Knowledge Organiser: Computing Systems —Digital Devices

Digital Devices

It is easy to recognise that personal computers, laptops and mobile devices are computers, but computers are also hidden in many more devices. Because they are relied on so heavily, knowing what they are and how to use them is valuable. Digital devices may be input, output or storage devices , however on a basic level, they all operate through

Input Devices

An **input** device is any piece of computer **hardware used to provide data to a computer system.** Examples include:

- keyboard
- mouse
- scanner
- digital camera

Storage Devices

A **storage device** is a piece of computer equipment which can be **used to store data**. Examples include:

- Hard disk drive
- DVD disk
- USB stick
- Memory Card

Output Devices

An **output** device is any piece of computer hardware **used to communicate the results of data that has been processed.** Examples include:

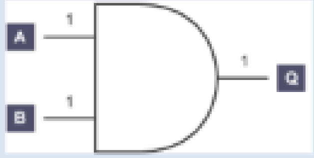
- monitor
- printer
- speaker

What is a Logic Gate

A circuit board can be found inside most digital devices. It is a flat, thin board that has tiny electrical **components** built onto it. Many electronic circuits have to make decisions. They look at one or more **inputs** and use these to determine the **outputs** from the circuit. The process of doing this uses electronic logic, which is based on digital switches called **gates**. Each input and output of the **logic gates** must be one of two states:

True or **1** or **on** **False** or **0** or **off**

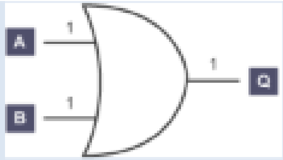
AND



An **AND** gate usually has two inputs. **AND tells us that both Input A AND Input B have to be 1 (or ON) in order for the output to be 1. Otherwise the output is 0.**

The Boolean expression can be written as **Q = A AND B**.

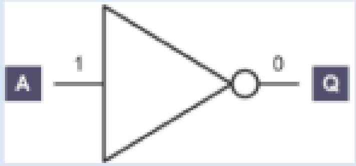
OR



An **OR** gate has two inputs. **OR tells us that EITHER Input A OR Input B has to be 1 (or ON) in order for the output to be 1. Otherwise the output is 0**.

The Boolean expression can be written as **Q = A OR B**.

NOT



A NOT gate has just one input. NOT tells us that Input A has to be 0 (or OFF) in order for the output to be 1. Otherwise the output is 0. A

The Boolean expression is written as Q = NOT A.

Key Vocabulary

Binary	A number system that contains two symbols, 0 and 1. Also known as base 2.
Boolean	A data type in computing which only has two possible values, true or false.
Component	Working parts of a product or system.
Hardware	The physical parts of a computer system, eg a graphics card, hard disk drive or CD drive.
Input	Data which is inserted into a system for processing and/or storage.
Logic Gate	Circuit components which take several inputs, compare the inputs with each other, and provide a single output based on logical functions such as AND, OR and NOT.
Output	Data which is sent out of a system.
Truth Table	Used to assess possible results of a Boolean algebra statement.

Truth Tables

Input A	Input B	Input Q
0	0	0
0	1	0
1	0	0
1	1	1

AND

Input A	Input B	Input Q
0	0	0
0	1	1
1	0	1
1	1	1

OR

Input A	Input Q
1	0
0	1

NOT

KS3 Knowledge Organiser — Computing Systems

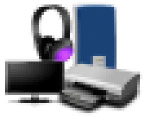
What is a Computer?

"A computer is generally considered to be a programmable machine, often electronic, which takes in data, processes it and then outputs the result".

There are actually a lot of devices that can be considered computers (or at least to contain a computer). A washing machine can be programmed, has buttons to input data, a CPU to process the instructions and motors/valves which produce different outputs. By definition it is therefore a computer.

Input and Output Devices

All of the devices shown on the right are **input devices**. They all send data/instructions to the computer system. For example, the games controller will send directional data/instructions, the scanner will send image data and the microphone will send sound data to the system.



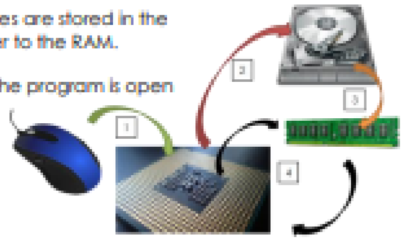
All of the devices shown on the left are **output devices**. They all output information (processed data) from the computer system to the user. For example, the monitor will display images and the speakers will output sound.

Key Vocabulary

Key Word	Definition
Input device	Piece of equipment that helps put data / commands into a computer.
Output device	Piece of equipment that helps get information out of a computer.
Process	Decisions and Calculations made by a computer
CPU	Central Processing Unit
RAM	Random Access Memory
Motherboard	Main circuit board – components are connected to this
Hard drive	The computer's file storage
I/O Devices	The input devices send data to the CPU, the output devices receive information from the CPU.

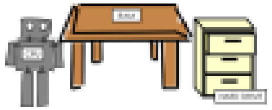
How does a computer actually work?

1. Firstly, when you double click a program's icon, the mouse (input device) sends an instruction (input) to the CPU requesting that the program is loaded.
2. The CPU will decode this instruction and then execute it. Now, because all programs and files are stored in the hard drive, it sends a signal to the hard drive requesting that the program files are copied over to the RAM.
3. The hard drive accepts this request and loads the program onto the RAM.
4. The CPU can now directly access and process the program files, at speed, and as a result the program is open and ready to use by the computer user.



The Office Worker Analogy (comparison)

- Imagine that the office worker is the CPU, their drawers are the hard drive and their desk is the RAM.
- The worker (CPU) has just been asked to do some work by their boss. So, they go to their drawers (the hard drive) to find the relevant documents that they need to work on.
- Now, because the drawer is low down with little space, it is not comfortable to work at those documents while they're in the drawer (hard drive). Work would be slow!
- The worker therefore decides to bring the documents onto the desk (RAM), which is at the right height for working, so that they (the CPU) can carry out their task efficiently, at speed.



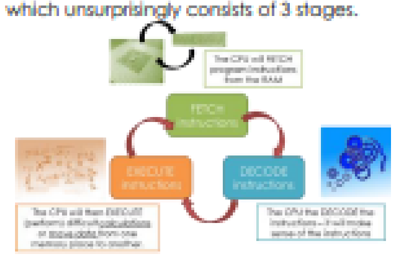
The CPU

- It is known as the brain of the computer.
- Its job is to process data, by carrying out calculations, performing logic and coordinating input and output signals.
- It is located on the motherboard and will often have a heat sink and fan positioned on top of it, to keep it cool, as it gets very hot, when in use!

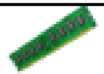
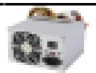
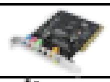
Clock Speed

- The CPU's speed is determined by its clock speed
- This is the number of instructions the CPU can process in one second.
- It is measured in Hertz (cycles per second).
- CPUs currently run at about 3 Gigahertz, which means 3 billion Fetch-Decode-Execute cycles per second!

When the CPU processes instructions, it performs the **Fetch-Decode-Execute** cycle, which unsurprisingly consists of 3 stages.



What's Inside a Computer?

Component	Image	Description
CPU (Heat Sink and Fan)		- Known as the Brain of the computer - Responsible for processing data & instructions - Gets hot very quickly and so often comes with a heat sink and fan to extract the excess heat.
RAM		- The computer's short-term memory. - Stores programs that are currently in use. - Fast data access speeds - Needs electricity in order to store data
Hard Drive		- The computer's long-term memory. - All programs and user files are stored there. - Does not require electricity to store data.
Motherboard		- Large circuit board which connects all of the other components together, allowing them to communicate with one another. - The CPU and RAM actually slot into this component.
Power Supply Unit (PSU)		- Provides the components of a computer with electricity. - Often has a fan to manage the heat that it generates.
Graphics Card		- Contains a GPU which provides extra processing power, specifically for rendering screen images at speed. - Similar to a CPU, it is often accompanied with a heat sink and fan to extract heat.
Sound Card		- Converts digital audio signals to analogue and vice-versa. - Allows the computer to interface with a variety of sound devices.
Network Interface Card		- Converts a computer's data signals into a form that can be transmitted across a network (and vice-versa).