OCR A Level Computer Science

Your notes

6.5 Thinking Concurrently

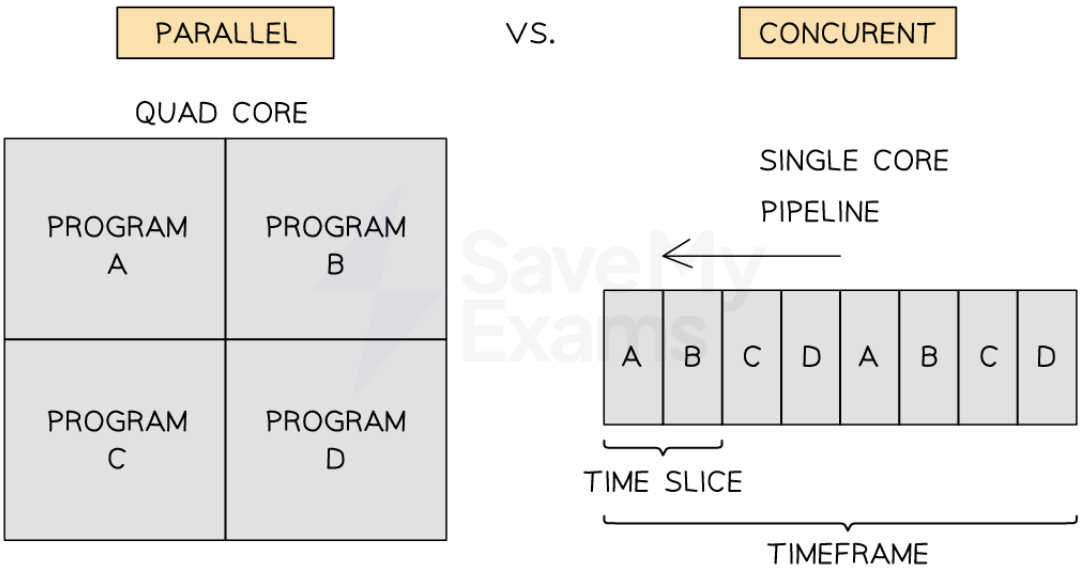
Contents

Your notes

Determine the Parts of a Problem That Can Be Tackled at the Same Time

What is Concurrent Computing?

- **Concurrent computing** is usually confused with parallel computing, especially when both terms are often used interchangeably. While both are related, they are distinct
- **Concurrent computing** allows **multiple processes/tasks** to run on a **single processor** by giving each process a **fraction of time** and **control** over the **processor** before swapping to another process
- **Parallel computing** is where **multiple processes** are **run at the same time** over **multiple processor cores** to enable faster computations
- To fully understand **concurrent processing**, it is important to imagine a world where **time slices** are not allocated to processes. Each process finishes to completion before another process can be run. Practically, if someone wishes to play a game while a virus scan is running, they will have to wait until the scan is complete before they can play
- In a world with **concurrent processing** the virus scan is allocated a few microseconds of **execution time**. The game is then allocated a few microseconds of **execution time**, before swapping back to the virus scanner. As human brains have very slow information processing speeds, the effect looks simultaneous but in actuality is **sequential**
- Modern programs, such as photo and video editing software and more commonly AAA games, make use of **parallel computing** to complete **multiple tasks at the same time** to improve running speed and maximise resource usage and efficiency



Your notes

- In order to determine parts of a problem that can be tackled at the same time, developers must consider **dependencies**
- **Dependencies** are **tasks that rely on other tasks** in order to either **start or complete**
  - **Example 1** - A roofer cannot put a roof on a house if the walls aren't fully built, and walls cannot be built unless the foundation is in place
  - **Example 2** - A persons taxes cannot be calculated until all of their income has been input and all deductibles taken into account
- When running a **batch program** on a set of data, such as an analysis of climate data or a companies departmental finances, if data sets do not **relate**, **rely** or **interact** with each other they can be run in **parallel** on **multiple cores**
- Running such programs on **multiple cores** increases **time efficiency** while also **maximising resource usage**
- If multiple different **batch programs** need to be run they can be **interchanged** and **pipelined** using **concurrent processing** on the same processor. This will allow multiple programs to make progress in a **shorter time frame**

Concurrent Processing

Your notes

Benefits & Drawbacks of Concurrent Processing

Advantages and Disadvantages of Concurrent Processing

Advantages	Disadvantages
Increased program throughput as the number of tasks completed in a timeframe are increased. For example, ten programs could be half finished versus two that may finish to completion	If large numbers of users or processes are running that involve high quantities of computation, these processes will take longer to complete as each is allocated a certain timeslice
Time spent waiting for user input or react to output is minimised by swapping to another task and waiting for an operating system interrupt before swapping back to the waiting task	

Examiner Tips and Tricks

It is important to note that some operating system scheduling algorithms can prioritise some concurrent processes over others, meaning larger processes could finish sooner

Advantages and Disadvantages of Parallel Processing

Advantages	Disadvantages
When performing repetitive calculations on large quantities of data such as image or video editing, parallel processing can speed up performance by splitting processes over several processors	Different processors running programs simultaneously may need to communicate, leading to overhead and delays on processing

Graphical processing units can render 3D objects quickly by splitting the computations of a scene between multiple cores	Some tasks may run faster or may be optimised to run on a single processor rather than multiple processors
Multiple different programs or browser web pages can run on different processors at the same time	


Your notes

Worked Example

A flight simulator allows a user to take control of a simulated aeroplane. The user can fly the plane in an environment that can simulate different weather conditions and additional planes in the sky.

Explain what is meant by 'concurrent processing' and describe one example of how the simulator could make use of it.

4 marks

Answer:

Concurrent processing is where multiple processes are allocated timeslices of processor time and are pipelined to allow multiple processes to make progress in the same time frame. **[1]**

Example:

An example of concurrent processing in a simulator would be the plane moving independently of other planes or weather conditions **[1]**. Individual planes or weather do not always interact with each other allowing them to operate separately **[1]**. This allows multiple objects and events to occur in the program "at the same time" and react to different events **[1]**

Examiner Tips and Tricks

Remember to state your example, say how it acts concurrently and why it is necessary that it is concurrent