# Data Representation

# Data Representation

- Refers to the **form** in which data is stored, processed, and transmitted.
- **Data** – information processed or stored by a computer.

- Text documents
- Images
- Audio clips
- Software programs

***Data Representation*** refers to the form in which data is stored, processed, and transmitted.

# Data Representation

- Computers are programmed using **machine code** or **object code** that are executed by the **central processing unit**.
- **Machine language –** is a collection of binary digits or bits that computer reads and interprets.

# Data Representation

- Back in the day, computers used light bulbs to provide output. They take too much space and difficult to store data. Turning off will make you lose all your data.
- Computer nowadays stores data by **holding electrons in capacitors**.

# Data Representation

How does data representation work on computers?

- Every time we input and transmit data using input devices,

➢ The data is **converted** to a machine code through the central processing unit,

➢ **Stores temporarily** to the random-access memory and is

➢ **Interpreted** to the output device to print/read the data.

# Data Representation

- **Digitization** is the process of converting information, such as text, numbers, photo, or music, into digital data that can be manipulated by electronic devices.
- The ***Digital Revolution*** has evolved through four phases, beginning with big, expensive, standalone computers, and progressing to today's digital world in which small, inexpensive digital devices are everywhere.

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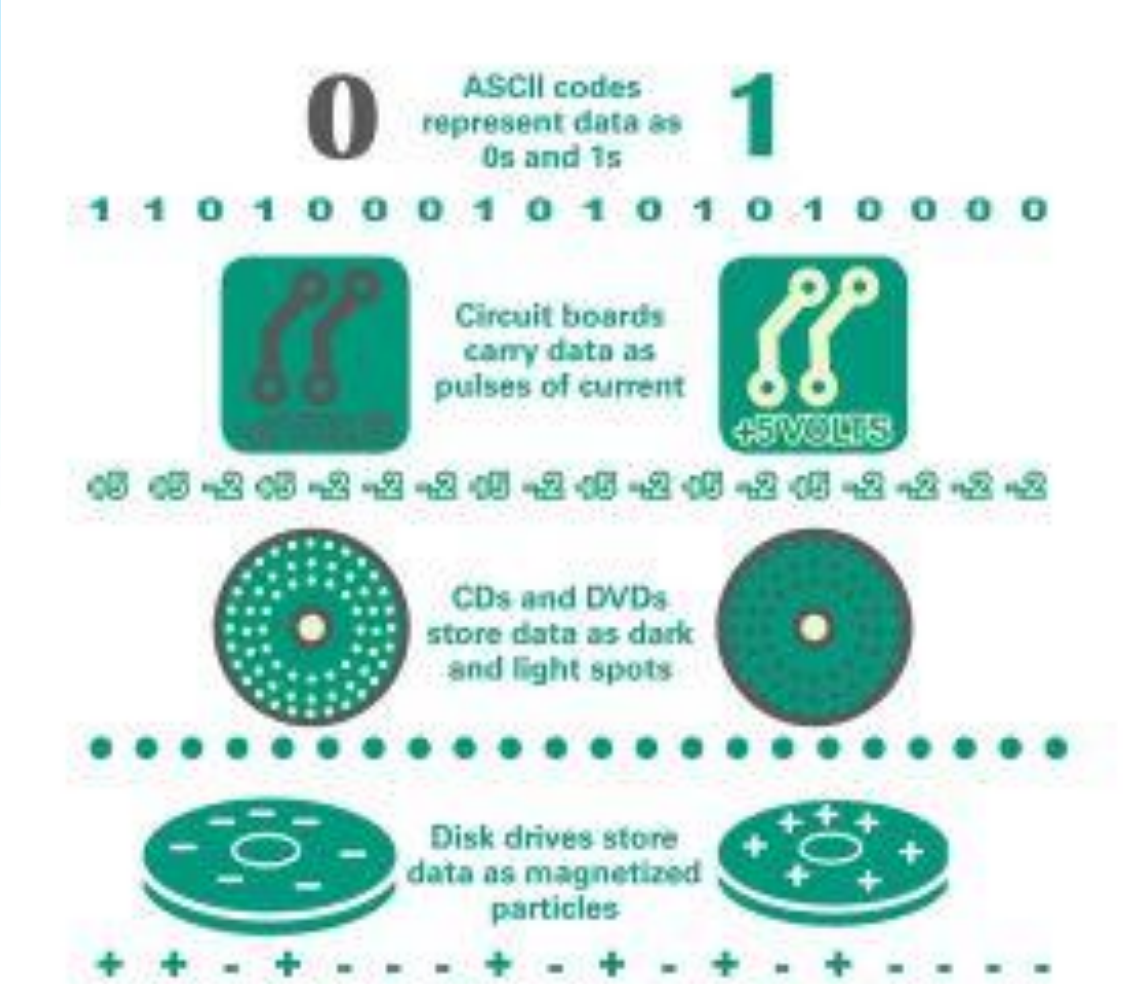
# Data Representation

- The 0s and 1s used to represent digital data are referred to as binary digits — from this term we get the word bit that stands for binary digit.
- A bit is a 0 or 1 used in the digital representation of data.

# Data Representation



# Representing Numbers

- Numeric data consists of numbers that can be used in arithmetic operations.
- Digital devices represent numeric data using the binary number system, also called base 2.
- The binary number system only has two digits: 0 and 1.
- No numeral like 2 exists in the system, so the number “two” is represented in binary as 10 (pronounced “one zero”).

# Representing Numbers

| DECIMAL (BASE 10) | BINARY (BASE 2) |
|---|---|
| 0 | 0 |
| 1 | 1 |
| 2 | 10 |
| 3 | 11 |
| 4 | 100 |
| 5 | 101 |
| 6 | 110 |
| 7 | 111 |
| 8 | 1000 |
| 9 | 1001 |
| 10 | 1010 |
| 11 | 1011 |
| 1000 | 111110000 |

# Bites and Bytes

- All the data stored and transmitted by digital devices is encoded as ***bits***.
- Terminology related to bits and bytes is extensively used to describe storage capacity and network access speed.
- The word **bit**, an abbreviation for **binary digit**, can be further abbreviated as a **lowercase *b***.
- A group of *eight bits* is called a **byte** and is usually abbreviated as an **uppercase *B***.

# Bites and Bytes

- When reading about digital devices, you'll frequently encounter references such as 90 kilobits per second, 1.44 megabytes, 2.8 gigahertz, and 2 terabytes.
- ***Kilo, mega, giga, tera,*** and similar terms are used to quantify digital data.

# Bites and Bytes

- Use bits for data rates, such as Internet connection speeds, and movie download speeds.
- Use bytes for file sizes and storage capacities.
- 104 KB: Kilobyte (KB or Kbyte) is often used when referring to the size of small computer files.

# Data Compressions

- To reduce file size and transmission times, digital data can be compressed.
- ***Data compression*** refers to any technique that recodes the data in a file so that it contains fewer bits.
- Compression is commonly referred to as “zipping.”

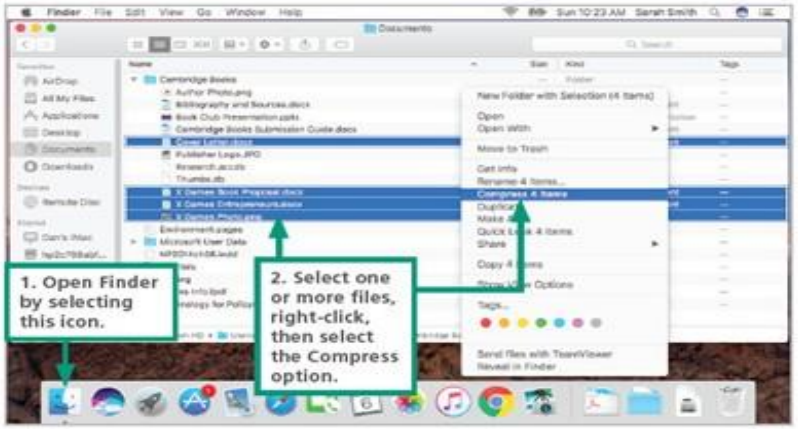
# Data Compressions

- Compression techniques divided into two categories lossless and lossy
- **Lossless compression** provides a way to compress data and reconstitute it into its original state uncompressed data stays the same as the original data
- **Lossy compression** throws away some of the original data during the compression process; uncompressed data is not the same as the original.

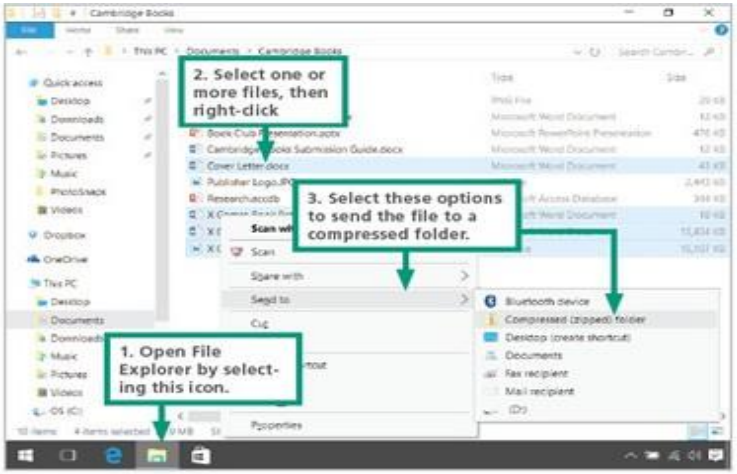
# Data Compressions

- Software for compressing data is sometimes referred to as  a compression utility or a zip tool.
- On laptops and desktop computers, the compression utility  is accessed from the same screen used to manage files.

FIGURE 1-8: COMPRESSING FILES

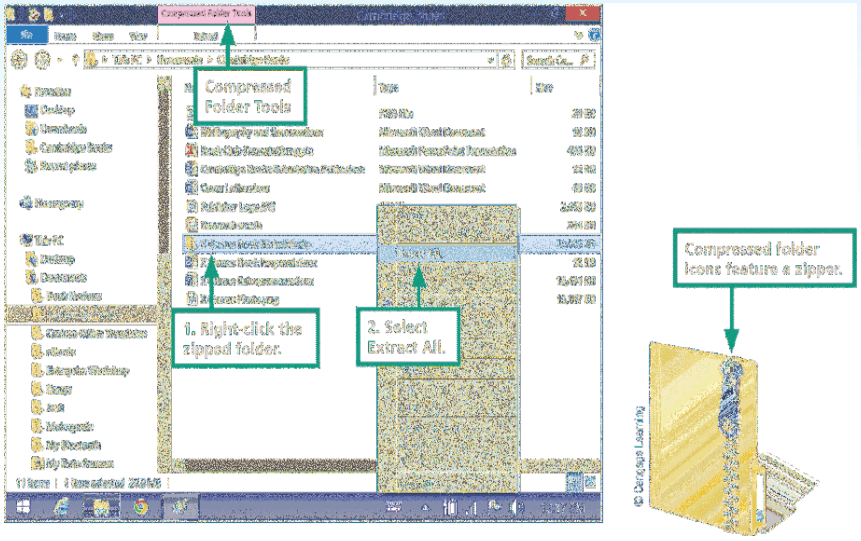



Compressing files using Finder on a Mac




Compressing files using File Explorer on a PC

# Data Compressions




- The process of reconstituting files is called extracting or unzipping.
- Compressed files may end with a .zip, .gz, .pkg, or.tar.gz.