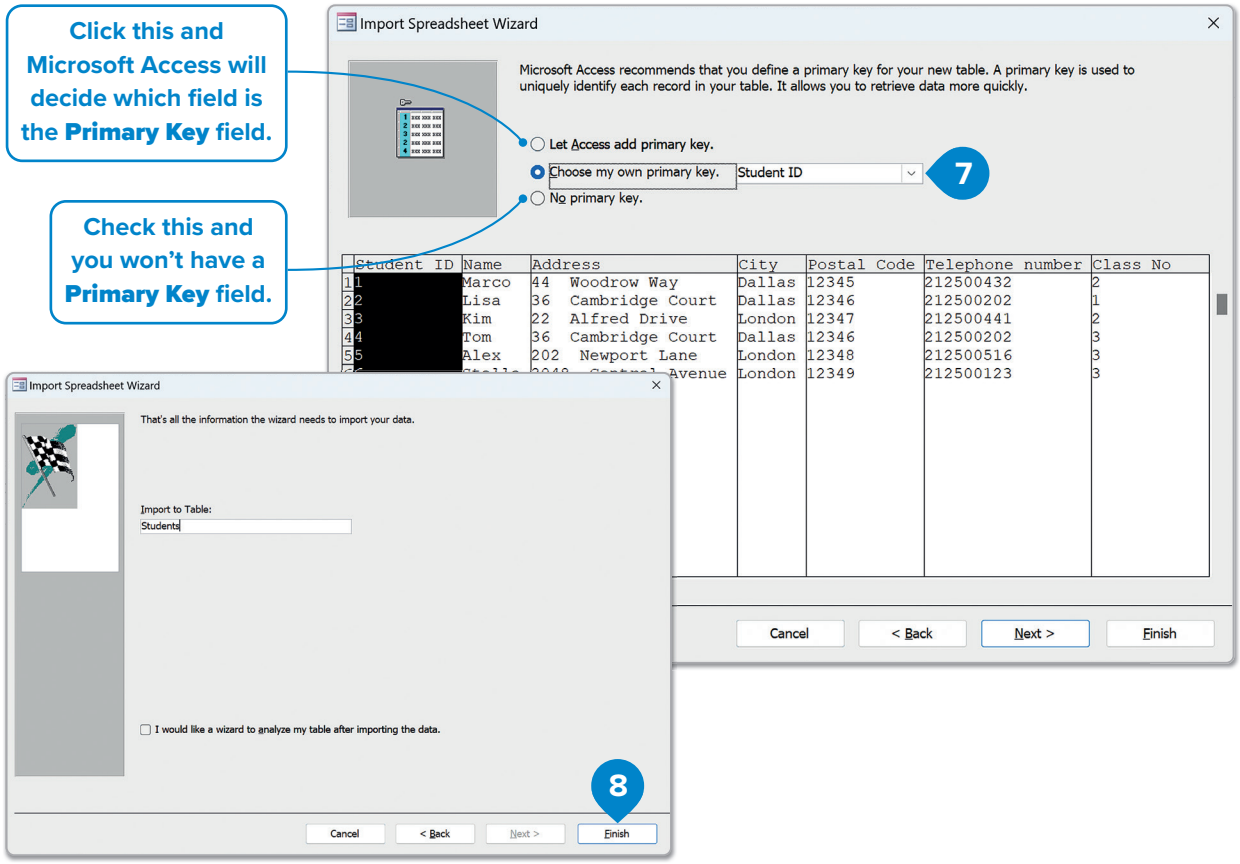


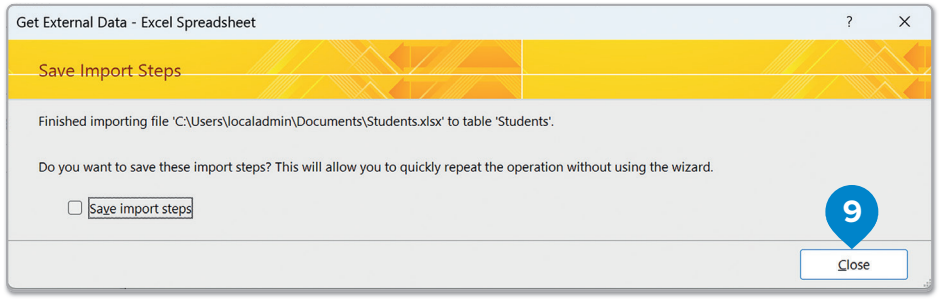


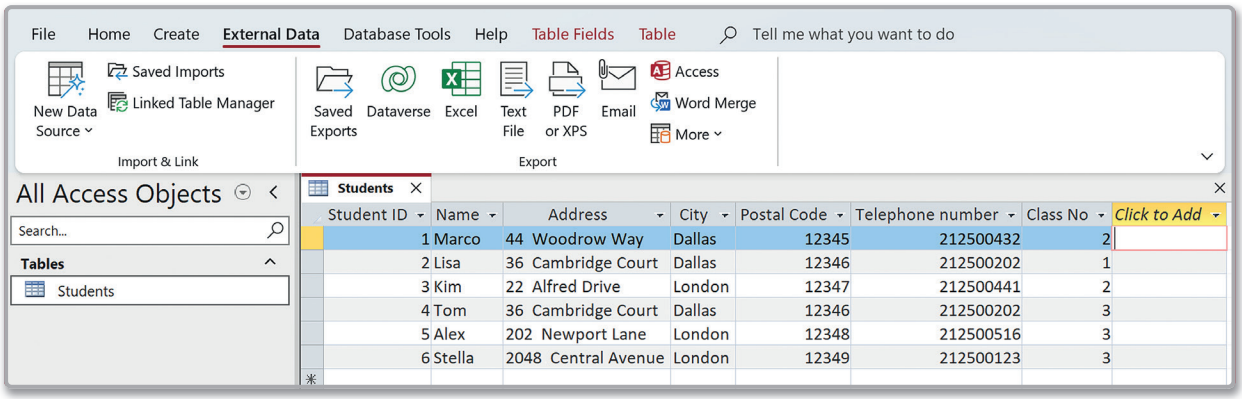


Click this and Microsoft Access will decide which field is the **Primary Key** field.

Check this and you won't have a **Primary Key** field.







Smart Tip

Most of the time, the only thing you have to do when a wizard pops up is to click "Next" until you finish all the steps. Although it's fully automated, check at each screen to make sure that the preselected options are the ones you want.

To import data from a CSV text file:

> Open **Microsoft Access** and create a new blank database.

> On the **External Data** tab, in the **Import & Link** group, click **New Data Source**. 1

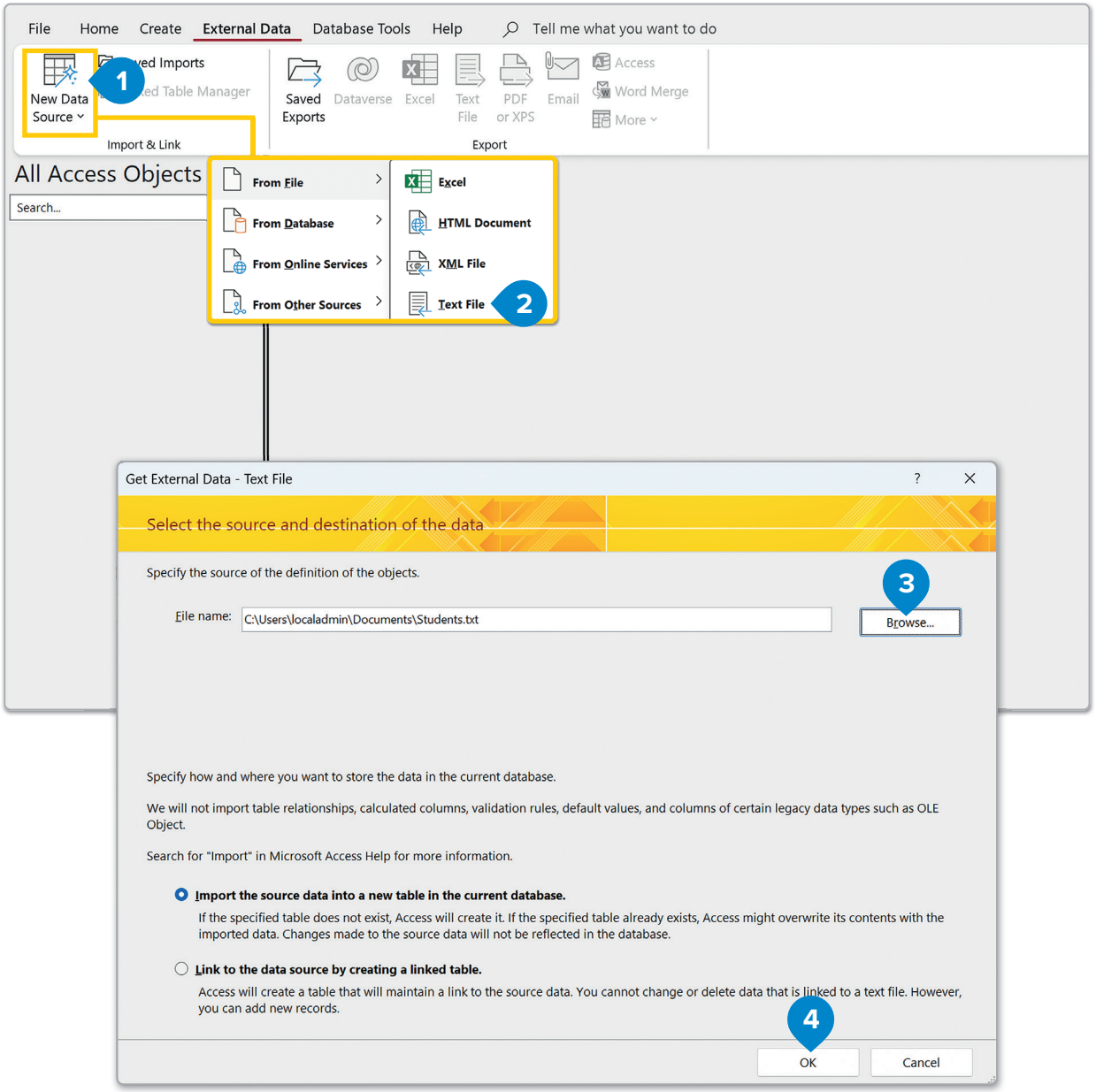
> In the menu that opens, click **From File** and click **Text File**. 2

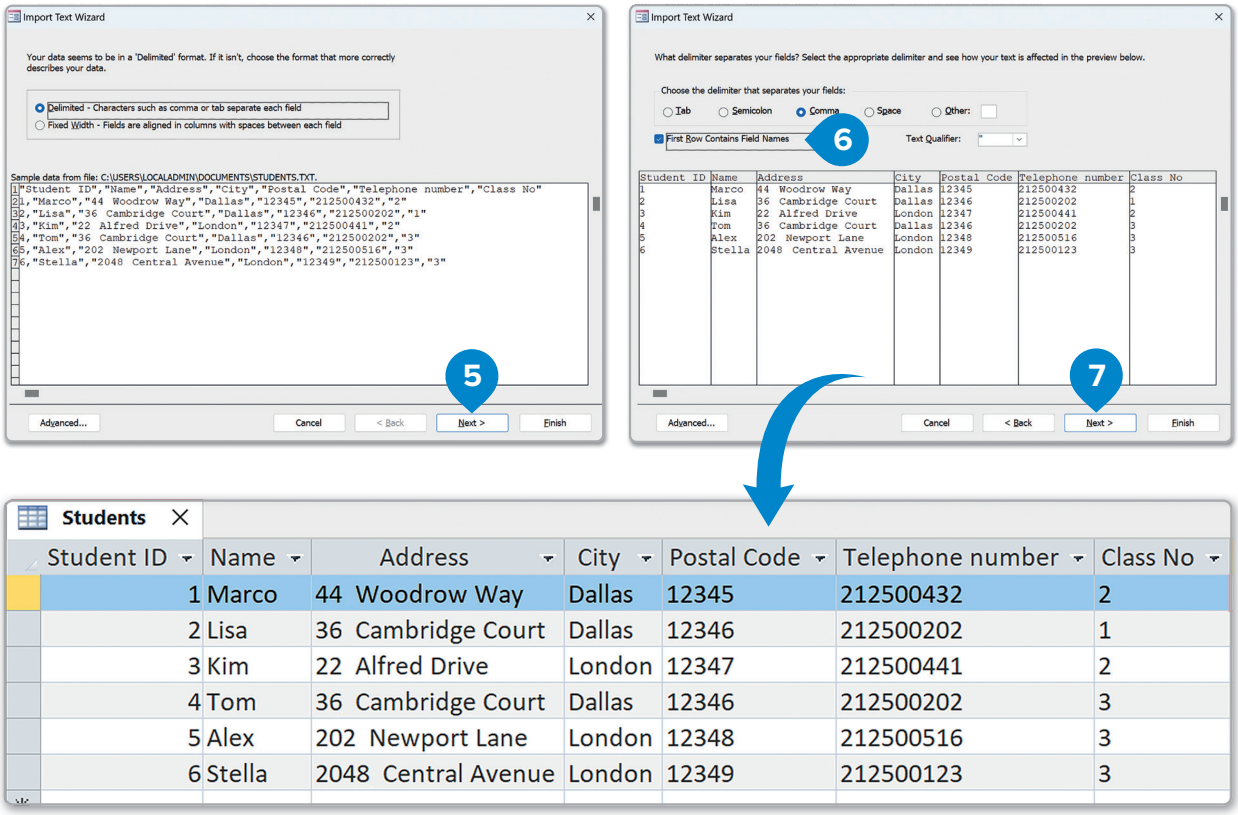
> In the **Get External Data - Text File** window, click **Browse**, 3 to select the text file you want to import, and click **OK**. 4

> Click **Next**. 5

> In the next window, make sure **First Row Contains Field Names** is checked, 6 if you have a header row in the **CSV** file you are importing, and then click **Next**. 7

> The remaining steps are exactly the same as in the previous example when you imported data from a **Microsoft Excel** file.





To import database objects like tables, queries, forms, and reports from another Microsoft Access database file:

> Open **Microsoft Access** and create a new blank database.

> On the **External Data** tab, in the **Import & Link** group, click **New Data Source**. 1

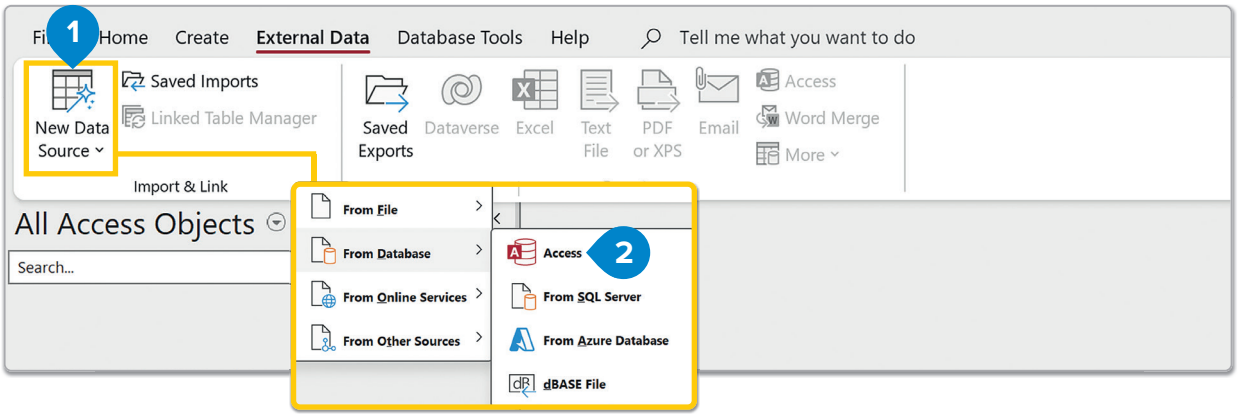
> In the menu that opens, click **From Database** option and click **Access**. 2

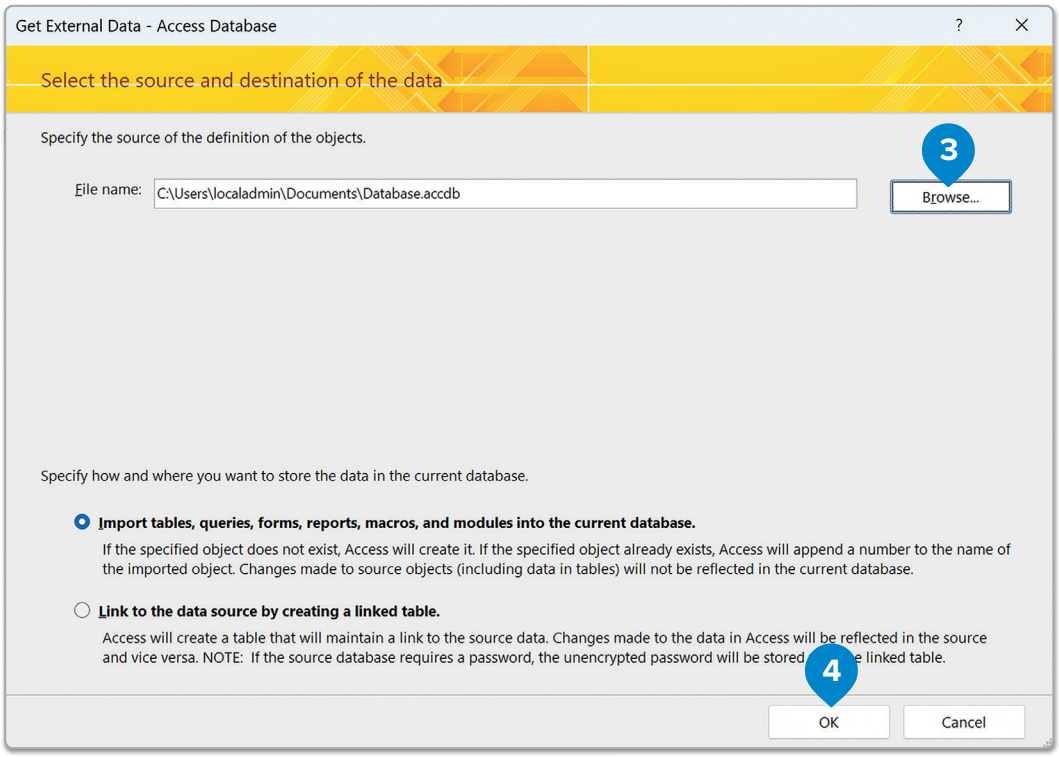
> In the **Get External Data - Access Database** window, click **Browse**, 3 to select the Microsoft Access database file from which you want to import objects, e.g., "**Database.accdb**."

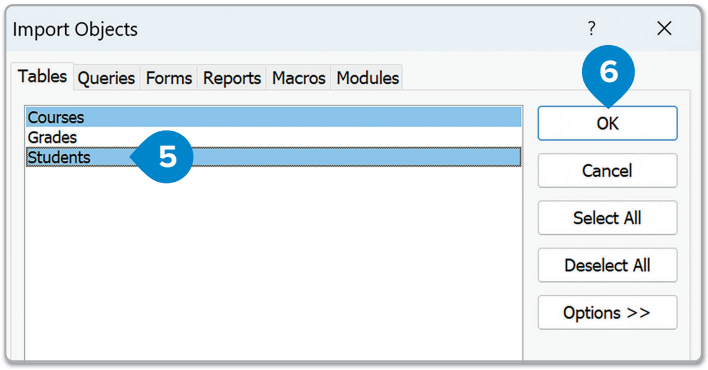
> Click **OK**. 4

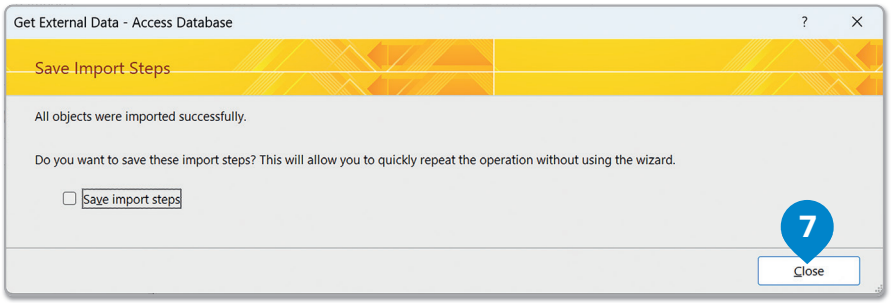
> In the **Import Objects** window, select the objects you want to import, e.g., the **Courses** and **Students** tables, 5 and then click **OK**. 6

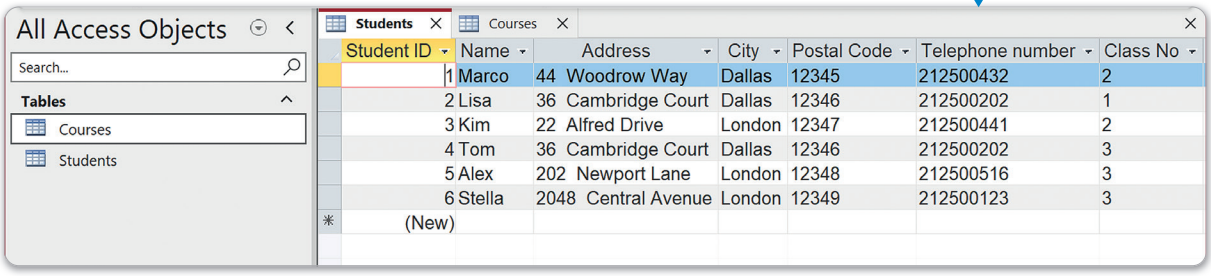
> Click **Close**, 7 and your objects will be waiting for you in the **Navigation** pane.











Hands on!

1. Read each of the statements carefully and check True or False.

	True	False
1. You can export data from a table in Microsoft Access directly to Microsoft Excel.		
2. When exporting data to a text file, the format options include both "Delimited" and "Fixed Width."		
3. The "First Row Contains Field Names" option must be checked while importing data to set column headers correctly.		
4. Linking a Microsoft Excel file to Microsoft Access allows you to edit the source data in Access.		
5. You can save your export steps to repeat the process efficiently in the future.		

2. Read the questions and put a check mark for the correct answer.

1. What does selecting "Delimited" during export mean?
   - a. Data is separated by spaces.
   - b. Data is separated by characters like commas or tabs.
   - c. Data is grouped by rows.
   - d. Data is exported without separators.

2. When exporting data to Microsoft Excel, which feature ensures you save time in future operations?
   - a. Select "Include Formatting."
   - b. Save Export Steps.
   - c. Use the "Navigation Pane."
   - d. Export only selected records.

3. What should you do when importing data from a CSV file into Microsoft Access?

   a. Choose "Link Table" for automatic synchronization.

   b. Select "Delimited" and ensure the first row has field names.

   c. Use the "File Properties" option to edit the table structure.

   d. Ensure that "Primary Key" is unchecked.

4. Which field is typically used as a "Primary Key" when importing data into Microsoft Access?

   a. A field with unique values for each record

   b. A field with multiple duplicates

   c. A field with all text values

   d. A field left blank in the source data

5. How do you ensure data formatting is preserved when exporting to Microsoft Excel?

   a. Select "Open File after Export."

   b. Choose "Export Data with Formatting and Layout."

   c. Save the export as a text file instead.

   d. Click "New Data Source" and export.

3. Complete with the missing word.

1. To export a table from Microsoft Access to a spreadsheet, choose _____ as the format.

2. A _____ file uses characters like commas to separate data.

3. When importing data, always define a _____ to ensure unique identification for each record.

4. Use _____ to repeat export operations with the same settings.

5. When you _____ data, ensure the first row contains field names to maintain consistency.

4. **Why is it important to export data to formats like Excel or CSV when sharing information with others? How does exporting data in these formats make it more efficient for teams to analyze and collaborate?**

5. **Export the report in the default folder to a Microsoft Excel file named "Books.xlsx."**

    1. Open the database you created in the previous lesson and the report "BooksReport."
    2. Ensure:
        - Data formatting and layout are preserved.
        - The file automatically opens after the export.
    3. Export the "Books" table as a CSV file:
        - Name the file "BooksExport.csv."
        - Ensure field names and data formatting are preserved.
    4. Save and close the database.

Project

Plan an Event Database

Create a database in Microsoft Access to track event details. This database will track event details, attendees, and tasks.

1. Create three tables.

- The "Events" table will include information about the events being organized.
- The "Attendees" table will store details about the people attending the events.
- The "Tasks" table will track the tasks associated with each event, including deadlines and statuses.
- You can use the following fields in your tables:

Events

Field Name	Data Type
EventID	AutoNumber
EventName	Short Text
Date	Date/Time
Location	Short Text
Organizer	Short Text

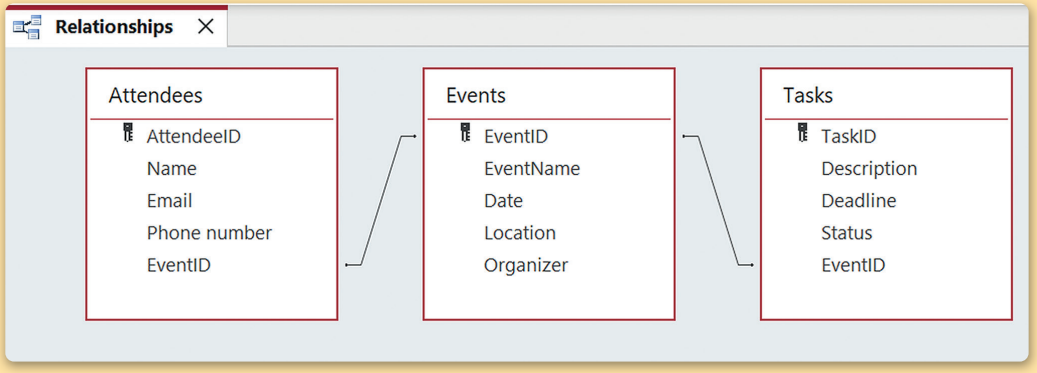
Attendees

Field Name	Data Type
AttendeeID	AutoNumber
Name	Short Text
Email	Short Text
Phone number	Short Text
EventID	Number

Tasks

Field Name	Data Type
TaskID	AutoNumber
Description	Short Text
Deadline	Date/Time
Status	Short Text
EventID	Number

- Don’t forget to set "Primary Keys" for your tables.
- After you create the tables above, connect them using relationships. Each event can have multiple attendees and tasks, as illustrated in the relationship diagram below.



2. Use the Form Wizard to create one data entry form for each table. Use the forms to input sample data into your database.

- For the "Attendees" table, use your classmates' personal details.
- For the "Events" table, add sample events, such as "Science Fair" or "Cultural Fest."
- For the "Tasks" table, list tasks like "Decorations" or "Prepare Invites", including deadlines and statuses such as "In Progress" or "Completed."

3. Create a report using the Report Wizard.

- Use the fields EventID, EventName, Name, Email, Description, and Deadline from the available tables.
- Group the report by EventID.
- Sort the report by EventName in ascending order and set the Layout to Outline and the Orientation to Landscape.
- Name the report "EventsReport."

4. Create and run the following queries.

- Find all attendees for a specific event based on "EventName" input.
- Display all tasks that are marked as "In Progress" and their deadlines.

5. Export and import data.

- Export the "Tasks" table to a Microsoft Excel file named "TasksList.xlsx." Ensure data formatting and layout are preserved.
- Modify the Microsoft Excel file by adding a new column named "AssignedTo" and fill it with team member names.
- Import the modified Microsoft Excel file back into Microsoft Access as a new table named "UpdatedTasks."
- Ensure the First Row Contains Field Names option is selected during the import process.
- Save and close the database.

Reflect

1. What did you learn about organizing data in a database that you didn't know before?

2. How did creating relationships between tables help you understand the connection between different types of data?

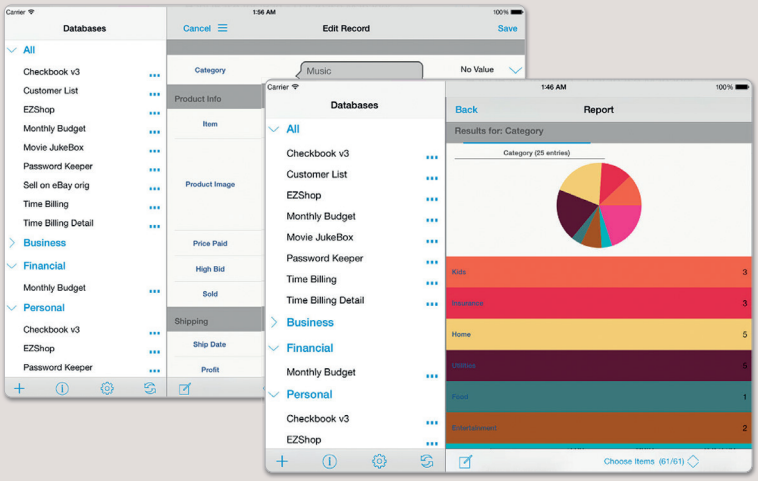
3. What was the most challenging part of designing and managing the database for the project? How did you overcome this challenge?

4. How did your team collaborate to input data and create forms and reports? Was everyone able to contribute effectively?

Discover more

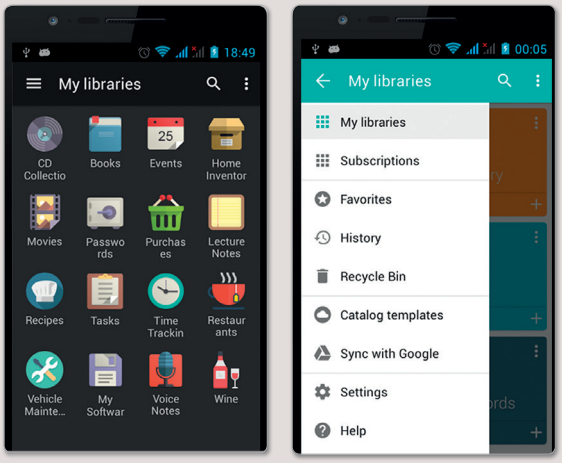
HanDBase for iOS

With HanDBase you can track almost anything on an iPhone or iPad. Here, you can have a shopping list, music and DVD collections, project organizers, sports schedules, or that list of passwords you keep handy in the desk drawer.



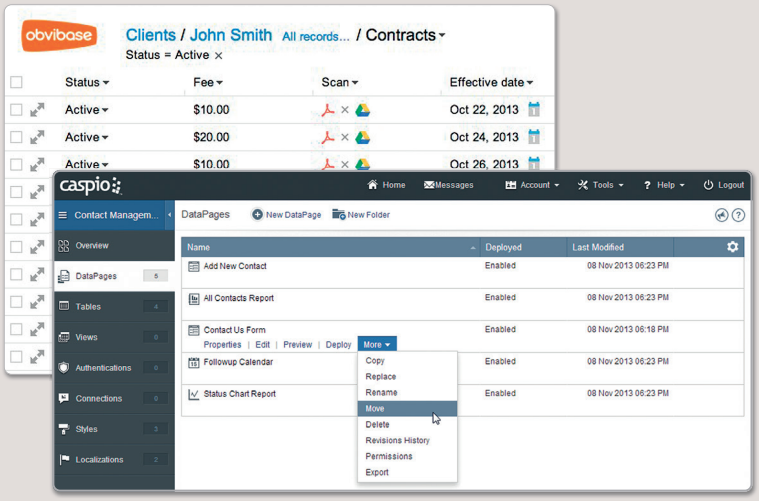
Memento for Google Android

Use Memento to gather all the information about DVD collection or books. Categorize your database by Director or Author and extract any information that you want. Find out how many books you have by a certain author or how many movies with your favorite actor.



Obvibase and Caspio

If you want to keep everything organized and readily accessible, you can use online database creators like Obvibase and Caspio. Now you can access your data from any web browser, and your data is secure and manageable.



Wrap up

Take a moment to reflect on your progress.

How confident are you in your ability to apply the following skills?

> I can explain what structured information is and describe its importance.
> I can create a database, add tables, and input data in Microsoft Access.
> I can describe different data types and their uses in a database.
> I can create and customize data entry forms using the Form Wizard.
> I can create and run queries to retrieve specific data and use parameter queries.
> I can create, customize, and save reports, including adding fields and calculations.
> I can export data from a database to Microsoft Excel and CSV files.
> I can import data from Microsoft Excel and CSV files into a database.

Key Terms

- criteria
- database
- data source
- data type
- export
- field
- field property
- group
- import
- label
- parameter
- primary key
- query
- relationship
- report
- structured information