

Specification & learning objectives

<u>A Level</u>	<u>Specification point description</u>
2.1.5a	Determine the parts of a problem that can be tackled at the same time
2.1.5b	Outline the benefits and trade-offs that might result from concurrent processing in a particular situation

Resources

PG Online textbook page ref: 275-276

Hodder textbook page ref: 31

[CraignDave videos for SLR 22](#)

Determine the parts of a problem that can be tackled at the same time.

This is a particular skill in ensuring that a solution is completed within the minimum amount of time. Often small teams will concentrate on two or more independent jobs that can be tackled simultaneously.

Effectively the paths are separate until they need to be combined. Using our data entry example, one part may be the data entry using the barcode reader while the validation routines can be written.

The barcode reading will eventually give the input code to the validation routine, but they can be independently written until they need to be combined provided there is a clear understanding of what the barcode reader is to produce.

This is why the skill of thinking ahead is so important; it would be no good if the barcode reader code produced the wrong type of input for the validation routine.



Outline the benefits and trade-offs that might result from concurrent processing in a particular situation.

Depending on the situation there are various benefits and trade-offs for concurrent development. As has been mentioned previously, the most common benefit is the **speed** at which a solution can be developed; however care, must be taken in communication between teams to ensure that the different parts are compatible when combined together.

The same is true when concurrent processing is performed. Solving a problem that can process concurrently can be difficult, especially if the two processes will need combining together. There is the issue of **waiting for one process to finish** and how the data will interact.

Often concurrent processing is programmed where two processes can occur independently; for example, writing a routine which allows a report to be printed in the background while the user can continue using the program is a very good way of concurrent processing, as the processor can print while it is waiting for the user response and the two processes do not need to wait for each other to solve the problem.

Outline the benefits and trade-offs that might result from concurrent processing in a particular situation.

- ✓ Increased program throughput.
- ✓ Processor time not wasted.
- ✓ Several tasks performed at the same time.
- ✓ Huge performance increase for graphics processing.

- Potential slow down if a users requests similar action.
- Overhead associated with using more than one processor/core.

Typical exam questions

A programmer is developing an ordering system for a fast food restaurant. When a member of staff inputs an order, it is added to a linked list for completion by the chefs. The programmer is considering using concurrent programming.

Discuss how concurrent programming can be applied to the food ordering system and the benefits and limitations of doing so. [9]

Mark Band 3 – High level

(7-9 marks)

The candidate demonstrates a thorough knowledge and understanding of concurrent programming; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence / examples will be explicitly relevant to the explanation.

There is a well-developed line of reasoning which is clear and logically structured.

The information presented is relevant and substantiated.

Mark Band 2 – Mid level

(4-6 marks)

The candidate demonstrates reasonable knowledge and understanding of concurrent programming; the material is generally accurate but at times underdeveloped.

The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed.

Evidence / examples are for the most part implicitly relevant to the explanation.

The candidate provides a reasonable discussion, the majority of which is focused. Evaluative comments are, for the most part appropriate, although one or two opportunities for development are missed.

There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.

Mark Band 1 – Low Level

(1-3 marks)

The candidate demonstrates a basic knowledge of concurrent programming with limited understanding shown; the material is basic and contains some inaccuracies. The candidates makes a limited attempt to apply acquired knowledge and understanding to the context provided.

AO1: Knowledge and Understanding Indicative content

Processes are happening at the same time / at overlapping times

Only 1 process can actually happen at a time on a single core processor, concurrent tries to simulate multiple processes

One process may need to start before a second has finished

Individual processes are threads, each thread has a life line

AO2: Application

Multiple orders can be made and added to the list at the same time

Programming will need to allow multiple threads to manipulate a single list

Will allow those reading and writing to manipulate at the same time

Locking will need implementing – more complex programming

AO3: Evaluation

Will allow for multiple orders at the same time – as it would happen in real life

Access to the linked list will need to be limited so it cannot be accessed / overwritten by two threads trying to do different operations

Examiner's Comment:

It was clear that many candidates had not covered the concept of concurrency and how it allows different processes to occur at the same time. Strong candidates appreciated that this could be simulated on a single core with time slicing or implemented within a parallel architecture. Many candidates lost sight of the fact that answers needed to be related to computer science rather than a restaurant chain and could not explain the underlying computer science that would allow a solution to be delivered.

Target: Overall grade:

Minimum expectations & learning outcomes

- You must explain how concurrency could be used to solve a problem amenable to computation.
- You must explain the limitations of concurrency.
- Answer the exam questions.

Feedback

<u>Breadth</u>	<u>Depth</u>	<u>Presentation</u>	<u>Understanding</u>
<input type="checkbox"/> All	<input type="checkbox"/> Analysed	<input type="checkbox"/> Excellent	<input type="checkbox"/> Excellent
<input type="checkbox"/> Most	<input type="checkbox"/> Explained	<input type="checkbox"/> Good	<input type="checkbox"/> Good
<input type="checkbox"/> Some	<input type="checkbox"/> Described	<input type="checkbox"/> Fair	<input type="checkbox"/> Fair
<input type="checkbox"/> Few	<input type="checkbox"/> Identified	<input type="checkbox"/> Poor	<input type="checkbox"/> Poor

Comment & action required

Reflection & Revision checklist

<u>Confidence</u>	<u>Clarification</u>
☹️ 😐 😊	Candidates need to understand what is meant by thinking concurrently. They need to be able to work out which parts of a program can be developed to take place (be processed) at the same time, and which parts are dependent on other parts.
☹️ 😐 😊	Candidates need to understand the benefits and trade offs that are brought from concurrent processing and be able to apply these to a given scenario.
Additional notes	<i>Candidates need to understand how concurrent processing could be applied to a specific program, why it would be applied to that program, and what problems might arise from using it.</i>