

Homework

Background information

How are binary digits **stored** and **processed** in digital devices?

Electronic components

Examples: processors (CPU, GPU), main memory (RAM), some storage devices (flash drives, SD cards, solid state disks).

In electronic components, 0s and 1s are represented by the **flow of electricity**, controlled by **interconnected switches**.

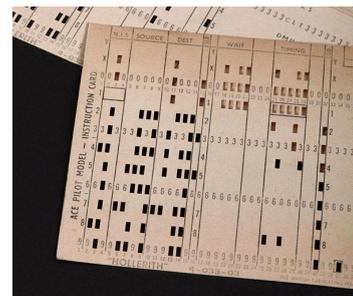


The past

Perforated paper

Perforated paper (in long strips or cards) was used for storing programs and data.

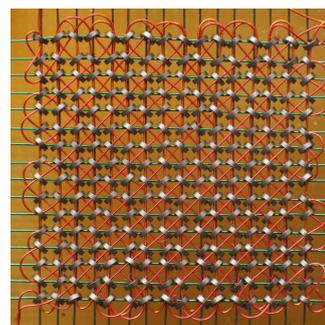
0s and 1s were represented by the presence or lack of **holes in paper**.



Magnetic core memory

The cores were metal rings, connected with wires. Each ring (core) stored one bit. **Electricity** was used for writing and reading the information in the cores.

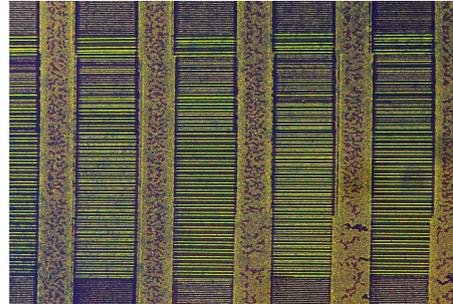
0s and 1s were represented by the way in which each core was **magnetised**.



Hard disks

Hard disk: 1TB = 8 trillion binary digits

The material on the surface of hard disks is **magnetic**. 0s and 1s are represented as changes in the **magnetic orientation** (N-S or S-N) of individual regions on the surface.



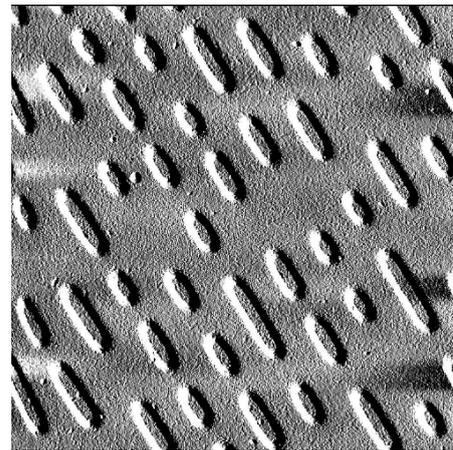
Optical disks

CD: 700MB = 5.6 billion binary digits

Examples: CDs, DVDs, and Blu-ray Discs.

The surface of optical disks is **reflective**. 0s and 1s are represented by **pits** (microscopic holes) or **lands** (regions without holes).

Light is used to read the binary digits off the surface of the disk.



How are binary digits **transmitted** between digital devices?

Wired connections

Binary digits are transferred through **wires** using **electricity**.

Binary digits are transferred through **fibre-optic cables** using **light**.



Wireless connections

In all **wireless** communications, binary digits are transferred using **electromagnetic waves**, transmitted and received by antennae.



Study the background information provided on these pages and answer the questions below.

If required, you could investigate further, searching for relevant resources on the internet.

Questions Where are the 0s and 1s?

- Q1. What do **electronic circuits** use to represent and process binary digits?
- A. Sound
 - B. Light
 - C. Electricity
 - D. Magnetism
- Q2. What do **hard disks** use to represent and process binary digits?
- A. Sound
 - B. Light
 - C. Electricity
 - D. Magnetism
- Q3. What do **optical disks** (such as CDs, DVDs, and Blu-ray Discs) use to represent binary digits?
- A. Sound
 - B. Light
 - C. Electricity
 - D. Magnetism
- Q4. Which of the following are used to **transmit** information between digital devices?
(Select all of the answers that you believe to be correct. There may be more than one.)

For each of the options that you select, provide a specific example:

- Sound Example:
- Light Example:
- Electricity Example:
- Magnetism Example:
- Water Example:
- Electromagnetic waves Example:

Questions Prefixes

Project Gutenberg is a digital library. Its website allows users to download books that are in the public domain (i.e. they are not restricted by intellectual property rights).

You find and download a classic work of English literature. It is 720KB (kilobytes) in size.

Q5. How many **bytes** is 720KB (kilobytes)?

- A. 720 bytes
- B. 90 thousand bytes
- C. 720 thousand bytes
- D. 5,760 thousand bytes
- E. 720 million bytes

Q6. How many **bits** is 720KB (kilobytes)?

- A. 720 bits
- B. 90 thousand bits
- C. 720 thousand bits
- D. 5,760 thousand bits
- E. 720 million bits

BBC Radio allows users to download and listen to podcasts (audio files containing anything from news to theatrical plays).

You download your favourite podcast, which is exactly 24,763,158 bytes in size.

Q7. Which unit would you find most appropriate to describe this size of 24,763,158 bytes?

- A. Kilobytes
- B. Megabytes
- C. Gigabytes
- D. Terabytes

Explorer task Prefixes

Go through some of the files on your computer. Locate and write down the size of different types of files (if you have this kind of file):

- The size of a document
- The size of a book
- The size of an image
- The size of a sound or a song
- The size of a video file
- The size of a program – this may vary wildly, but you could try downloading an installer program or a free operating system from the internet and check the size of the file that you have downloaded

These sizes are always expressed in bytes, using an appropriate prefix. You can convert all of these quantities to plain bits, to appreciate their size and be able to perform comparisons.

Explorer task Large quantities in our devices

Note down the model of your computer, laptop, tablet, or mobile phone. Perform an internet search for their ‘technical specifications’. You should be able to find and write down:

- The size of their main memory (RAM)
- The size of their storage devices (hard disks, solid state disks, SD cards, etc.)
- In some cases, the graphics card/chip may have a separate memory component, and you can also write down its size

These sizes are always expressed in bytes, using an appropriate prefix. You can convert all of these quantities to plain bits, to appreciate their size and be able to perform comparisons.

Explorer task Spreadsheet conversion

If you are interested in slightly more advanced uses of spreadsheets, you can explore how this [conversion spreadsheet](https://ncce.io/rep1-5-rc) works (ncce.io/rep1-5-rc). It can convert a quantity expressed in any unit (bits or bytes), using any prefix (none, kilo-, mega-, giga-, or tera-), into another.

You can examine how the conversion is performed, but it’s also interesting to see how:

- Units and prefixes (for both input and output) are restricted to a specific set of choices, using a drop-down menu: this is one way to ensure that your data is valid (data validation)
- The powerful **VLOOKUP** function is used to look up a prefix in a table and associate it with the corresponding multiple

- Formatting is used to bring out important information and highlight structure

This resource is available online at ncce.io/rep1-5-w. Resources are updated regularly — please check that you are using the latest version.

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