Subject: Computing

Year: 8 – Autumn term

Topic: Computer Systems

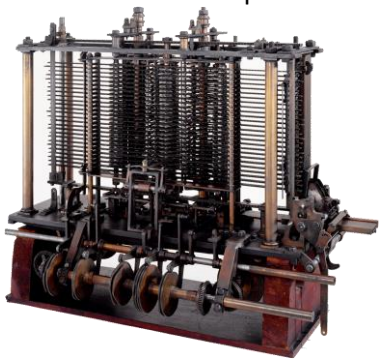
I need to know: the different layers of computing systems: from programs and the operating system, to the physical components that store and execute these programs, to the fundamental binary building blocks that these components consist of. You will also learn about artificial intelligence and open source software.

The Antikythera mechanism

- It was retrieved in 1900 from a Roman shipwreck off the coast of Antikythera island.
- It was constructed in the 1st or 2nd century BC.
- We now know that it was a complex geared mechanism that could predict solar eclipses, as well as the position of the moon and known planets.

Babbage's Analytical Engine

- Babbage (1837) conceived of a programmable machine that would perform calculations, as specified by instructions on punched cards.



Modern computers

- Receive an input , processes it, produces output
- General-purpose: designed to automate any process, as specified by a program
- The data and instructions to be performed can be stored in memory .

Your software

You use programs for every task that you perform on your computer.

- The word **software** simply means **programs**.

The **physical components** of a computing system are called **hardware**. Hardware is any component of a computing system that you can touch

- Processor
- Memory
- Storage
- Graphics processor
- Connections

The **storage** (secondary memory) is the set of components that **stores** programs and data. Storage is **persistent**: it retains its contents when the power is off.

- Hard disk drives (HDD)
- Solid-state drives (SSD)
- USB flash drives
- USB sticks
- SD cards

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The **main memory** is the component that **stores** the programs and data **currently in use**. Memory is **volatile**: its contents are lost when the power is off.

Terminology: The main memory is commonly referred to as **RAM** (random-access memory).

- This is what the main memory looks like in desktops and laptops.
- Sometimes, memory is integrated with other components, rather than being a separate component.

The **processor** is the component that **executes** program instructions.

An instruction may:

- Perform arithmetic or logic operations on data
- Perform input/output of data
- Control program flow

Terminology: Commonly referred to as the **CPU** (central processing unit).

- This is what the processor looks like in desktops and laptops.
- Sometimes, the processor is integrated with other components, rather than being a separate component.

How it works with other components

- Instructions are **fetched** one by one from memory into the processor, along with any required data.
- The processor **decodes** and **executes** each instruction.
- Any resulting data is moved into memory.

The **operating system** is a set of programs that controls the operation* of a computing system.

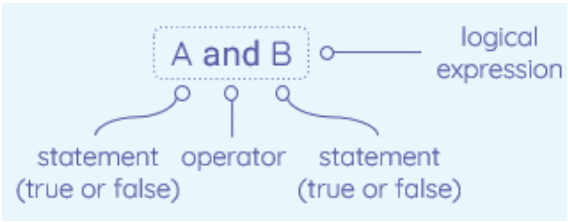
- Program execution
- Memory management
- File system organisation
- Input and output
- Communication
- Graphical user interface

Windows Mac

There are three fundamental logical operations:

- not (inversion)
- and (conjunction)
- or (disjunction)

Logical operations operate on statements that are **true** or **false**.



What is **artificial intelligence**?

- Any machine that performs tasks that typically require intelligence in humans

Applications of AI	Moral considerations
Self-driving cars	Who is responsible in an accident? (Accountability)
Medical diagnosis	How can decisions be explained? (Transparency)
Banking Detecting fraud Approving loan & mortgage applications	How can we guarantee that machine training does not lead to discrimination? (Bias) How can decisions be explained? (Transparency)
Automation Performing tasks instead of humans	How will humans handle lower demand for labour? How will the benefits of AI be fairly distributed?

Challenge: AI Experiments with Google (experiments.withgoogle.com/collection/ai) is an impressive showcase of AI projects that you can explore. Make sure you check out Quick, Draw! (quickdraw.withgoogle.com), which is very well known.