

**Skills  
and Pathways**

# Databases

**Sampler**



**Mc  
Graw  
Hill**



## Skills and Pathways: Databases

Printed and distributed by McGraw Hill in association with Binary Logic SA.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means—electronic, mechanical, photocopying, recording, or otherwise—without prior written permission from the publishers. No part of this work may be used or reproduced in any manner for the purpose of training artificial intelligence technologies or systems.

Disclaimer: McGraw Hill is an independent entity from Microsoft® Corporation and is not affiliated with Microsoft Corporation in any manner. Any Microsoft trademarks referenced herein are owned by Microsoft and are used solely for editorial purposes. This work is in no way authorized, prepared, approved, or endorsed by, or affiliated with, Microsoft.

Please note: This book contains links to websites that are not maintained by the publishers. Although we make every effort to ensure these links are accurate, up-to-date, and appropriate, the publishers cannot take responsibility for the content, persistence, or accuracy of any external or third-party websites referred to in this book, nor do they guarantee that any content on such websites is or will remain accurate or appropriate.

Trademark notice: Product or corporate names mentioned herein may be trademarks or registered trademarks and are used only for identification and explanation without intent to infringe. The publishers disclaim any affiliation, sponsorship, or endorsement by the respective trademark owners.

Microsoft, Windows, Office 365, Microsoft 365, Access, Excel, PowerPoint, Outlook, Microsoft Teams, OneDrive, OneNote, Bing, and Microsoft Edge are trademarks or registered trademarks of Microsoft group of companies. Google, Gmail, Chrome, Google Docs, Google Drive, and Android are trademarks or registered trademarks of Google LLC. Apple, iPad, iPhone, Pages, Numbers, Keynote, iCloud, and Safari are registered trademarks of Apple Inc. HanDBase is a registered trademark of DDH Software LLC. LibreOffice is a registered trademark of the Document Foundation. Obvibase is a trademark or registered trademark of Obvibase or Obvibase's licensors. Caspio is a trademark or registered trademark of Caspio Inc. The above companies or organizations do not sponsor, authorize, or endorse this book, nor is this book affiliated with them in any way.

Cover Credit: © dookdui/123rf

Copyright © 2026 Binary Logic SA      MHID: xxxxxxxxxx      ISBN: xxx-xxx-xxx-xxx-x

[mheducation.com](https://mheducation.com)   [binarylogic.net](https://binarylogic.net)



For Review Purposes Only

# Contents

<b>1. Data and information</b>	<b>6</b>
Data, information, and knowledge .....	7
Data collection .....	10
Data types and encoding .....	15
Data validation I .....	25
Data validation II .....	34
<b>2. Collecting information</b>	<b>42</b>
Introduction to databases .....	43
Filter and sort .....	47
Keys and relationships .....	51
Contact management .....	56
Lab data collection .....	60
<b>3. Handling databases</b>	<b>64</b>
Structured information .....	65
Data entry forms .....	74
Queries .....	82
Reports .....	93
Import and export data .....	101
<b>4. Advanced databases</b>	<b>114</b>
Databases and tables .....	115
Forms and records .....	123
Advanced queries .....	138
Advanced reports .....	148
Protect and print databases .....	160

# Key Features

- > An innovative approach to building digital competencies, developed by expert educators.
- > Curriculum aligns with the latest industry standards, preparing students for certifications and future careers.
- > Well-defined learning goals and hands-on, applicable digital skills.

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

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

**Type validation check**

Now, proceed with the fifth course, labeled "Number of Events." Before entering the number of events for each city, perform the **type validation** check to ensure that negative values cannot be entered. This procedure requires setting a minimum value, which will be set to 1. As negative values and zero event values are not allowed. This ensures that only valid, positive event numbers can be input.

**To apply Type validation:**

- Select cells E3 to E17, and start the validation process.
- In the **Data Validation** window, click on the **Settings** tab.
- In the **Allow** list, select **Whole number**.
- In the **Data** list, select **greater than or equal to**.
- In the **Minimum** field, type 1.
- Click on the **Ignore blank** option.

**Hands on!**

Confirm working on data collection about the agricultural production of your country. Now, you should apply validation type checks to your spreadsheet table the Range Format, and Type to verify that inputted data matches acceptable data entry rules. During this process, set input and error messages to prevent users from entering the wrong type of data.

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

**Project**

**Form teams and organize a library database**

Let us build a database in Microsoft Access to help a library track its members, books, and loan records. Work together to organize the library's information!

- Create three tables.
  - The **Members** table will include information about the library members who can borrow books.
  - The **Books** table will include information about all the books the library has available.
  - The **Borrowers** table will track all book loans for all members and will feature a loan start date and due date.
- You can use the following fields in your tables:
 

Table	Field Name	Field Type
Members	MemberID	AutoNumber
Members	MemberName	Text
Members	Address	Text
Members	City	Text
Members	State	Text
Members	Zip	Text
Books	BookID	AutoNumber
Books	BookTitle	Text
Books	Author	Text
Books	Category	Text
Borrowers	BorrowerID	AutoNumber
Borrowers	BookID	AutoNumber
Borrowers	LoanStart	Date/Time
Borrowers	DueDate	Date/Time
- The book categories can be Non-fiction, Mystery, Adventure, Fantasy/Sci-Fi, History, and Education.
- You can add more categories if you want. Don't forget to set Primary Keys for your tables!
- After you create the tables above, you will need to connect them appropriately, as you have learned to do in this unit.

**Hands on!**

Export the sports table that you created previously to Microsoft Excel. Open the file with Microsoft Excel and add some more records. Now save the Microsoft Excel file and import it into a blank Microsoft Access database. Do you notice the new records in Microsoft Access?

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.

**Wrap up**

**Take a moment to reflect on your progress.**

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

- Ensuring compatibility by saving in older database formats.
- Setting foreign keys to link tables.
- Configuring MS Access to set a form as the startup option.
- Modifying data formats, hiding fields, and designing forms.
- Enhancing forms with visual elements.
- Applying filters and removing them to view all records.
- Creating and refining queries to generate tables, group data, and modify criteria.
- Creating, customizing, and managing reports, including adding and formatting subreports.
- Managing database performance by compacting, repairing, backing up, and encrypting databases.
- Organizing database structure and printing databases.

**Key Terms**

action query	database	margin	subreport
application parts	delete query	password	template
background	filter	query	
back up	linked tables	report	
criteria		split	

**Other platforms**

**HandBase for iOS**

With HandBase you can track around anything on your iPhone or iPad. Here, you can have your shopping list, music & DVD collection, sports schedules, or that list of people who you keep handy in your back pocket.

**Memento for Google Android**

Use Memento to gather all the information about your DVD collection or books. Categorize your collection by Director or Author and select any information that you want. And, of course, you can have your favorite movies with your favorite actor.

**Overbase and Caspio**

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



# 2

## UNIT 2

# Collecting information

Databases are powerful computing tools that can be applied in many areas of life. Whether managing a school project or organizing information in a job, databases help make sense of data by efficiently organizing and storing it. This unit introduces the concept of databases, their role in managing data, and how they support decision-making. It also explores the meanings of "data" and "information," providing insights into their effective use.

### Learning Objectives

In this unit, you will:

- > explain what a database is and why databases are useful.
- > create a simple database table in a spreadsheet application.
- > format and manage data in a database.
- > design a database for storing information.
- > apply filters to a dataset in a spreadsheet application.
- > sort data alphabetically or numerically.
- > use multilevel sorting for better data organization.
- > create custom filters for specific data criteria.
- > describe what a primary key is and why it is important.
- > use ID fields to ensure unique records.
- > identify the different types of relationships in databases.
- > create and use primary keys and relationships in a database.
- > export contacts from an email service.
- > import contact data from a CSV file into a spreadsheet application.
- > explain the importance of organizing and managing contact information.
- > create a database for contact management in a spreadsheet application.
- > use a data logger to collect environmental data.
- > connect a data logger to a computer and download data.
- > import data into a spreadsheet application for analysis.
- > analyze and visualize the collected data.

### Tools

- > Microsoft Excel
- > Outlook.com

## LESSON 1

# Introduction to databases

### What is a database?

A **database** is a system for organizing **data**. It is a collection of data that can be changed, sorted, and quickly searched to show detailed information about something in particular. For example, today, data in schools is no longer stored in huge filing cabinets; instead, every school has an electronic database with all its students' "files." The database is stored on a computer and is only a few megabytes in size! Each file looks the same as it did in the past, but now it is on a computer screen. You can use database programs to manage electronic databases. A very simple example of a database is an electronic address book, which can include information about thousands of people.



In the address book database, each record has four fields:

1. Name
2. Home address
3. Phone number
4. Email address

For example, a university database might have one table including its students' information and another table including its teachers' information.

TEACHERS			
STUDENTS			
Name	Phone Number	Home Address	Email Address
Lisa	212 500 202	36 Cambridge Court	lisa.bacademy@outlook.com
Tom	212 500 202	36 Cambridge Court	tom.bacademy@outlook.com
Alex	212 500 516	202 Newport Lane	alex.bacademy@outlook.com
Stella	212 500 123	2048 Central Avenue	stella.bacademy@outlook.com

In computer lingo, a database table is a collection of similar items. A database is organized into one or more tables.

Lisa	212 500 202	36 Cambridge Court	lisa.bacademy@outlook.com
------	-------------	--------------------	---------------------------

A record in a database table is an item of information with certain characteristics. A database table is a collection of records.

Home Address
36 Cambridge Court

Every characteristic, or piece of information, is called a field. A field has a name and some data.

For Review Purposes Only

## Create a database

Next, create your own database. Decide what kind of **information** you want to include. Think of the characteristics you want to collect for each record and give them a title or a **field** name.

Although there are various programs for database management, you can use **Microsoft Excel** to create your database table in a very simple way!

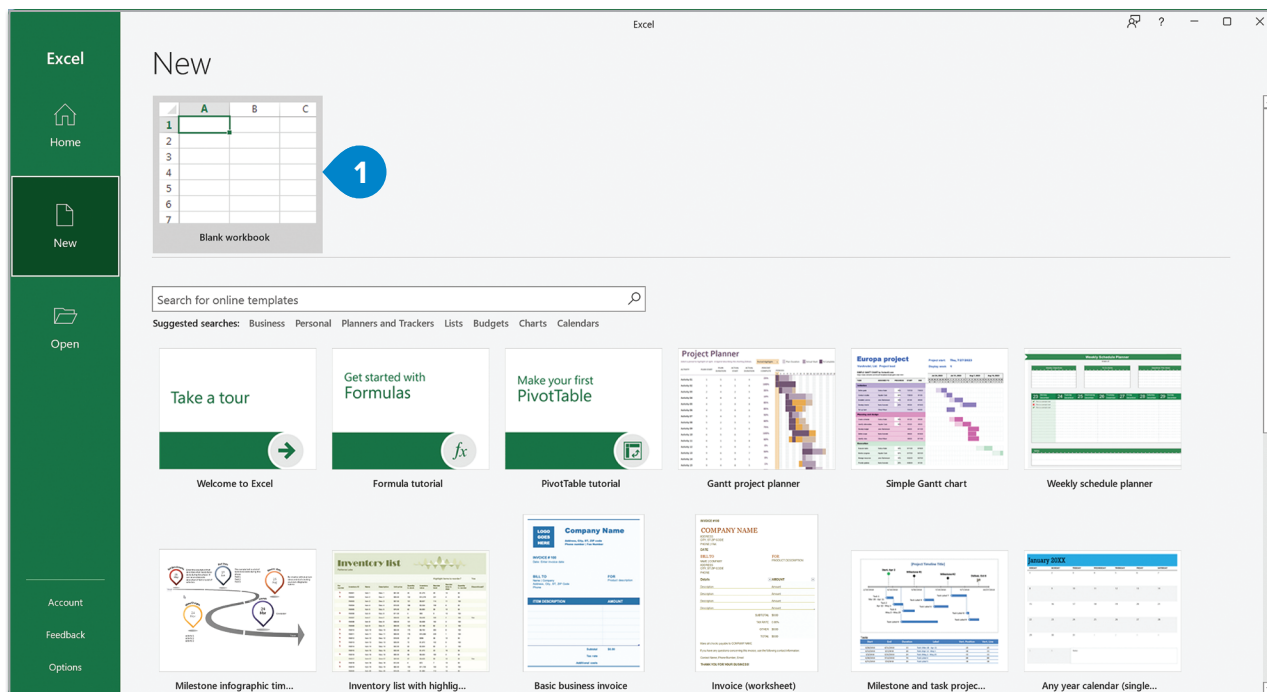
Let's create an address book database of your friends' information.

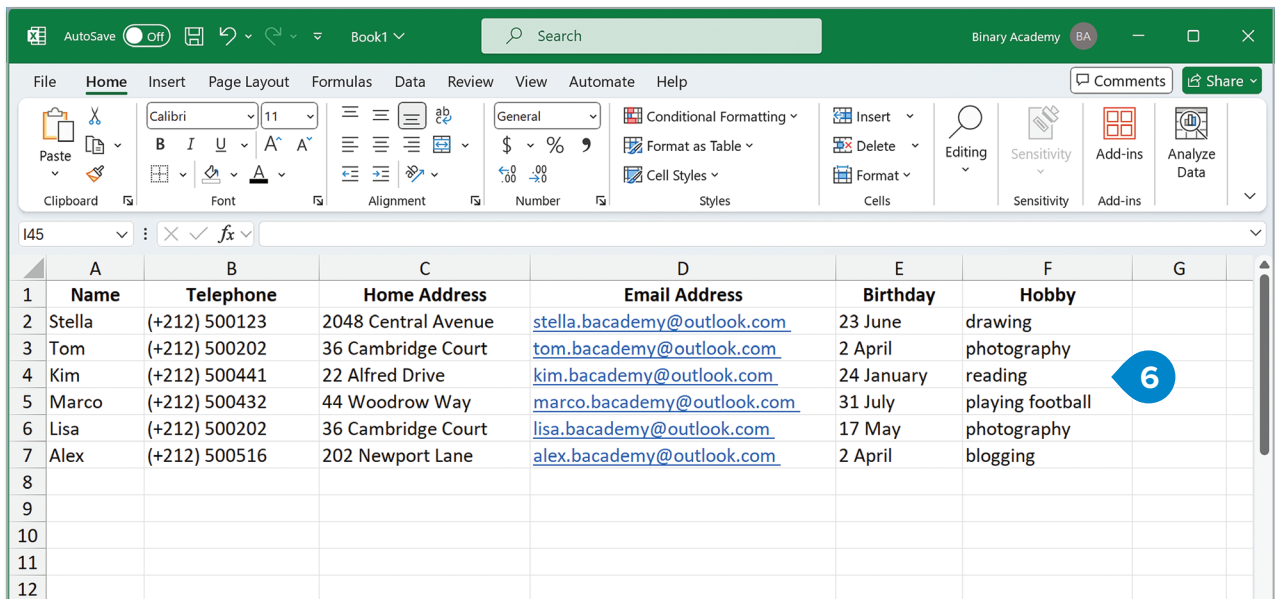
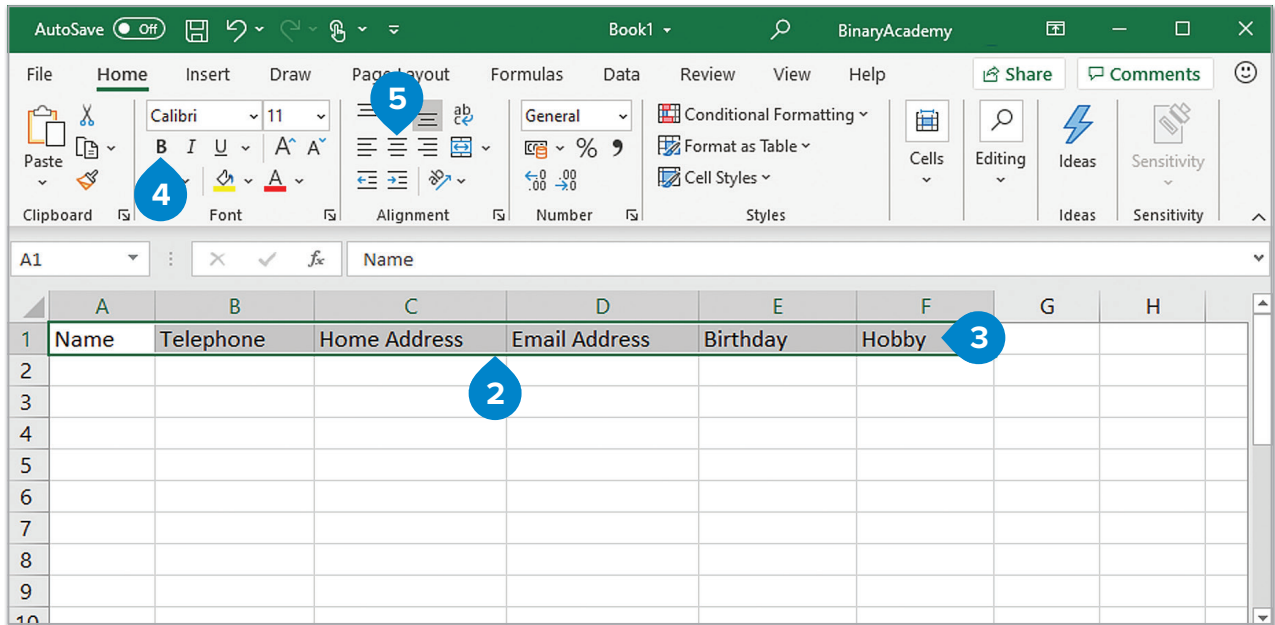
The field names are:

**Name, Telephone, Home Address, Email Address, Birthday, Hobby.**

### To create a table:

- > Run **Microsoft Excel** and create a new **Blank workbook**. **1**
- > Type the database field names horizontally in different cells from **A1** to **F1**. **2**
- > Select **A1** to **F1**. **3**
- > Click the **Bold** button, **4** to make the titles stand out, and align the text to **Center**. **5**
- > Now add one record for each of your friends. Every record must contain information about the six different fields. **6**





## History

Edgar F. "Ted" Codd was an English computer scientist who invented the relational model for database management in 1970, while working for IBM. His theory is the basis for relational databases and data management.

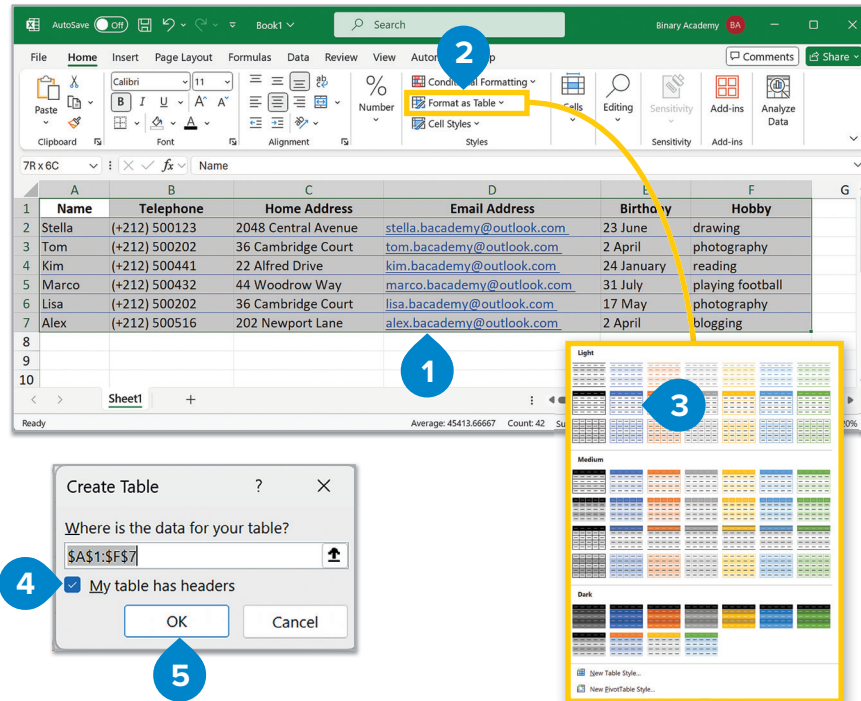


## Format as table

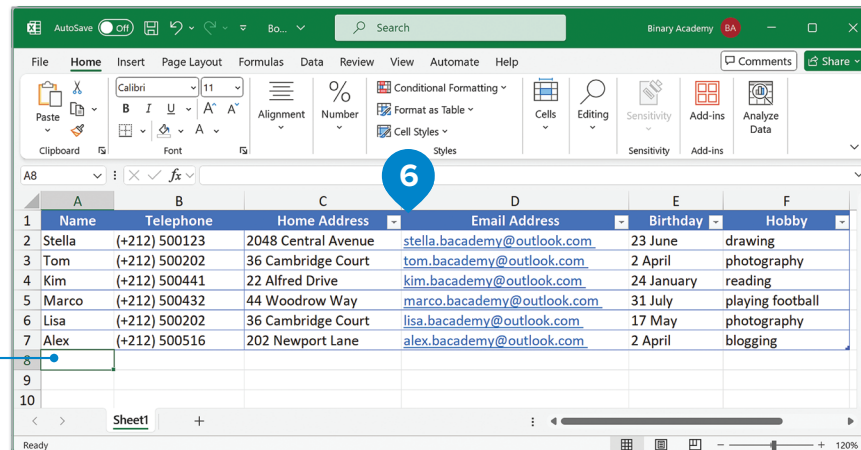
Now that your database information is ready, format it with a style of your choice to make Microsoft Excel understand it's a data table.

### To apply a table style:

- > Select your table cells from **A1 to F7**. **1**
- > On the **Home** tab, in the **Styles** group, click **Format as Table**. **2**
- > Select a style you like!  
Let's select one in the **Light** group. **3**
- > In the **Create Table** window, select **My table has headers**. **4**
- > Click **OK**. **5**
- > Your table has a new style and the program knows that the titles are field headers. **6**



If you want to add another friend later, you can simply start typing the new information on the first empty row under the data and Microsoft Excel will recognize it as a new record and include it in the table!



All the information in a database must relate to the same topic. E.g., you cannot have information about sports in an animal database!

## Hands on!

Now, let's create a database about music!

Choose your favorite music artist or band and search the Web for their discography.

A discography is information about all the albums an artist or band has ever released. Create a database with the following fields: Album Title, Date Released, Top Chart Position, Albums Sold.

## LESSON 2

# Filter and sort

### Apply a filter

To have a specific set of records (**data**), apply a **filter**. This is useful especially if you have really big tables and you only want a part of your data.

#### To apply a filter:

- > Click the column header arrow next to a field header, e.g., **Name**. ❶
- > Select only the names you want to display, ❷ and click **OK**. ❸
- > You have now applied a filter to your database table based on the content of one field. ❹

The screenshot illustrates the process of applying a filter to a database table. It shows a table with columns: Name, Telephone, Home Address, and Email Address. The table contains records for Stella, Tom, Kim, Marco, Lisa, and Alex. The 'Name' column header is clicked, opening a filter menu. In the filter menu, the 'Select All' option is selected, and the records for Kim, Lisa, and Stella are checked. The 'OK' button is clicked. The resulting table shows only the records for Kim, Lisa, and Stella.

**1** Click the column header arrow next to a field header, e.g., **Name**.

**2** Select only the names you want to display, and click **OK**.

**3** You have now applied a filter to your database table based on the content of one field.

**4** You can **Select All** records by using the same steps, and everything will be displayed as it was before.

	A	B	C	D
	Name	Telephone	Home Address	Email Address
1	Stella			<a href="mailto:stella.bacademy@outlook.com">stella.bacademy@outlook.com</a>
2	Tom			<a href="mailto:tom.bacademy@outlook.com">tom.bacademy@outlook.com</a>
3	Kim			<a href="mailto:kim.bacademy@outlook.com">kim.bacademy@outlook.com</a>
4	Marco			<a href="mailto:marco.bacademy@outlook.com">marco.bacademy@outlook.com</a>
5	Lisa			<a href="mailto:lisa.bacademy@outlook.com">lisa.bacademy@outlook.com</a>
6	Alex			<a href="mailto:alex.bacademy@outlook.com">alex.bacademy@outlook.com</a>
7				
8				

	A	B	C	D
	Name	Telephone	Home Address	Email Address
1	Stella	(+212) 500123	2048 Central Avenue	<a href="mailto:stella.bacademy@outlook.com">stella.bacademy@outlook.com</a>
2	Kim	(+212) 500441	22 Alfred Drive	<a href="mailto:kim.bacademy@outlook.com">kim.bacademy@outlook.com</a>
3	Lisa	(+212) 500202	36 Cambridge Court	<a href="mailto:lisa.bacademy@outlook.com">lisa.bacademy@outlook.com</a>
4				
5				
6				
7				
8				

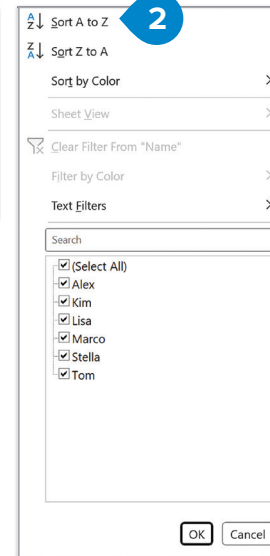
## Filter and Sort

In Microsoft Excel, you can easily **sort** your data by selecting the relevant column(s) and choosing the sort option in the toolbar. This will help you quickly locate or organize the information in your address book database.

### To sort your data:

- > Click the column header arrow on the **Name** header. ①
- > Click **Sort A to Z**, ② to sort the table records alphabetically.
- > All records will automatically change position in the table and will now be sorted based on the **Name** field. The column header arrow, ③ of the field header will also change so that the table records be displayed in a specific order.

	A	B	C
1	Name	Telephone	Home Address
2	Stella	(+212) 500123	2048 Central Avenue
3	Tom	(+212) 500202	36 Cambridge Court
4	Kim	(+212) 500441	22 Alfred Drive
5	Marco	(+212) 500432	44 Woodrow Way
6	Lisa	(+212) 500202	36 Cambridge Court
7	Alex	(+212) 500516	202 Newport Lane
8			
9			



	A	B	C	D	E	F
1	Name	Telephone	Home Address	Email Address	Birthday	Hobby
2	Alex	(+212) 500516	202 Newport Lane	alex.bacademy@outlook.com	2 April	blogging
3	Kim	(+212) 500441	22 Alfred Drive	kim.bacademy@outlook.com	24 January	reading
4	Lisa	(+212) 500202	36 Cambridge Court	lisa.bacademy@outlook.com	17 May	photography
5	Marco	(+212) 500432	44 Woodrow Way	marco.bacademy@outlook.com	31 July	playing football
6	Stella	(+212) 500123	2048 Central Avenue	stella.bacademy@outlook.com	23 June	drawing
7	Tom	(+212) 500202	36 Cambridge Court	tom.bacademy@outlook.com	2 April	photography
8						

## Multilevel sorting

Sometimes, it's useful to sort your data according to multiple fields instead of just one. This is called **multilevel sorting** and it works as follows.

Let's say you want to sort your data alphabetically by hobby and then by name. This just means that all your records will be sorted by hobby, and if some of those records happen to have the same hobby, these will be sorted by name.

### To apply multilevel sorting:

- > Select your table cells from **A1** to **F7**. ①
- > On the **Home** tab, in the **Editing** group, click **Sort & Filter**, ② and then **Custom Sort**. ③
- > In the **Sort by** list, click **Hobby**. ④
- > Click **Add Level**, ⑤ to add a second level of sorting to your data. A new row will add.
- > In the **Then by** list, click **Name**. ⑥
- > Click **OK**. ⑦
- > All records will be sorted based on the **Hobby** field, ⑧ and then based on the **Name** field. ⑨

If you have already sorted any field, such as the name field we described in the previous example, click the Undo button to work on the unsorted data.

Excel interface showing the 'Data' tab ribbon. The 'Sort' button is highlighted with a yellow box and labeled 2. The 'Sort A to Z' option is highlighted in the dropdown menu with a yellow box and labeled 3. A blue circle labeled 1 points to the 'Name' column header.

'Sort' dialog box. The 'Sort by' dropdown is set to 'Hobby' (labeled 4). The 'Add Level' button is labeled 5. The 'Then by' dropdown is set to 'Name' (labeled 6). The 'OK' button is labeled 7.

	A	B	C	D	E	F	G	H
		Name	Telephone	Home Address	Email Address	Birthday	Hobby	
1		Alex	(+212) 500516	202 Newport Lane	alex.bacademy@outlook.com	2 April	blogging	
2		Stella	(+212) 500123	2048 Central Avenue	stella.bacademy@outlook.com	23 June	drawing	
3		Lisa	(+212) 500202	36 Cambridge Court	lisa.bacademy@outlook.com	17 May	photography	
4		Tom	(+212) 500202	36 Cambridge Court	tom.bacademy@outlook.com	2 April	photography	
5		Marco	(+212) 500432	44 Woodrow Way	marco.bacademy@outlook.com	31 July	playing football	
6		Kim	(+212) 500441	22 Alfred Drive	kim.bacademy@outlook.com	24 January	reading	
7								
8								

Notice that the names of the students who like photography are in alphabetical order.

The arrow buttons in the field headers will change to present that the table is displayed in a specific order.

Try sorting the database table using other fields, like Telephone or Birthday, and notice what happens.



### Smart Tip

Sorting is a very good way to organize your data in any program that supports it. It's much easier to find information if it is in a logical order rather than being randomly.



## Custom filters

Now, let's explore some more advanced filters. For example, we can display the records of students whose birthdays fall in April.

### To apply a custom filter:

- > Click the column header arrow next to a field header, in this example, **Hobby**. **1**
- > Click **Text Filters**, **2** and then click **Custom Filter**. **3**
- > In the **Custom AutoFilter** window, in the text box, type "**photography**". **4**
- > Click **OK**. **5**
- > Only those records whose **Hobby** field contains the word photography are displayed. **6**

**1** Click the column header arrow next to a field header, in this example, **Hobby**.

**2** Click **Text Filters** and then click **Custom Filter**.

**3** In the **Custom AutoFilter** window, in the text box, type "**photography**".

**4** Click **OK**.

**5** Only those records whose **Hobby** field contains the word photography are displayed.

**6** The spreadsheet displays only the records where the **Hobby** field contains the word photography.

Notice the options in the drop-down list. The filter names are self-explanatory.

You can try out different filters to notice what effect they have. You can also apply another filter in another field of your database to filter your records even more.

There are many other filters apart from "contains" which you can use depending on what you want to display.

Name	Telephone	Home Address	Email Address	Birthday	Hobby
Stella	(+212) 500123	2048 Central Avenue	stella.bacademy@outlook.com	23 June	drawing
Tom	(+212) 500202	36 Cambridge Court	tom.bacademy@outlook.com	2 April	photography
Kim	(+212) 500441	22 Alfred Drive	kim.bacademy@outlook.com	24 January	reading
Marco	(+212) 500432	44 Woodrow Way	marco.bacademy@outlook.com	31 July	playing football
Lisa	(+212) 500202	36 Cambridge Court	lisa.bacademy@outlook.com	17 May	photography
Alex	(+212) 500516	202 Newport Lane	alex.bacademy@outlook.com	2 April	blogging

Name	Telephone	Home Address	Email Address	Birthday	Hobby
Tom	(+212) 500202	36 Cambridge Court	tom.bacademy@outlook.com	2 April	photography
Lisa	(+212) 500202	36 Cambridge Court	lisa.bacademy@outlook.com	17 May	photography

## Hands on!

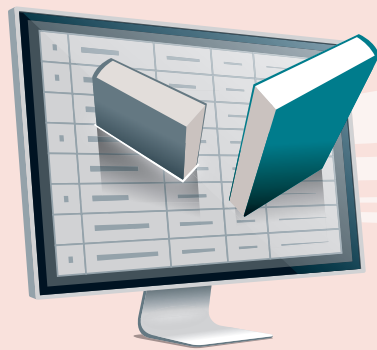
Remember the music database you created? It's time to do some sorting and filtering! Sort your records based on the Release Date field, from oldest to newest. Then apply a filter on that field to check if your favorite artist released any albums the year you were born. If no records are displayed, try another filter to check if any albums were released on your birthday, without considering the year.

# Project

## Create a database

Let's create a database for your school's library. Form teams and get down to business!

1. Think about what tables you need for such a database.
  1. Assume that students can borrow books from the library. You will need to have information on books, students, borrowing rules, and whatever else you can think of that would be useful for the operation of this library.
  - > Design your database on paper first. Decide on the tables you want to include and their names. Then, write down the names of the fields in each table. Now, think about what the relationships between the tables are going to be.
  - > Try to implement what you have learned about primary keys and relate your tables in the best way you can think of.
  - > Once you have designed your database tables and fields on paper, visit your school's library, and gather sample data to fill your tables.



2. Finally, based on what you have learned, use your database design and sample data to create a database in Microsoft Excel.
  - > Once you have completed your database, think of five questions that someone may typically ask the librarian and demonstrate how you can use your database to answer them.
  - > Use sorting and/or filtering to answer the questions.
  - > For example, how can you use your database to find out if the library has the book *"Gone with the Wind"* by Margaret Mitchell?
  - > Or, can your database tell you if a particular student has borrowed a particular book?

# Wrap up

**Take a moment to reflect on your progress.**

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

- > Describing a database and its purpose.
- > Creating a database table with various fields.
- > Organizing and formatting data in a database table.
- > Designing a simple database for specific needs.
- > Applying filters to display specific records in a spreadsheet application.
- > Sorting data alphabetically or numerically in a spreadsheet application.
- > Using multilevel sorting to organize data.
- > Creating custom filters based on specific criteria.
- > Explaining what a primary key is and describing its purpose in a database.
- > Using ID fields to ensure each database record is unique.
- > Describing different types of database relationships.
- > Creating primary keys and establishing table relationships.
- > Exporting contacts from an email service.
- > Importing contact data into a spreadsheet application from a CSV file.
- > Explaining the importance of organizing contact information.
- > Creating and managing a contact database in a spreadsheet application.
- > Using a data logger to collect data.
- > Identifying the purpose and functionality of data loggers.
- > Transferring, visualizing, and analyzing data using software tools.

## Key Terms

CSV

custom filter

data

database

data collection

data logger

export

field

filter

ID field

import

information

many-to-many

multilevel sorting

one-to-many

one-to-one

primary key

record

relationship

sort

table

# Databases

## From chaos to clarity

How do people organize massive amounts of information—like contacts, schedules, and inventory—so effortlessly? Imagine having the power to create, manage, and make sense of complex data, making life easier for yourself and others.

**Skills and Pathways: Databases** introduces you to the essentials of managing structured information. You'll start with data collection and organization, learning foundational skills like filtering, sorting, and establishing relationships between data points. As you progress, you'll dive into practical applications, exploring structured data entry, report generation, and data importing/exporting.

By the end, you'll have the skills to design and manage databases with confidence—and be ready to earn a credential that shows you're not only organized but also a pro at handling and analyzing data.