

Operating Systems and Systems Software

Device	What is it?	Input, Output or Storage ?	What it is used for ?
	Monitor	Output	Displaying images and text
	Mouse	Input	Selecting items on a screen
	CD or DVD	Storage	Storing files eg movies
	USB Flash Memory Stick	Storage	Backing up or transferring data from one computer to another
	Keyboard	Input	Creating or editing a document
	Printer	Output	Print Work
	Hard Disk Drive	Storage	Storing applications and files
	Speakers	Output	Hearing system sounds / noises / beeps
	Scanner	Input	Scanning important documents to store digitally
	Sim Card	Storage	Storing mobile phone contacts
	Webcam	Input	Using video calling over the Internet
	Headphones	Output	Listening to music

Key Terms

Hardware	Objects that you can touch, like a keyboard
Software	You cannot 'touch' software. Software refers to the programs that run on a computer. Examples of software: Windows, MS Word, MS Excel, Kodu and Logo.
Input Devices	In computing, an input device is computer hardware which is used to enter data for processing. Examples of input devices include keyboard, mouse, image scanner, digital cameras and joysticks
Output Devices	An output device is any hardware device used to send data from a computer to another device or user. Typical examples of output devices are monitors and projectors (video), headphones and speakers (audio), or printers and plotters
Storage Devices	A piece of computer equipment on which information can be stored.
Peripheral	A peripheral device is defined as a computer device , such as a keyboard or printer, that is not part of the essential computer (i.e., the memory and microprocessor).
Binary	Binary is a number system that only uses two digits: 1 and 0
Operating System	Manages the hardware and software in a computer (E.g. Windows 10).
Systems Software	Software that helps maintain the computer – such as anti-virus or compression ('Zip') software
Applications Software	Everyday programs such as Microsoft Office, web browsers and graphics packages
Optical media	Refers to discs that are read by a laser. This includes CD-ROMs, DVD-ROMs

Computer Systems

Computer systems can be categorised as either: **General Purpose** or an **Embedded systems**.

General purpose computers are devices that have a variety of uses, the user chooses the task for the computer to complete. Eg Mobile Phone.

Embedded systems are more specialised, they can only do a limited number of things, but they do them very well. Eg Coffee Maker .

The start up sequence

CPU	The central processing unit, is a large chip inside the computer. It is the brains of the computer: it controls everything.
RAM (Random Access Memory)	RAM is both readable and writable. You can add, change, and delete data stored in RAM. It is volatile. When the computer is switched off, all the data stored in RAM is lost , It is fast to read/write.
ROM (Read only Memory)	ROM is read-only. ROM is non-volatile memory, which means it does not need power to keep the data inside it.
Hard Drive	The hard drive (sometimes called the hard disk) is the main storage device in your computer. If you have files and folders on your computer, they are stored on the hard drive. The operating system is also stored on the hard drive.
BIOS	Contains all the basic code for controlling your computer hardware (such as keyboards, mice, monitors, and hard drives).

Operating Systems and Systems Software

There are lots of different operating systems. The most popular are:

- Windows
- macOS
- Linux
- Android

Roles of the Operating Systems :

Error handling	When a program fails or encounters a problem, the operating system protects the wider system from crashing.
Program management	Often our computers are running multiple processes at once. The operating system makes sure that each application has enough resources to accomplish its tasks.
Memory management	The operating system controls where each piece of data is stored in RAM.
Interaction with the user	The operating system provides a graphical user interface which makes operating the computer much simpler.
Processor management	Instructions are executed by the CPU, but the operating system controls which instructions are fed in to be executed.
Input and output	The operating system captures data from peripherals and provides data to the output devices to display to the user.
Security	The operating system stops unauthorised individuals from accessing data on secondary storage or the data in memory.
File management	When you save data to your hard drive, the operating system will find an available section of storage and send the data to be written to that location.

Utility Software: Compression software / Encryption software / Defragmentation software / Antivirus Software / Backup tools

Software

Operating Systems

- The operating system is the programme that allows you to interact with your computer
- The operating system and the hardware completes a system of what your computer can do
- There are 2 different types of OS, one is known Microsoft Windows and the other MAC OS
- Microsoft Windows comes preloaded on most Desktop Computers
- Operating Systems does not just come on desktop computers but it can be on smartphones for example Apple IOS and Google Android

Systems Software

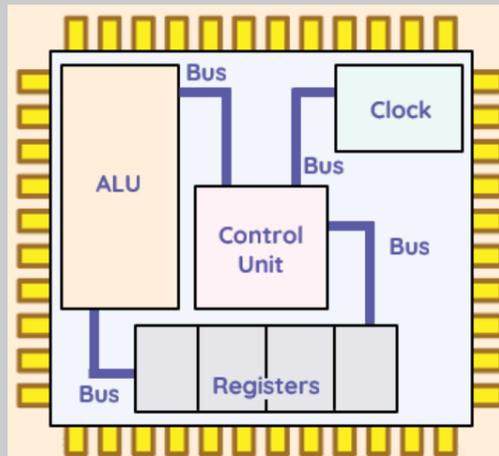
- Type of computer a programme is designed to run a computers hardware.
- System Software controls the computer’s internal functioning chiefly through an operating system.
- Directs the computer to execute commands given by the user.
- It controls peripherals such as monitors, printer etc

Application Software

- A programme or a group of programs designed for end-users
- These application systems exchange data electronically with other applications via a network
- An application systems which normally consists of user interface
- An example of an application system would be photo editor / word processor

PROGRAMS	TYPE OF SOFTWARE
♦ Word processor (Microsoft Word)	♦ Application Software
♦ Anti-virus software	♦ System Software
♦ iOS	♦ Operating System
♦ Compression software (WinZip)	♦ System Software
♦ Disk Cleaner	♦ System Software
♦ File Manager	♦ System Software
♦ Android	♦ Operating System
♦ Windows 10	♦ Operating System
♦ Presentation software (Powerpoint)	♦ Application Software
♦ Web Browser	♦ Application Software

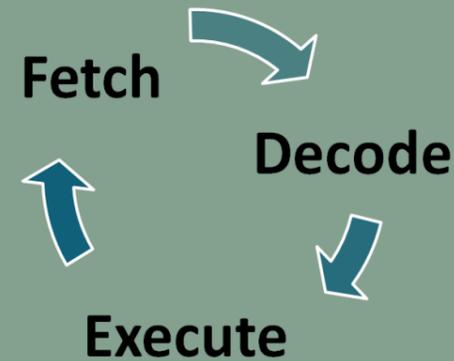
The CPU Key Terms



The Control Unit	The control unit runs the show. It understands the instructions and tells the other components what each instruction needs from them. It manages the instructions, and controls the other components.
Arithmetic logic unit (ALU)	The ALU is the calculator of the CPU. It handles mathematical and logical operations that are required as part of an instruction. It manages calculations and logic.
Clock	The CPU contains an internal clock that is used to regulate the number of cycles carried out per second, and synchronise the other components. It manages the cycles per second.
Registers	These are very small, very fast memory locations located inside the CPU. There are a few key registers. (MAR) Memory address register Stores memory addresses used when searching for data in RAM. (MDR) Memory data register Stores the data when fetched from memory. Current instruction register (CIR) Holds the binary representation of the instruction to be executed. Program counter (PC) This register counts up as each instruction is executed, keeping track of how many instructions are in a program. Accumulator (Acc) Stores important data being used in calculations.

The Fetch-Decode-Execute Cycle

The fetch-decode-execute cycle describes the basic operation of modern computers.



FETCH

Instructions are loaded into memory (RAM) before the processor starts running the program. Each instruction is the fetched from memory (in order), and put into the appropriate registers. The control unit can then access the instruction for the next stages.

DECODE

The binary representation of an instruction needs to be decoded before it can be run. This is the process the control unit uses to work out what the other components need to do. Each processor will have slightly different encodings for instructions.

EXECUTE

Once the instruction is understood, the instruction will be executed. The control unit will tell the other components what they need to do in order for the instruction to work.

Main Memory

RAM	Read and Write Stores instructions and data ready for a CPU to execute Volatile 6–8MB
ROM	Read Only Stores permanent instructions that tell a computer how to 'boot up' Non-Volatile 1–256GB
Virtual Memory	If a program needs more memory than is available, the operating system will reserve some in secondary storage that acts as an extension of main memory.

Secondary Storage

Solid-state storage devices have no moving parts. They store data inside electronic circuits, which can be set to store a 1 or 0. These devices are typically much smaller than magnetic devices. They can have a large capacity, but are more expensive. This type is also called **flash memory**.

Optical storage is most commonly used to distribute media and software — movies and video games for example. This type uses lasers to read and write data on a reflective surface. These devices are typically small in capacity, but very cheap to produce.

Magnetic storage is the oldest form of storage, and has been in use since the 1920s (before computers were available). Data is stored **in series** as polarised dots. The polarity (positive or negative) of the dot determines whether it stores a 1 or 0. These devices come in very large capacities and are generally inexpensive.

Device and capacity	Strengths	Weaknesses
USB 6-32Gb or more	Easily portable, fast, high capacity storage, durable	Easy to lose. Slower than an internal hard disk
INTERNAL HARD DRIVE 1 TB or more	Large storage capacity	Internal hard disks are not portable. External hard disks are not very convenient to carry around and have moving parts so are breakable
OPTICAL DRIVE 4GB to 9GB or up to 50GB for re-writable Blu-ray	Large storage capacity, sound and picture quality excellent, cheap	Easily scratched, too large to fit in a pocket
SD CARD 8-64 GB, typically	Used in portable devices such as cameras	Easily lost. Not good for long term storage – may deteriorate after several years
CLOUD STORAGE Infinite, depending on how much you are prepared to pay	Useful for backup as it is secure, not likely to be lost. Data can be accessed from anywhere, or shared with others	Can be slower to access than data held on a local hard disk

Binary

Binary is a number system that only uses two digits: 1 and 0. All information that is processed by a computer is in the form of a sequence of 1s and 0s. Therefore, all data that we want a computer to process needs to be converted into binary.

The binary system is known as a 'base 2' system. This is because: There are only two digits to select from (1 and 0). When using the binary system, data is converted using the power of two.

8 BIT TABLE

128	64	32	16	8	4	2	1
-----	----	----	----	---	---	---	---

Example Binary To Denary

Q : Convert 0 0 0 1 1 0 0 0 to denary

128	64	32	16	8	4	2	1
0	0	0	1	1	0	0	0
			16	8			

A: 16 + 8 = 34

Example Denary To Binary

Q : Convert 12 to binary

128	64	32	16	8	4	2	1
				8	4		
0	0	0	0	1	1	0	0

A: 0 0 0 0 1 1 0 0

Adding Binary

When two numbers are added together in **denary**, we take the first number, add the second number to it and get an answer. For example, 1 + 2 = 3.

When we add two **binary** numbers together the process is different.

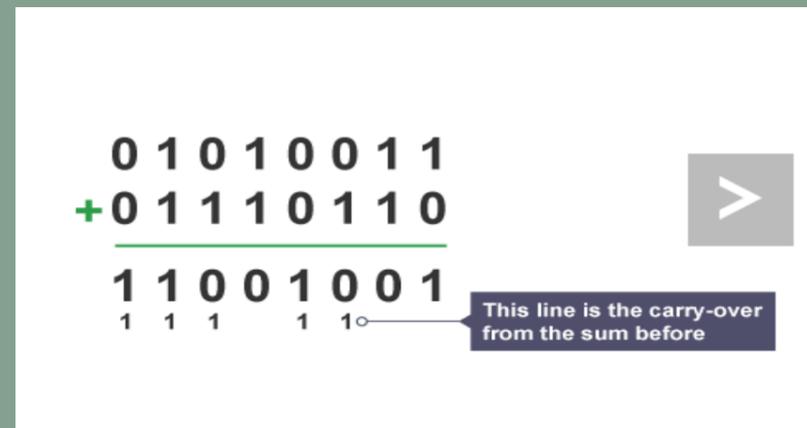
There are four rules that need to be followed when adding two binary numbers. These are:

- 0 + 0 = 0
- 1 + 0 = 1
- 1 + 1 = 10 (said one zero and is binary for 2)
- 1 + 1 + 1 = 11 (said one one and is binary for 3)

Example

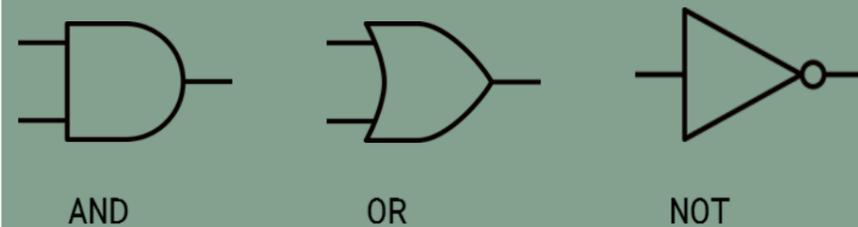
Let's try adding together two binary numbers: 0101 0011 and 0111 0110.

To get to the answer, use the following method:



Logic Gates

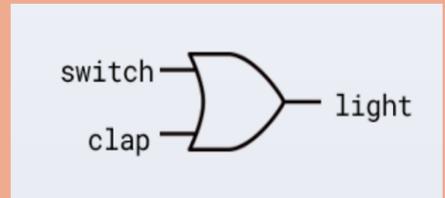
There are **three** fundamental logic gates. These are AND, OR, and NOT.



Truth Tables

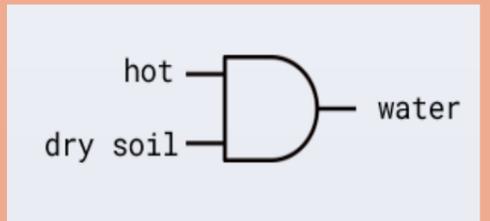
"The light will turn on if the switch is turned or if I clap."

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



"The plants will be watered if it is hot and the soil is dry."

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



"The buzzer will not turn on if the battery is charged."

Input A	Output Q
0	1
1	0

