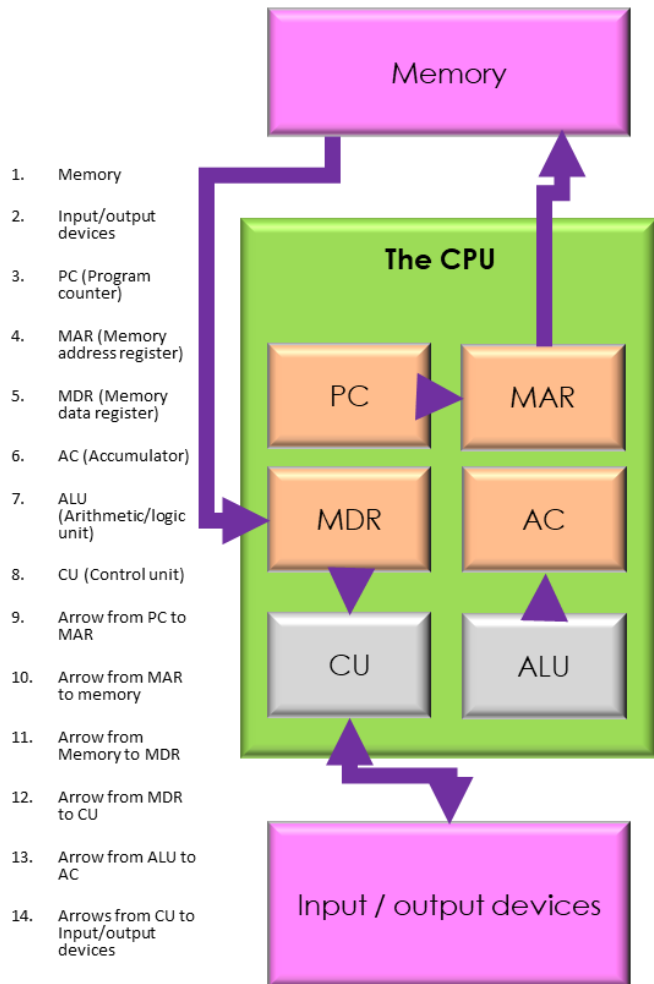


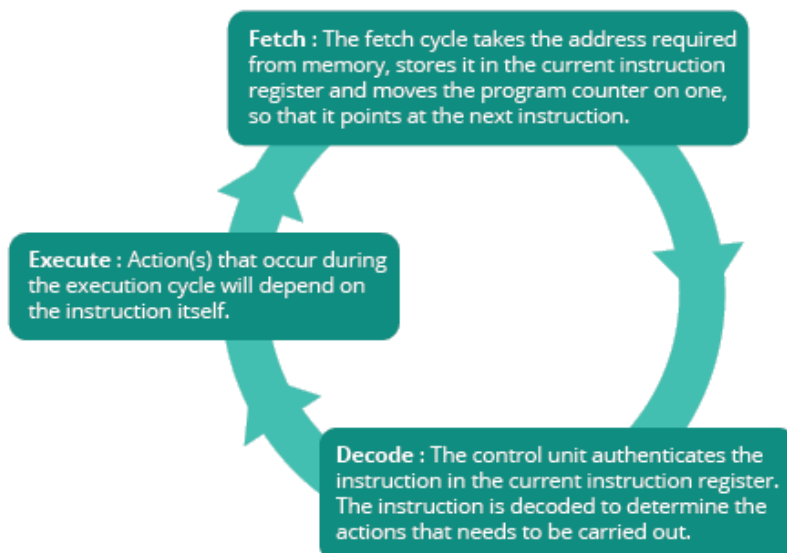
Topic 1 - CPU



Key terminology

Term	Definition
Central processing unit (CPU)	The main component in a computer for processing data and instructions.
Control unit (CU)	Directs the flow of instructions and/or data and coordinates the other parts of the CPU. It generates clock ticks.
Arithmetic logic unit (ALU)	The ALU performs all the mathematical calculations / logical operations in the CPU.
Cache	Incredibly fast, but very expensive volatile memory used by the CPU.
Registers	Fast access storage locations found on the CPU where data or control information is temporarily stored.
Program counter (PC)	A counter that keeps track of the memory address of the instruction to be executed next.
Current instruction register (CIR)	A temporary holding area for the instruction that has just been fetched from memory.
Accumulator (ACC)	A register for temporary storage of arithmetic and logic data in the CPU.
Memory address register (MAR)	Stores the address in the main memory that is currently being read or written.
Memory data register (MDR)	Stores the data in the main memory that is currently being read or written.
Memory	Used for the temporary storage of currently running programs and data.
Clock speed	The number of FDE cycles that a CPU can carry out per second.
Cores	Some processors have multiple processors (cores) which can work in parallel, sequentially or can multitask.

The Fetch-Decode-Execute (FDE) cycle



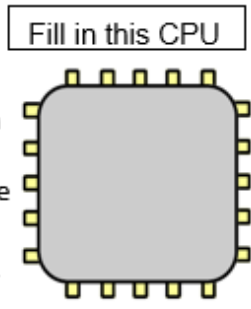
The CPU is the main processing component in a computer system, it is often called the brain of the computer. The CPU has several sub-components:

ALU (Arithmetic Logic Unit)– is the part of the CPU that processes and _____ data. It performs simple calculations on the data that is temporarily stored in the registers. Examples of calculations that an ALU might perform are _____ and subtraction.

Controller - sends and receives _____ from all parts of the computer. This ensures that all processes take place at the right time and in the correct order. These signals _____ along a **control bus**.

Registers – these are storage locations found on the _____ where data or control information is temporarily stored. Registers are usually much _____ to access than internal memory, since they have to be accessed so often.

Internal memory (*sometimes called level 1 cache memory*) is fast access _____ storage on the CPU. Data is moved from the registers to the internal memory when it is not being actively used. Data from internal memory can then either be written to RAM or called back into the registers for further processing. This process of using internal memory _____ up the processing of data.



CPU manipulates travel signals speeds addition faster temporary

Performance is affected by greater

- cache size
- clock speed
- number of cores.

Cache size

- Can store more data and instructions.
- It can provide instructions and data to the CPU at a much faster rate (than other system memory such as RAM).

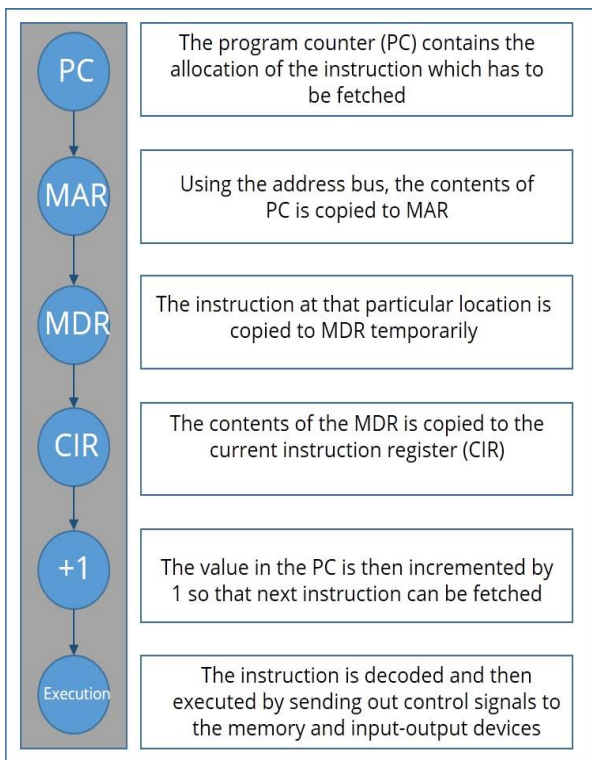
Clock speed

- The FDE cycle will run faster, resulting in more instructions being processed.

Number of cores

- More instructions can be processed at the same time.

NOTE: Performance may be affected where one core is waiting on the result of another and therefore cannot carry out any more instructions.



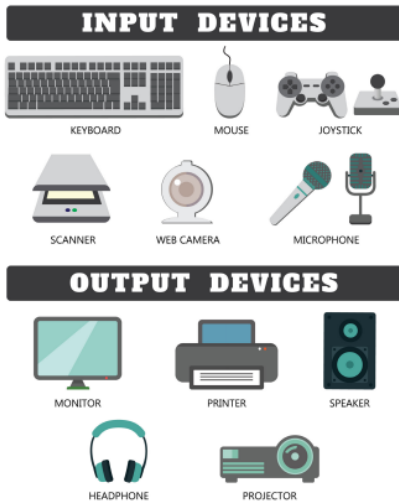
Cover the diagram at the side and describe what happens in the Fetch – Decode – Execute cycle your own words in the space below

What can improve CPU performance? [3 marks]

Key terms

Term	Definition
Input	Data is sent to the computer system using a device.
Output	Data is received from the computer system using a device.
Virtual memory	Data that appears to be stored in main memory, but some of is actually held in secondary storage. Data is transferred between the two automatically as required.
Volatile	Stored data is lost when the power is interrupted or switched off.
Permanent	Stored data is kept when the power is interrupted or switched off.

Input and output devices



Primary storage

Summary of the different types of memory:

Type	Cache memory	Read-only Memory (ROM)	Random Access Memory (RAM)	Flash memory	Virtual Memory
Volatile or permanent	Volatile	Permanent	Volatile	Permanent	Volatile
Data can be changed	✓		✓	✓	✓
Relative speed	★★★★★	★★★★	★★★	★★	★
Example use	The temporary storage of frequently accessed data and instructions.	Storing programs such as the system BIOS.	Storing currently running programs and data.	Storing the programs such as the system BIOS.	Compensates for a main memory shortage by temporarily storing data in secondary storage.

Additional hardware components

Graphics Processing Unit (GPU)		Sound cards	Motherboards
Integrated GPU	Dedicated GPU		
<ul style="list-style-type: none"> Uses the computer's RAM Cheaper than installing a dedicated GPU Generates less heat and uses less power Perfect for general graphics processing such as watching or editing videos and word processing. 	<ul style="list-style-type: none"> Has its own video memory Provides the best visual experience Used by people such as professional graphic designers and serious gamers Uses more power and require a good cooling system. 	<ul style="list-style-type: none"> The sound card will convert analogue input signals into digital data and reverse this process for output. 	<ul style="list-style-type: none"> The motherboard is the main circuit board of the computer.

Secondary storage

	Functional characteristics	Devices	Capacity	Durability	Portability	Speed	Cost	
Solid state	<ul style="list-style-type: none"> A non-mechanical design of semiconductor chips It does not require defragmentation There are two types of solid state memory NOR and NAND 		Flash memory drive	2 GB – 512 GB	★★★★	✓	★★★★	££££
	<ul style="list-style-type: none"> Both contain cells (transistors) in a grid, but the wiring between the cells differs If a chain of transistors conducts current, it has the value of 1. If it doesn't conduct current, it's 0. 		Solid-state drive	128 GB – 4 TB	★★★★		★★★★	£££££
Magnetic	<ul style="list-style-type: none"> Each sector can be magnetised as 1 or demagnetised as 0 Data is read and written using a mechanical arm that has a head at the end In hard disc drives, a platter is divided into billions of tiny areas. As the disk spins, the arm travels across the disk 		Hard disc drive	250 GB – 16 TB	★		★★★	£££
	<ul style="list-style-type: none"> Each sector of the platter can store data and the movement of both the disk and the read / write head means that every sector on the hard drive can be reached. A pit is "burned" with a laser beam into the surface 		Magnetic tape drive		★★	✓	★	£
Optical	<ul style="list-style-type: none"> A pit represents 0 The lack of a pit (a flat, unburned area on the disc, called a land) represents the number 1 Data is stored in a continuous spiral. 		CD / DVD / Blu-ray Drive	CD: 700 MB DVD: 9 GB BD: 50 GB	★★★	✓	★★	££
Cloud storage	<ul style="list-style-type: none"> A technology that allows users to store their data on third-party servers. They can then access that data from many computing devices. 			Unlimited		✓		Free / subscription based

Embedded systems

An embedded system is a combination of software and hardware that performs a specific task whereas a general-purpose computer is designed to carry out multiple tasks.

Examples include - MP3 players, mobile phones, video game consoles, digital cameras, DVD players, and GPS. Household appliances, such as microwave ovens, washing machines and dishwashers.

Cover the answer and above and attempt your own answer - What is an embedded system? [1 mark]

Match up the key terms:

1. Adware	A) Created to provide remote access to a computer without detection. This can allow it to modify system settings and even install other types of malware.
2. Bot	B) Used to track users activity without their knowledge and might use key loggers to monitor actions taken by the user and gain personal information.
3. Ransomware	C) Encrypts the user personal data using strong encryption methods and will demand a ransom to decrypt. This ransom will usually be in the form of a fee.
4. Rootkit	D) These enter users computer as a normal file or program and once downloaded, will perform malicious tasks to steal confidential information.
5. Spyware	E) A type of malware that can copy itself and spread to other users by attaching itself to other files.
6. Trojan	F) This is designed to provide users with advertisements in the form of pop-ups that redirect them elsewhere.
7. Virus	G) A type of malware that needs user actions to spread it and as a result, can continue to spread, exploiting the network and consuming bandwidth.
8. Worm	H) An automated type of malware used to perform DDOS attacks to get access to servers.

What is malware?

How can it be prevented?

What attacks are not mentioned in the list?

What is social engineering?

Match them up

These characteristics are used to decide what type of storage is best suited to a given purpose. Match up the characteristics to correct statement.

1. Capacity	A. This refers to how quickly the data can be read and transferred from the storage device.
2. Cost	B. This refers to how easy is it to transport from one place to another.
3. Speed	C. This refers to how expensive per byte it is.
4. Portability	D. This refers to longevity – how well does it maintain performance over time?
5. Durability	E. This refers to how resistant it is to external factors such as being dropped, scratched and how it responds to being in extreme conditions.
6. Reliability	F. This refers to how much space is available on the storage device.

RAM vs ROM – what is the difference? [4 marks]

3 types of storage technologies

- List and describe them

1.	
2.	
3.	

Amir has a home network that includes two laptop computers, four mobile phones, and two televisions.

Amir wants to protect the computers on his network from threats such as unauthorised access.

The following incomplete table contains a form of attack, description and method of preventing each attack.

Complete the table by writing the missing Forms of attack, Descriptions and Methods of prevention.

Form of attack	Description of attack	Method of prevention
	A program attempting all possible password combinations	
Data interception		
		Anti-virus

What is the difference between cache memory and virtual memory?
