

Big Question: What is meant by CPU performance and do all CPUs perform the same?

S.P.I.R.I.T

- ✓ Independence
- ✓ Perseverance

Monday, 04 April 2022

Learning Intention

To develop knowledge by

Be able to explain that CPU performance is not fixed and is affected by different factors

To secure understanding

Identify key factors that affect CPU performance

To achieve excellence by

Making comparisons between different CPUs according to their cores, cache and clock speed



Latency

The delay before a transfer of data begins following an instruction for its transfer.

CPU performance



Computer performance is the amount of work accomplished by a computer system.

CPU, memory and bus speeds will all affect the **overall speed of a computer.**

If one is significantly slower, then it will slow down the others.

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**CPU's process instructions /data at different rates.
Some are faster than others, some are slower.**

There are certain factors that affect the performance of a CPU

It is difficult to assess the performance of a CPU because a computer might excel at some tasks but not do so well at others.

For example, a computer that is going to be used for gaming will require the best combination of hardware to handle intensive graphics quickly.

The same computer might not perform so well if it was used to analyse vast amounts of scientific data.



Here are 3 key factors about CPU architecture
that affect its performance:



Explain that performance is affected by:

- o size of cache
- o speed of clock
- o number of cores

Task: In your books, write a couple of sentences explaining that :

- CPUs do not all perform the same
- What factors can affect a CPUs performance

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Speed of clock

- The speed at which a processor operates is called the **clock speed**.

- The speed of the processor is measured in **Hertz (Hz)**.

Clock speed higher	Clock speed lower
faster performance but runs hotter and consumes more power.	lower performance, less costly, needs less power - so good for battery life in laptops.

- One clock tick per second would be measured as 1 Hz.

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- A processor that operates at **1,000 clock ticks** per second would be a 1,000 Hz processor, also known as a **1 kHz processor.(Kilohertz)**
- **1GHz (gigahertz)** processor has 1 billion clock ticks per second



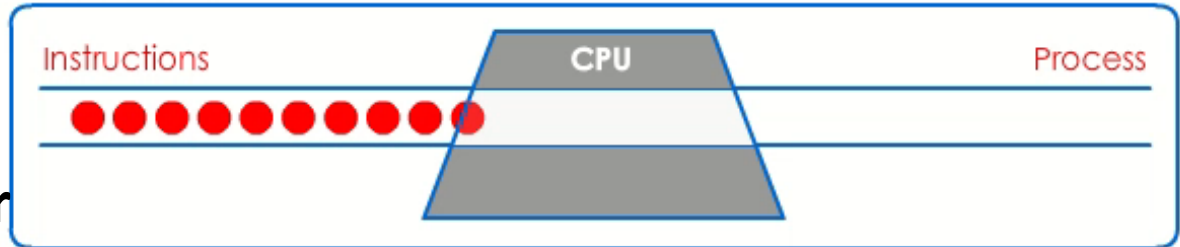
Speed of clock

- The faster the clock speed, the faster the computer is able to run the fetch-decode-execute cycle and therefore **process more instructions**.
- The faster the clock speed, the more power is generally required which creates **more heat** and can **place more strain on battery life**.
- Impact on temperature can be damaging.

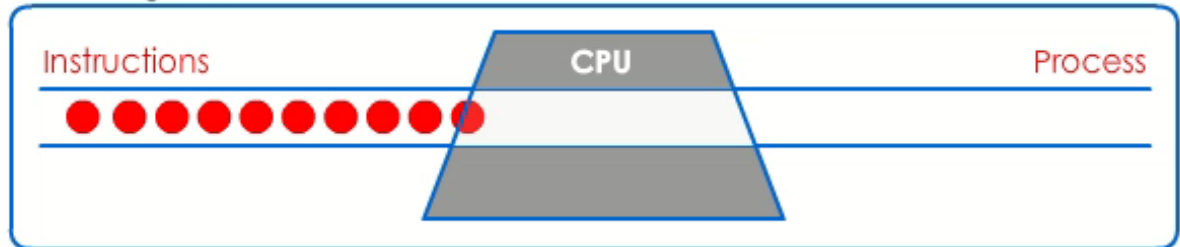
[Clockspeed.swf](#)

To secure understanding Identify key factors that affect CPU performance

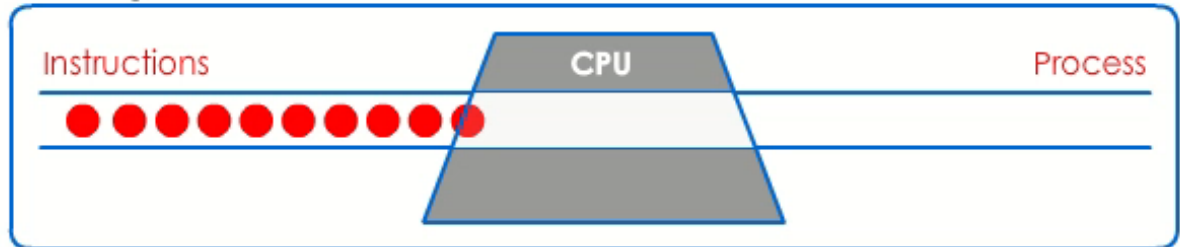
kHz Kilo Hertz



MHz Mega Hertz

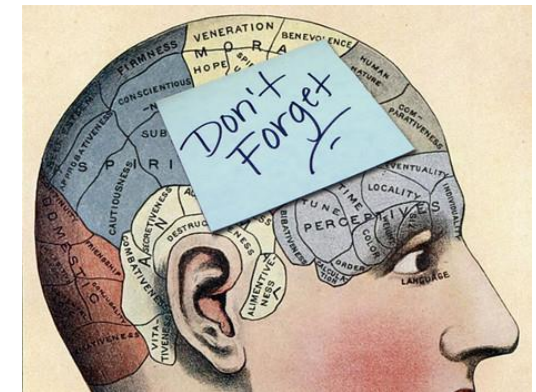
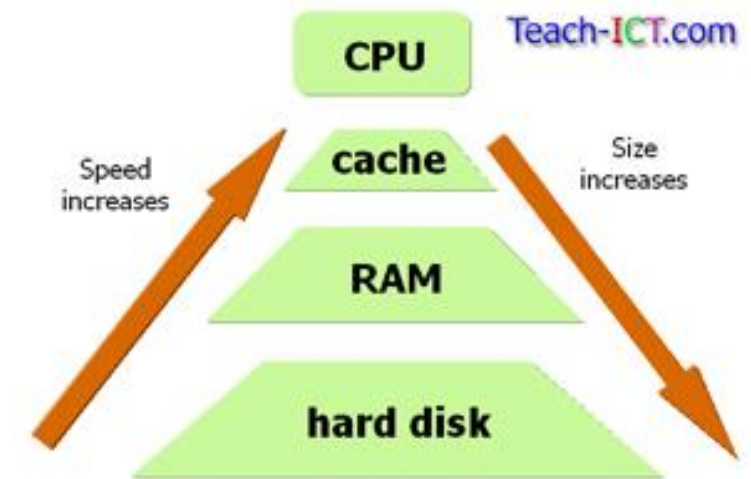


GHz Giga Hertz



Size of cache

- **Fast access memory** that is **very expensive**. Due to its cost, only small amounts of cache memory are present in most computer systems.
- Cache memory improves the performance of the CPU as it is able to provide instructions and data to the CPU at a much faster rate than other system memory such as RAM.
- More cache memory will allow more instructions that are repeatedly used by a CPU to be stored, and therefore increase the hit rate; increasing performance as a result.



To secure understanding Identify key factors that affect CPU performance



Number of cores

- A **core** is the term used to describe the processing components within the CPU.
- A core contains an **ALU, control unit and registers**.
- **Multi-core processors** therefore have **many processing components within the same CPU**.
- In a **single-core CPU** each instruction is processed one after the other

A **dual-core CPU**, has 2 cores. This means **two instructions may be processed at the same time**. In theory, a dual-core CPU should be able to process instructions twice as fast as a single-core CPU.

To secure understanding Identify key factors that affect CPU performance

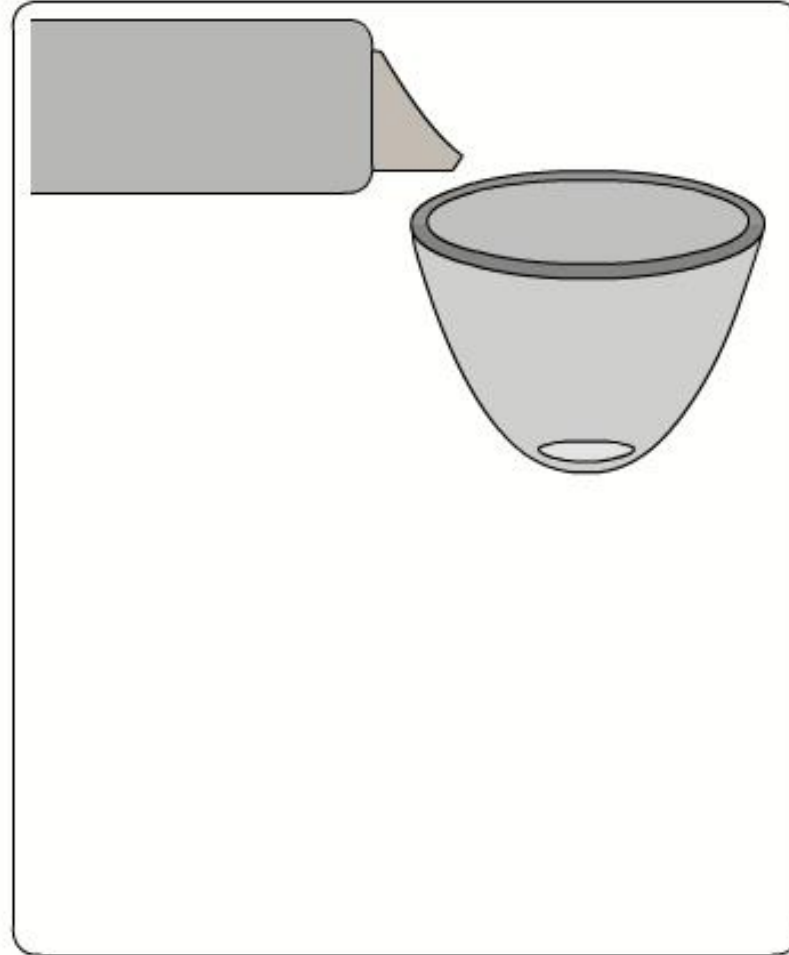


Cores

Multi-core execute
Single-core



[1.3.b Multi-core execute.swf](#)



8 instructions :
3.5 seconds

Single-core

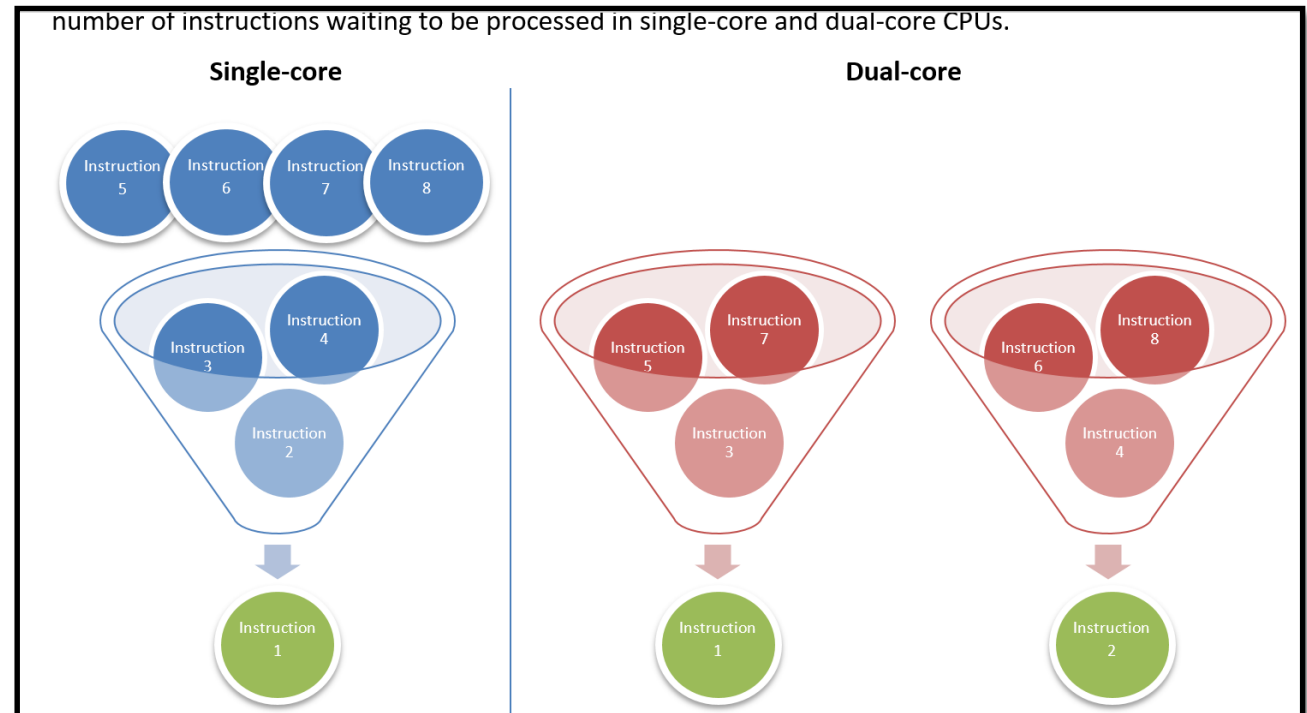
Dual-core

Quad-core



Number of cores

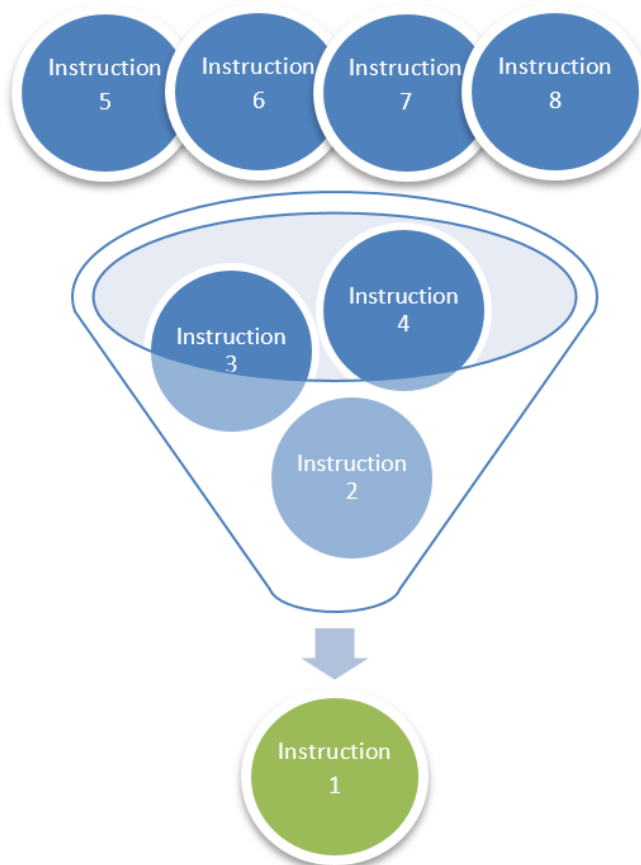
- More cores, means more instructions can be processed **AT THE SAME TIME**
- Performance may be affected **where one core is waiting on the result of another and therefore cannot carry out any more instructions**, leading to the performance being no better than a single core processor.
- However multiple cores increase processor cost.



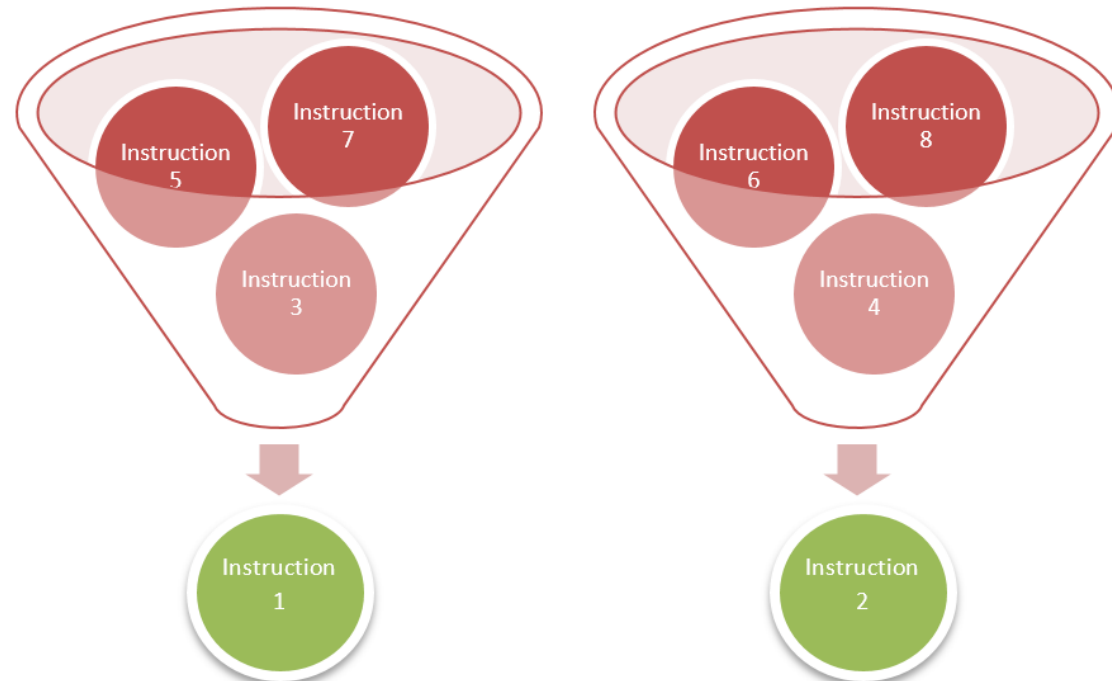
Number of cores

number of instructions waiting to be processed in single-core and dual-core CPUs.

Single-core



Dual-core



Tasks

1. Glue in the performance questions
2. Neatly answer them in the book
3. Glue in the core diagram **and** write an explanation of what's happening

THINK IT: Rank the CPUs in order of which is best to worst. **You must justify your choice**

CPU	Clock speed	Cores
CPU1	2.8 GHz	2
CPU2	3.5 GHz	6
CPU3	3.4 GHz	4

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