

Topic 1

**The characteristics of
contemporary processors,
input, output and storage**

1(a) The XOR operator can be used to encrypt data.

Show the effect of applying XOR on Text and Key, by completing the last row of the table below.

Text	O								C								R							
Value	0	1	0	0	1	1	1	1	0	1	0	0	0	0	1	1	0	1	0	1	0	0	1	0
Key	A								B								C							
Value	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	1
XOR																								

[2]

(b) Show the effect of applying XOR on your answer to part (a) and Key, by completing the first and last rows of the table below.

(a)																								
Key	A								B								C							
Value	0	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1	1
XOR																								

[2]

(c) Explain whether the type of encryption described above is symmetric or asymmetric.

[2]

(d) Explain why asymmetric encryption is more suited to transactions over the internet than symmetric encryption.

[4]

2(a) A web forum stores all its content in a database.

The forum stores details of its users in the table called `Users`. An extract of `Users` is shown below.

<code>userID</code>	<code>username</code>	<code>passwordHash</code>	<code>locked</code>
1	Zeus	8dfa46a79248037752bba6166fcb34f8	1
2	Hera	74d39d60507eb55e000c6ec5c1265891	0
3	Poseidon	b015d770d0208ddcce2c2c719fe29371	0

Describe what is meant by the term 'primary key', giving an example from the table above.

[2]

(b) The user's password is passed to a function that generates a hash and the result is stored in `passwordHash`.

(i) Describe what is meant by the term 'hash'.

[1]

(ii) Describe **one** advantage to storing the password as a hash.

[2]

(e) The function `checkAccess` takes in the password the user has entered (`givenPassword`) along with the password hash (`passwordHash`) and locked value (`locked`).

`passwordHash` and `locked` have already been extracted from the database before being passed to the function. It should return the value `true` if a user should be allowed access to a system and `false` if they aren't.

Your function should make use of the pre-written function `hash()` which takes in a string and returns the hash of that string.

e.g.

`hash("Hello")` returns `f7ff9e8b7bb2e09b70935a5d785e0cc5d9d0abf0`

Complete the function `checkAccess`.

```
function checkAccess (givenPassword, passwordHash, locked)
```

4(a) A survey is carried out to look at the types of vehicle that travel down a stretch of motorway.

For each vehicle that passes by, a letter is entered into the system.

For a car 'C' is entered.

For a motorbike 'M' is entered.

For a lorry 'L' is entered.

For any other vehicle 'O' is entered.

It is decided to compress the data that has been generated.

It is decided that Run Length Encoding will be used.

The following sequence has been compressed using Run Length Encoding.

3C3M4C

Show the result of decompressing the sequence.

[2]

(b) Show the result of using Run Length Encoding to compress the sequence:

CCCCOLLCCCCMOCCCC

[3]

5 Shreya is a web developer who creates webpages for a variety of different companies.

Photographs on a webpage are usually compressed.

(i) State which method of compression is most likely to be used for this purpose.

----- [1]

(ii) Explain the need to compress photographs in this situation.

----- [2]

6 A survey is carried out to look at the types of vehicle that travel down a stretch of motorway.

For each vehicle that passes by, a letter is entered into the system.

For a car 'C' is entered.

For a motorbike 'M' is entered.

For a lorry 'L' is entered.

For any other vehicle 'O' is entered.

It is decided to compress the data that has been generated.

State what is meant by the term 'compression'.

[1]

7(a) A charitable organisation is trying to make the works of William Shakespeare available to more people.

The organisation decides to make a copy of Shakespeare's entire works available as a downloadable text file from its website. It further decides to compress the file before making it available to download.

(i) State an advantage to the website's visitors of the file being compressed.

[1]

(ii) Explain why the company should use lossless and not lossy compression.

[3]

(b)



The organisation looks at using either run length encoding or dictionary encoding to compress the file described in **part (a)**.

Discuss the **two** compression methods and justify which you would recommend. You may refer to the extract of text below to illustrate your argument.

*What's in a name? that which we call a rose
By any other name would smell as sweet;
So Romeo would, were he not Romeo call'd,*

[12]

8 A software company decides to release a duplicate file finder which it has named “De-Duplicator”. Duplicate files are files that are exactly the same (bit for bit identical). Space is often wasted on computers by having multiple versions of the same file. Duplicate file finders are programs that find and identify duplicate files on a hard drive so that they can be removed.

Every time the program encounters a file it takes a hash of the file and checks it against a list. If the hash exists in the list, the file is marked to be deleted. If the hash does not exist it is added to the list.

(i) Explain **two** characteristics you would look for in a hashing algorithm for this purpose.

1

.....

.....

.....

.....

2

.....

.....

.....

.....

[4]

(ii) After running the program a user finds that they still have apparent duplicates of some of their images. Explain why these apparent duplicates might still be present.

.....

.....

.....

.....

.....

[2]

9 A team of programmers create a robot that will be used in a factory. The robot will be able to do the work of multiple humans.

The programmers discuss whether to write the instructions for the robot in assembly language or a high-level language.

The robot uses a multi-core processor. The programmers assume that this means that the robot will execute programs more quickly than using a single core processor.

(i) Give **one** reason why this assumption can sometimes be true.

----- [1]

(ii) Explain why this assumption is not always true.

----- [2]

10(a) OCRSystems are designing a new CPU for a computer system that will be used for video rendering.

-) Part of the video rendering process is when the video is exported. This is when the computer combines all of the separate video elements together to form the final video.

An important design consideration is whether OCRSystems use a CISC processor type or a RISC processor type.

Describe one difference between a CISC processor and a RISC processor.

[2]

- (b) OCRSystems are considering using parallel processing in a computer system that will be used for video rendering.

Describe how parallel processing would increase the performance of this computer system.

[3]

(c) A computer system will contain several input and output devices.

Explain the role of device drivers when using input and output devices on a computer system.

[2]

(d) Before a video is rendered, the user will first capture and edit the individual video elements before they are combined together to form the final video.

(i) State **two** different output devices that could be used when editing the videos.

1 -----

2 -----

[2]

(ii) A storage device is used to store the individual video elements while they are being captured in different locations and during the video editing process.

Discuss the suitability of a flash storage device **and** a magnetic storage device for storing the different video elements while they are being collected and edited.

You should refer to the following in your answer:

- the benefits of each type of storage
- the drawbacks of each type of storage
- the suitability of each type of storage.

11(a The processor contains registers including the accumulator and the program counter. The contents of) these registers are modified during the Fetch-Decode-Execute cycle.

(i) Describe how the accumulator is used during the Fetch-Decode-Execute cycle.

----- [2]

(ii) Describe how the program counter is used during the Fetch-Decode-Execute cycle.

----- [2]

(iii) State the name of **three** other registers that are used during the Fetch-Decode-Execute cycle.

1 -----

2 -----

3 -----

[3]

A series of 20 horizontal dashed lines spanning the width of the page, providing a template for handwriting practice.

----- [12]

(c) A charity uses a desktop computer to record financial donations that it receives. The computer contains a single core, 2.4GHz processor with 2MB cache.

A processor uses the Von Neumann architecture.

(i) Describe what is meant by the term 'Von Neumann architecture'.

----- [2]

(ii) Give **one** way that the Harvard architecture differs from the Von Neumann architecture.

----- [1]

12 Different computing devices in Arnold's home use different processor architectures.

One processor architecture is the Harvard architecture.

(i) Describe the Harvard architecture.

[2]

(ii) Arnold has a smart washing machine.

Explain why the Harvard architecture is suitable for a device like this.

[2]

13 A delivery company sends parcels across the UK.

To prove parcels have not been damaged in transit, the delivery drivers use a digital camera to take a photograph of them when they arrive at their destination. The digital camera uses flash memory.

(i) Describe one advantage of the digital camera using flash storage rather than magnetic.

[2]

(ii) Explain whether lossless or lossy compression would be most appropriate to store the photographs. Justify your response.

[3]

14(a Processors following the Von Neumann Architecture use registers.

)

(i) Describe what is meant by the term 'register'.

[2]

(ii) Give **one** other feature of the Von Neumann Architecture.

[1]

(b) An example of a register is the Accumulator (ACC).

Give a Little Man Computer instruction that will copy the contents of the accumulator into memory when executed.

[1]

[4]

(iii) Describe **one** non-graphical use for a GPU.

[2]

16 Amy's processor makes use of pipelining during the fetch-decode-execute cycle.

Explain why pipelining can improve the performance of a processor.

[2]

17(a The table below shows the Little Man Computer instruction set.

)

Mnemonic	Instruction
ADD	Add
SUB	Subtract
STA	
LDA	Load
	Branch always
BRZ	
BRP	
INP	Input
OUT	Output
	End program

Complete the table above to show the missing mnemonics and instructions.

[5]

(b) Write a program using the Little Man Computer instruction set that will allow a user to input two numbers and then output the larger of the two numbers. The program should loop continuously.

1

2

[4]

(ii) Explain **one** benefit of memory management to the user.

[2]

(iii) Describe how virtual memory allows a user to run programs when physical memory is full.

[2]

19 A CPU will repeatedly run the Fetch-Decode-Execute-cycle shown in Fig. 1.

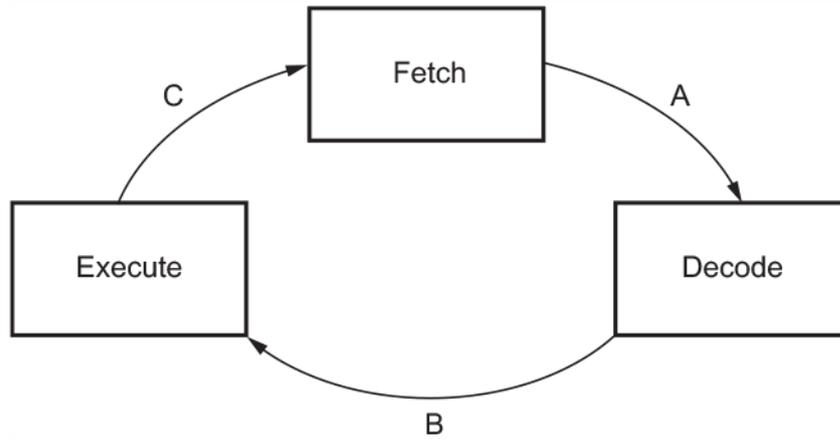


Fig. 1

(i) Describe what happens during the 'Fetch' stage shown in Fig. 1.

You should refer to the use of specific registers in your answer.

[4]

(ii) A CPU may need to stop running the Fetch-Decode-Execute-cycle in order to handle an interrupt.

Tick **one** box to indicate where in Fig. 1 an interrupt would be handled.

A

B

C

[1]

20 Traditionally films have been distributed on optical media such as DVDs.

Giving an example other than DVDs, describe what is meant by the term 'optical media'.

[2]

21 The Government Communications Headquarters (GCHQ) is responsible for monitoring communications in order to keep the UK secure. A large part of its job involves trying to break into encrypted messages.

The code breakers at GCHQ have access to supercomputers (computers with many processors).

Describe why a supercomputer will be useful to GCHQ.

[2]

22 A company produces digital photo frames (i.e. photo frames that display digital photographs).

The photo frame has a RISC processor.

Describe **one** advantage to the company of using a RISC processor, rather than a CISC processor.

[2]

23 * A student, Dan, on a limited budget finds his computer is running slowly. He uses his computer for university work and internet browsing.

Discuss what measures can be taken to improve Dan's computer's performance. You should explain what these measures are, why they improve the performance and justify whether you would recommend them.

[9]

24 An insurance company's offices have a large number of black and white printers.

The company's technicians keep accurate records of the printers in the building, and the quantity of toner cartridges in stock, in a flat file database. An extract of the database is shown in Fig. 1.

Printer Model	Location	Notes	Cartridge Code	Quantity in stock	Re-order URL
LasPrint LP753	office 3		LP-7XB	12	www.megacheapprint.com / toner / LP-7XB
LasPrint LP710	office 6	drum replaced	LP-7XB	12	www.megacheapprint.com / toner / LP-7XB
Zodiac ZN217	reception		Zod17	4	www.zodiaclasserprinting.com / shop / Z17
Zodiac ZN217	conference Room 2	had to add RAM	Zod17	4	www.megacheapprint.com / toner / LP-7XB
LasPrint LP753	office 8		LP-7XB	12	www.megacheapprint.com / toner / LP-7XB

Fig. 1

Printers have their own on-board RAM.

State what the printers' RAM is used for.

[1]

25 A processor contains a number of special registers.

Name and describe **three** buses used to convey information between the special registers.

1

2

3

[6]

26 Some computer systems use co-processors.

Explain the effect of using a co-processor system for each of the following applications.

(i) Complex calculations for scientific research.

----- [2]

(ii) Printing personalised letters to customers for an advertising campaign.

----- [2]

END OF QUESTION PAPER

Question		Answer/Indicative content	Marks	Guidance																																																																																																													
1	a	<table border="1"> <tr> <td>(a)</td> <td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td> </tr> </table> <p>One byte correct (1) all three bytes correct. (1)</p>	(a)	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	2																																																																																	
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	b	<table border="1"> <tr> <td>(a)</td> <td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td> </tr> <tr> <td>Key</td> <td>A</td> <td colspan="7"></td> <td>B</td> <td colspan="7"></td> <td>C</td> <td colspan="7"></td> </tr> <tr> <td>Value</td> <td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td> </tr> <tr> <td>XOR</td> <td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td> </tr> </table> <p>One byte correct (1) all three bytes correct. (1)</p>	(a)	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	Key	A								B								C								Value	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	1	1	1	XOR	0	1	0	0	1	1	1	0	1	0	0	0	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	2	Allow FT if (a) is incorrect but bottom row must match XOR with top row and key.
(a)	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1																																																																																						
Key	A								B								C																																																																																																
Value	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	1	1	1																																																																																						
XOR	0	1	0	0	1	1	1	0	1	0	0	0	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0																																																																																						
	c	Symmetric (1) as the same key is used to decrypt it as encrypt it (1)	2	Allow FT for asymmetric if (b) indicates asymmetric encryption used																																																																																																													
	d	<p>Any four from:</p> <p>Symmetric encryption would require both parties to have copy of the key (1) this couldn't be transmitted over the internet or an eavesdropper monitoring the message may see it (1)</p> <p>Asymmetric gets round this requirement as there are two different keys (1) One key encrypts the data (1) which can be publically distributed (1) and a different key to decrypt it (1) which is kept private (1)</p>	4																																																																																																														
Total			10																																																																																																														
2	a	<p>A field which has a unique value for every record / A unique identifier. (1)</p> <p>E.g. userID (1)</p>	2 (AO1.1 – 1, AO2.1 -1)	Examiner's Comments Well received and answered by most candidates.																																																																																																													
	b	i	<p>A result generated by applying an algorithm / numeric process to a value. (1)</p>	1 (AO1.1)																																																																																																													

Question		Answer/Indicative content	Marks	Guidance
	ii	<p>Hash functions are one way / can't be reverse (1)</p> <p>If someone gains access to the database they cannot access user's password. (1)</p>	<p>2</p> <p>(AO1.2 1 mark, AO2.1 1 mark)</p>	<p>Examiner's Comments Many candidates achieved the mark in part i) few achieved both marks in part ii) mostly stating as opposed to describing the advantage e.g. 'those who gain unauthorised access cannot access passwords' without going on to say 'hash functions are one way'.</p>
	c	<pre>SELECT passwordHash, locked (1) FROM Users (1) WHERE username='Apollo' (1)</pre>	<p>3</p> <p>(AO 3.2)</p>	<p>Do not award first mark for SELECT *</p> <p>Examiner's Comments In most cases, candidates who achieved marks in c) went on to achieve marks in d) with few candidates achieving all marks in either. Many candidates did not use correct SQL statement structure or syntax e.g. confusing attribute names with string literals.</p>

Question	Answer/Indicative content	Marks	Guidance
d	UPDATE Users (1) SET locked=1 (1) WHERE username='Hades' (1)	3 (AO 3.2)	<p>Allow other updating method e.g. a DELETE statement followed by an INSERT statement, for full marks e.g.</p> <pre>DELETE FROM Users WHERE username = 'Hades' (1 mark) INSERT INTO Users (1 mark) VALUES (<userID value>,'Hades',<passwordHash value>,1) (1 mark)</pre> <p>Examiner's Comments In most cases, candidates who achieved marks in c) went on to achieve marks in d) with few candidates achieving all marks in either. Many candidates did not use correct SQL statement structure or syntax e.g. confusing attribute names with string literals.</p>

Question		Answer/Indicative content	Marks	Guidance
	e	<p>Takes a hash of givenPassword (NB this may be done inline e.g. if hash (givenPassword)=passwordHash and locked==0 then (1)</p> <p>Returns true if password is correct and account is unlocked. (1)</p> <p>Returns false if account is locked (1)</p> <p>Returns false if password is incorrect (1)</p>	<p>4</p> <p>(AO 3.2)</p>	<p>Example code:</p> <pre>temp = hash(givenPassword) if temp==passwordHash and locked==0 then return true else return false endif</pre> <p>Candidates may have taken a different approach - any solution that fulfils the criteria on the left should get them marks.</p> <p>Examiner's Comments Candidates were asked to complete a function in this question. Although many students demonstrated reasonable logic in solving this problem, some used output statements rather than returned values from the function, therefore, not gaining full marks.</p>
		Total	15	

Question	Answer/Indicative content	Marks	Guidance
3	<p>Mark Band 3-High Level (7-9 marks) The candidate demonstrates a thorough knowledge and understanding of modern encryption and the difference between symmetric and asymmetric encryption. The material is generally accurate and detailed.</p> <p>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.</p> <p>The candidate provides a thorough discussion which is well balanced. Evaluative comments are consistently relevant and well-considered.</p> <p>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</p> <p>Mark Band 2-Mid Level (4-6 marks) The candidate demonstrates reasonable knowledge and understanding of modern encryption and the difference between symmetric and asymmetric encryption; the material is generally accurate but at times underdeveloped.</p> <p>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.</p> <p>The candidate provides a sound discussion, the majority of which is focused. Evaluative comments are for</p>	9 AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)	<p>AO1 Modern encryption is many orders stronger than that used in a pre-computer era. Asymmetric encryption uses different keys for encryption and decryption. Symmetric encryption uses the same key for encryption and decryption. Asymmetric encryption algorithms tend to involve more processing than symmetric algorithms.</p> <p>AO2 Modern encryption can be used without specialist knowledge. Often users may not even be aware their data is being encrypted (e.g. HTTPS, messaging systems) Asymmetric encryption is often used when exchanging data. For example credit card details over the internet. Symmetric encryption is best suited when the same person is encrypting and decrypting. For example when backing up data.</p> <p>AO3 The strength and ease of use of encryption has made it widely used on the Internet. E-Commerce would not be possible without it. Governments are no longer able to easily crack encrypted messages they intercept (as far as we know). This gives individuals unprecedented levels of privacy But also means those communicating for nefarious purposes can do so undetected.</p> <p><u>Examiner's Comments</u></p>

Question	Answer/Indicative content	Marks	Guidance
	<p>the most part appropriate, although one or two opportunities for development are missed.</p> <p>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</p> <p>Mark Band 1-Low Level (1-3 marks) The candidate demonstrates a basic knowledge modern encryption and the difference between symmetric and asymmetric encryption; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided.</p> <p>The candidate provides a limited discussion which is narrow in focus. Judgments if made are weak and unsubstantiated. The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</p> <p>0 marks No attempt to answer the question or response is not worthy of credit</p>		<p>Candidates were assessed on the quality of their extended response in this question. Many candidates explained the difference between symmetric and asymmetric encryption very well. Some went on to describe the circumstances in which they are used equally well. Few discussed the impact on society. Many candidates scored in the mid band on this question.</p>
	Total	9	

Question		Answer/Indicative content	Marks	Guidance
4	a	Full answer CCCMMMCCCC – CCC – ... followed by MMMCCCC (1 per -, max 2)	2 AO1.2	
	b	4C1O3L5C1M1O5C – 4C1O – Followed by 3L5C – Followed by 1M1O5C	3 AO1.2	Accept answer without 1s <u>Examiner's Comments</u> Well answered by most candidates, demonstrating clear understanding of Run Length Encoding as a method of compression.
		Total	5	
5	i	Lossy	1 AO2.1 (1)	
	ii	1 mark per bullet up to a maximum of 2 marks, e.g.: <ul style="list-style-type: none"> • Reduces the size of the image file • Uses lower bandwidth in transmission • Takes up less storage (on the HTTP server) 	2 AO2.1 (2)	
		Total	3	
6		(The process of) making a file smaller/take up less storage	1 AO1.1	
		Total	1	

Question			Answer/Indicative content	Marks	Guidance
7	a	i	Downloads quicker. (1) Saves user money by using less bandwidth / on data usage. (1) (Max 1)	1 (AO1.2)	Do not accept 'saves the user space on their device'. Examiner's Comments This question was well received by most candidates, invariably scoring most marks.
		ii	Lossy takes away some of the information from the original. (1) Lossless preserves all the information from the original. (1) With text the loss of small amounts of information will make it unreadable. (1)	3 (AO1.1 – 2 marks AO2.1 – 1mark)	
	b		Mark Band 3–High Level (9–12 marks) The candidate demonstrates a thorough knowledge and understanding of dictionary and run length encoding for compression. 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. The candidate is able to weigh up both forms of compression and justify dictionary encoding being the better choice. 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 (5–8 marks)	AO1.1 (2) AO1.2 (2) AO2.1 (3) AO3.3 (5) 12	Points may include but aren't limited to: AO1 Knowledge and Understanding Run length encoding relies on consecutive pieces of data / characters being the same. Each set of consecutive symbols can be represented by the symbol and its number of occurrences e.g. AAAABBBBBBCCC could be represented as 4A5B3C (or A4B5C3 or any sensible RLE encoding) In dictionary encoding frequently occurring pieces of data / groups of characters are replaced by symbols / tokens / smaller groups of characters / indexes. A dictionary is then used to say which symbols / tokens / characters / indexes match which groups of characters. When decompressed the dictionary is used to replace the tokens with the original text.

Question	Answer/Indicative content	Marks	Guidance
	<p>The candidate demonstrates reasonable knowledge and understanding of dictionary and run length encoding for compression; the material is generally accurate but at times underdeveloped.</p> <p>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.</p> <p>The candidate makes a reasonable attempt to come to a conclusion as to which form of compression is better suited.</p> <p>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</p> <p>Mark Band 1-Low Level (1–4 marks)</p> <p>The candidate demonstrates a basic knowledge of dictionary and run length encoding for compression; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided.</p> <p>The candidate provides nothing more than an unsupported assertion.</p> <p>0 marks</p> <p>No attempt to answer the question or response is not worthy of credit.</p>		<p>AO2.1 Application Run Length Encoding is very unsuitable for the example text. There are very few consecutive repeating symbols in the text. only instances being ll and ee these still require 2 characters to represent them 2l and 2e</p> <p>Dictionary encoding is well suited. There are lots of repeating groups of characters For example 'call' 'name' '[SPACE]we' 'Romeo' We could for example have: What's in53? that which2 15 rose</p> <p>By5ny other3 would smell5s sweet;</p> <p>So4would,2re he not41'd</p> <p>1:call</p> <p>2:[space]we</p> <p>3:[space]name</p> <p>4:[space]Romeo[space]</p> <p>5:[space]a</p> <p>(NB candidates are unlikely to show full compression, just a demonstration of the principle is sufficient. The best candidates are likely to show an awareness that space is a character that can be used in compression and that upper and lowercase letters are different. Demonstrating this is indicative of but not a requisite of the band.)</p> <p>AO3.3: Evaluation</p>

Question	Answer/Indicative content	Marks	Guidance
			<p>Run length encoding is not suited to natural language (more likely to be used in simple images).</p> <p>Applying it to the example the resulting text would be the same size as the original / worse than the original (if we use 1s to represent every individual instance of a character).</p> <p>Dictionary encoding works well. We can already see benefit on small piece of text. Would fare substantially better on full works.</p> <p>Dictionary encoding is the best compression method for this scenario.</p> <p>Examiner's Comments Candidates were assessed on the quality of their extended response in this question. Most candidates could describe each of the given types of compression appropriately, with many applying them to the scenario. Many candidates correctly concluded that dictionary encoding was the most appropriate in this case, but few then went on to give clear and appropriate justification for their assertion. In general, most candidates scored well on this question.</p>
	Total	16	

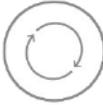
Question			Answer/Indicative content	Marks	Guidance
8		i	<ul style="list-style-type: none"> • Low chance of collision (i.e. different inputs giving same output) (1 – AO1.2) to reduce risk of different files being marked as the same (1 – AO2.1). • Quick to calculate (1 – AO1.2) as lots of files need to be hashed / needs to be quicker than a bitwise comparison to make it worthwhile (1 – AO2.1). • Provides a smaller output than input (1 – AO1.2) so quicker to compare hashes than original data (1 – AO2.1). 	4	<p>1 mark for each correct identification (AO1.2) up to a maximum of two identifications</p> <p>1 mark for each valid explanation (AO2.1) up to a maximum of two explanations.</p> <p>No credit for function being one way as this serves no benefit in this scenario.</p>
		ii	<ul style="list-style-type: none"> • Hashing works on the data / bits (1) and so two images may appear the same but not be identical at a bit level (1). This could be because they are different file types (1) / different sizes (1). Even the change of a single bit may result in a completely different hash (1). 	2	<p>Up to 2 marks for a valid explanation.</p> <p>Accept any other sensible examples of changes to images that might not be immediately apparent to someone viewing the image.</p>
			Total	6	

Question			Answer/Indicative content	Marks	Guidance
9		i	<ul style="list-style-type: none"> • Can execute multiple instructions / FDE cycles at the same time // some instructions in the program can be run in parallel 	1	<p>Do not accept just "multiple instructions"</p> <p>Do not accept tasks/programs for instructions</p> <p><u>Examiner's Comments</u></p> <p>Many candidates were able to gain the mark here. Candidates who did not tended to be vague or repeated the question.</p>
		ii	<ul style="list-style-type: none"> • Some instructions may not be able to be run in parallel • An instruction may be dependent / waiting for other instructions to be completed • Other factors influence processing speed – clockspeed / cache / bottlenecks / etc • Program / OS needs to be written to specifically use multiple cores 	2	<p><u>Examiner's Comments</u></p> <p>Most candidates were able to access one mark but many gave only one point. Candidates should be encouraged to look at how many marks there are for a question and make sure they provide enough points to be able to access those marks.</p>
			Total	3	

Question		Answer/Indicative content	Marks	Guidance
10	a	<ul style="list-style-type: none"> • CISC has a larger instruction set • RISC has a smaller instruction set • CISC is difficult to pipeline • RISC is easier to pipeline • CISC tends to have more addressing modes • RISC tends to have fewer addressing modes • CISC instructions may take multiple clock cycles to execute • RISC instructions take one clock cycle to execute • CISC has complex circuitry/more transistors. • RISC has less complex/simple circuitry • CISC uses less RAM • RISC uses more RAM 	AO1.2 (2)	<p>Accept any other valid points > Mark in pairs</p> <p><u>Examiner's Comments</u></p> <p>This question was generally answered well with many candidates describing the number of clock cycles required to execute instructions for RISC and CISC. Some candidates were not given the marks because they did not use the correct terminology.</p>
	b	<ul style="list-style-type: none"> • Parallel processing will allow multiple separate jobs/instructions/FDE cycles to run concurrently. • Longer rendering jobs can be split, shortening the overall time taken. • Different CPUs/cores can tackle different frames/sections/components of the video simultaneously. 	AO1.2 (1) AO2.1 (2)	<p><u>Examiner's Comments</u></p> <p>To achieve all 3 marks for this question, candidates needed to describe what parallel processing is, and then be clear as to how this would affect the computer system in the question. Many candidates were not given all the available marks as they did not make clear links between parallel processing and the scenario.</p>
	c	<ul style="list-style-type: none"> • A piece of software which allows hardware/device to communicate... • ...with the operating system 	AO1.2 (2)	<p><u>Examiner's Comments</u></p> <p>This question was generally answered well. Some candidates were not given the second mark as they did not make reference to the operating system.</p>

Question		Answer/Indicative content	Marks	Guidance
	d i	<ul style="list-style-type: none"> • Monitor • Speakers//Headphones 	AO2.1 (2)	<p>Must be output devices.</p> <p>Must be suitable for video editing.</p> <p><u>Examiner's Comments</u></p> <p>Many candidates answered this question correctly, with most selecting a monitor/screen and headphones/speakers which were both valid responses.</p>

Question	Answer/Indicative content	Marks	Guidance
	<p>ii</p> <p>Mark Band 3–High Level (7–9 marks) The candidate will provide a range of accurate benefits and drawbacks of both magnetic and flash devices. 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. The candidate will come to a clear conclusion that must be justified by their comments</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Mark Band 2-Mid Level (4–6 marks) The candidate will provide drawbacks or benefits about both magnetic and flash methods. These will be for the most part relevant. 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 will attempt to come to a conclusion, although it may not be fully justified by their answer.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</i></p> <p>Mark Band 1-Low Level (1–3 marks) The candidate has provided some drawbacks or benefits of magnetic or</p>	<p>AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)</p>	<p>AO1 Magnetic Benefits:</p> <ul style="list-style-type: none"> • Lower price per GB • As standard comes in high capacity <p>Magnetic Drawbacks:</p> <ul style="list-style-type: none"> • Lower R/W speed • Higher power consumption • Moving parts /less durable <p>Flash Benefits:</p> <ul style="list-style-type: none"> • Higher R/W speed • No moving parts/more durable • Lower power consumption • Can have a higher capacity. <p>Flash Drawbacks:</p> <ul style="list-style-type: none"> • Higher cost per GB • At higher capacities prices rise exponentially. <p>AO2: Suitability of Magnetic:</p> <ul style="list-style-type: none"> • Video files are very large, benefiting magnetics low cost per GB • Can be used to archive the different video elements after it's been rendered • Could possibly get damaged while being transported between the different filming sites • Slow R/W speeds may take it longer to load into the software <p>Suitability of flash:</p> <ul style="list-style-type: none"> • Very fast R/W speeds therefore reducing the amount of loading time during the editing process/giving smoother playback

Question	Answer/Indicative content	Marks	Guidance
	<p>flash methods. The material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion.</p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 mark No attempt to answer the question or response is not worthy of credit.</p>		<ul style="list-style-type: none"> • If money is not a barrier, flash can be bought in sufficient capacities for videos. <p>AO3: Candidates can conclude either method, but to score in the top MB must have a clear line of reasoning to justify their choice.</p> <p><u>Examiner's Comments</u></p> <p>Candidates were assessed on the quality of their extended response in this question. Most candidates understood the basic differences between flash storage and magnetic storage devices, but did not make clear links to the scenario. Mid-level responses were common, with few candidates giving a balanced discussion and a conclusion with suitable justifications.</p> <p> Assessment for learning</p> <p>Questions with the command word 'discuss' require candidates to give a balanced discussion and provided a suitable conclusion which justifies their comments. Opportunities to practise these questions will support candidates to do better on these style questions.</p>
	Total	18	

Question			Answer/Indicative content	Marks	Guidance
11	a	i	<ul style="list-style-type: none"> • Holds all input/output • Holds results of calculations (from the ALU) • Checked for conditional branching (e.g. BRZ) • Stores data which has come from the MDR/RAM 	2	<p>Examiner's Comments</p> <p>Most candidates were able to access 1 mark for the result of ALU calculations, but few were able to give two uses. Some confused the accumulator with the program counter and the ALU.</p>
		ii	<ul style="list-style-type: none"> • Holds the <u>address/location</u> of the <u>next</u> instruction (to be executed/fetched) • Contents copied to the MAR at start of FDE • Incremented (by one) on every cycle • Can be changed by branch/jump instructions 	2	<p>Examiner's Comments</p> <p>This question was generally well answered by candidates who gave clear responses.</p> <p>Misconception</p>  <p>Some candidates thought that the program counter kept track of a count of the number of instructions that had been fetched.</p>
		iii	<ul style="list-style-type: none"> • Memory Address Register // MAR • Memory Data Register // MDR • Current Instruction Register // CIR • Index Register // IR 	3	<p>Allow Memory Buffer Register for MDR</p> <p>Examiner's Comments</p> <p>Most candidates gained full marks on this question and were able to correctly identify three other registers. Some lost marks for saying the ALU or control unit were registers.</p>

Question	Answer/Indicative content	Marks	Guidance
b	<p>Mark Band 3–High Level (9-12 marks) The candidate demonstrates a thorough knowledge and understanding of both CISC and RISC. The material is generally accurate and detailed.</p> <p>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.</p> <p>The candidate provides a thorough discussion which is well balanced. Evaluative comments are consistently relevant and well-considered.</p> <p>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</p> <p>Mark Band 2-Mid Level (5-8 marks) The candidate demonstrates reasonable knowledge and understanding of CISC and/or RISC; the material is generally accurate but at times underdeveloped.</p> <p>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.</p> <p>The candidate provides a sound discussion, the majority of which is focused. Evaluative comments are for the most part appropriate, although one or two opportunities for development are missed.</p>	<p>12 (AO1.1) (2), (AO1.2) (2), (AO2.1) (3), (AO3.3). (5)</p>	<p>AO1 CISC is a complex instruction set. The traditional approach to processor design. Lots of instructions available although some instructions in CISC will rarely get used. RISC is a reduced instruction set. A smaller number of instructions available, several instructions can be combined to perform the same tasks as CISC processors. RISC instructions are used regularly. RISC has fewer transistors/less complex circuitry whereas CISC integrated circuits are more expensive/complicated. RISC instructions take one cycle whereas CISC may take several. RISC can only do complex things by combining multiple instructions whereas CISC is done in one line. Compilers for RISC need to be more complex than compilers for CISC</p> <p>AO2 CISC processors would run the same software as the desktop machines. Would be less power efficient and require larger battery and cooling mechanisms. More expensive to purchase. RISC processor requires software to be written specifically for it (cannot use CISC instructions). More power efficient and so requires less/no cooling and smaller battery/longer battery life. RISC devices may require greater RAM as programs tend to be larger than their CISC equivalents.</p> <p>AO3 Mobile use of CISC would save money on software and increase compatibility but cost more to purchase and be physically larger (heat sink/larger</p>

Question		Answer/Indicative content	Marks	Guidance
		<p>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</p> <p>Mark Band 1-Low Level (1-4 marks) The candidate demonstrates a basic knowledge of CISC or RISC; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided.</p> <p>The candidate provides a limited discussion which is narrow in focus. Judgments if made are weak and unsubstantiated. The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</p> <p>0 marks No attempt to answer the question or response is not worthy of credit.</p>		<p>battery) and/or have a shorter battery life.</p> <p>RISC would require investment in software but be cheaper to purchase and give a better performance out of the office (lighter/longer battery life). Some compatibility issues may be reduced with emulators and translators.</p> <p>Examiner's Comments Many candidates were able to discuss the difference in reduced or complex instruction sets and gave some discussion of the increase in hardware requirements for CISC. Few talked about the software differences, and some assumed the charity would need to be programming the devices which was not relevant to the question.</p>
	c	i	2	<p>Examiner's Comments Many candidates were able to access full marks on this question. This question has been asked in previous papers and candidates should be encouraged to use these to make sure they are clear in their responses. There were many possible responses in the mark scheme to help candidates to gain full marks. Most candidates gained at least 1 mark.</p>

Question			Answer/Indicative content	Marks	Guidance
		ii	<ul style="list-style-type: none"> Separate <u>memory for data and instructions</u> / Multiple memory units Different (sets of) buses one for <u>instructions</u> & one for <u>data/instructions and data</u> can be accessed concurrently. 	1	<p>Examiner's Comments</p> <p>This question was generally answered well by candidates and the majority gave separate areas of memory for data and instructions. Where candidates were not given marks, it was generally because their answer was unclear, e.g. just saying 'separate memory'.</p>
			Total	22	
12		i	<p>1 mark per bullet up to a maximum of 2 marks, e.g:</p> <ul style="list-style-type: none"> Uses separate memory blocks for instructions and data Has separate buses (data and address) for data and instructions Has fixed memory sizes for data and Instructions Instruction memory may be ROM 	<p>2 (AO1.1) (1) (AO1.2) (1)</p>	<p>Accept unit instead of blocks (BP1)</p> <p>Examiner's Comments</p> <p>Some candidates were vague in their response and were not clear that Harvard has separate memory blocks. Candidates must be specific in their response.</p>
		ii	<p>1 mark per bullet up to a maximum of 2 marks, e.g:</p> <ul style="list-style-type: none"> Fixed instruction size No need for memory to be shared between data and instructions Removes need for secondary storage Instructions would never be changed 	<p>2 (AO2.1) (2) Any 2 (Max 2)</p>	<p>Examiner's Comments</p> <p>This question was not answered well. Many candidates repeated their response to the previous question and did not answer the question correctly. Candidates need to read questions carefully.</p>
			Total	4	

Question		Answer/Indicative content	Marks	Guidance
13	i	<ul style="list-style-type: none"> - Has no moving parts... (1) ... less likely to be damaged / data loss (1) - Consumes less power... (1) ...meaning battery needs recharging less often (1) - Unaffected by magnetic fields.. (1) - ...which could lead to data loss. (1) - Faster access speed... (1) - ...so photographs can quickly be written to it / browsed. (1) <p>(Mark in pairs)</p>	2 AO1.2 (1) AO2.1 (1)	<p><u>Examiner's Comments</u></p> <p>Many candidates gave a reason for the advantage without stating the actual advantage e.g. 'flash storage has no moving parts' without going on to say, therefore the advantage is 'less likely to be damaged/lose data'.</p>
	ii	<ul style="list-style-type: none"> - Lossy compression (1) <p>Any 2 of the following, must be in context:</p> <ul style="list-style-type: none"> - Some loss of detail is acceptable (1) - Unlikely to be noticeable (1) - Will make the file size smaller than lossless(1) 	3 AO1.2 (1) AO2.1 (2)	<p>Do not accept 'smaller' on its own, must be 'smaller than lossless'.</p> <p>Do not accept lossless compression as most appropriate. In this case give zero marks for the justification also.</p> <p><u>Examiner's Comments</u></p> <p>Candidates would be best advised to fully consider how they would justify their choice appropriately for the given scenario before committing to 'lossy or lossless'. Those who correctly chose 'lossy' went on to achieve at least one of the other two available marks.</p>
		Total	5	

Question			Answer/Indicative content	Marks	Guidance
14	a	i	<ul style="list-style-type: none"> - Small piece of memory/used for storing data (1) - Within the processor (1) 	2 AO1.1	Accept 'location' for MP1 <u>Examiner's Comments</u> Most candidates described a register as 'a memory location' with many going on to add 'in the processor' therefore achieving full marks.
		ii	<ul style="list-style-type: none"> - Single control unit (1) - Single ALU (1) - Follows fetch, decode, execute cycle (1) - Data and Instructions stored in the same memory / format(1) (Max 1)	1 AO1.1	Do not accept use registers – in the question <u>Examiner's Comments</u> A number of different correct responses were offered here. Most candidates achieved the mark.
	b		- STA	1 AO1.2	Accept STO <u>Examiner's Comments</u> Well answered in the main, demonstrating an improvement in candidate understanding of LMC instruction set.
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
15	a		<ul style="list-style-type: none"> • Concurrent processing of multiple instructions • One instruction can be fetched while previous is being decoded... • And the one before is being executed. • In case of a branch pipeline is flushed. • Increases speed of execution 	3 AO1.1	
	b	i	<ul style="list-style-type: none"> • Clock speed • Number of cores • Cache 	2 AO1.1	Accept Use of pipelining/size of pipeline Use of out of order execution Use of SIMD instructions Integrated graphics processing on CPU
		ii	<ul style="list-style-type: none"> • RAM is <u>volatile</u> • Used for storing programs/data/parts of OS <u>currently in use</u> • ROM is <u>non volatile</u> • Used for storing (e.g.) BIOS / bootstrap 	4 AO1.2	
		iii	<ul style="list-style-type: none"> • Performing complex numerical calculations • Calculations on matrices / vectors / multiple data at the same time • ...e.g. insurance pricing, modelling risk, calculating bills 	2 AO2.2	Example has to relate to insurance company
			Total	11	
16			1 mark per bullet up to a maximum of 2 marks: <ul style="list-style-type: none"> • Reduces/removes latency • ... CPU is not idle while waiting for next instruction • Next instruction is fetched while current one is decoded/executed • All parts of the processor can be used at any instance in time. 	2 AO1.2 (2)	
			Total	2	

Question		Answer/Indicative content	Marks	Guidance																						
17	a	<ul style="list-style-type: none"> • Store value in accumulator at address given • BRA // BR • Branch if zero • Branch if <u>zero or positive</u> • HLT // COB // END 	5 AO1.1	<table border="1"> <thead> <tr> <th>Mnemonic</th> <th>Instruction</th> </tr> </thead> <tbody> <tr> <td>ADD</td> <td>Add</td> </tr> <tr> <td>SUB</td> <td>Subtract</td> </tr> <tr> <td>STA</td> <td>Store value in accumulator at address given</td> </tr> <tr> <td>LDA</td> <td>Load (to accumulator)</td> </tr> <tr> <td>BRA</td> <td>Branch always</td> </tr> <tr> <td>BRZ</td> <td>Branch if zero</td> </tr> <tr> <td>BRP</td> <td>Branch if zero or positive</td> </tr> <tr> <td>INP</td> <td>Input</td> </tr> <tr> <td>OUT</td> <td>Output</td> </tr> <tr> <td>HLT</td> <td>End program</td> </tr> </tbody> </table>	Mnemonic	Instruction	ADD	Add	SUB	Subtract	STA	Store value in accumulator at address given	LDA	Load (to accumulator)	BRA	Branch always	BRZ	Branch if zero	BRP	Branch if zero or positive	INP	Input	OUT	Output	HLT	End program
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BRP	Branch if zero or positive																									
INP	Input																									
OUT	Output																									
HLT	End program																									
	b	<ul style="list-style-type: none"> • Inputs two numbers • ..stores at least one of them • Comparison / subtraction to decide which is larger • Jump / output if num1 larger • Jump / output if num2 larger <u>or nums equal</u> • Loops back to start after either output 	6 AO3.2	<u>Example answer</u> start INP STA x INP STA y SUB x BRP first LDA x OUT BRA start first LDA y OUT BRA start x DAT y DAT																						
		Total	11																							

Question			Answer/Indicative content	Marks	Guidance
18		i	<ul style="list-style-type: none"> • Paging • ...blocks of memory of equal size / fixed size • Segmentation • ...blocks of memory split logically /variable size 	4 AO1.2	
		ii	e.g. <ul style="list-style-type: none"> • Security • ...does not let programs access memory reserved for other programs. • Multitasking • ...allows multiple programs to run at once 	2 AO1.2	
		iii	<ul style="list-style-type: none"> • (Currently unneeded) pages moved from memory to secondary storage • ...to create room in memory • pages moved back to memory when required 	2 AO1.1	
			Total	8	

Question			Answer/Indicative content	Marks	Guidance
19		i	<p>1 mark per bullet up to a maximum of 4 marks, e.g.:</p> <ul style="list-style-type: none"> • Data/address is copied from PC to MAR • PC is incremented (by 1) (this can be in any location from here down) • Data in MAR is passed onto the Address Bus • Read signal is sent onto the control bus • RAM copies the data from the location specified by the address bus onto the data bus • Data on the data bus is passed into the MDR • Data is copied from the MDR to the CIR 	<p>4 AO1.1 (2) AO2.1 (2)</p>	<p>The bullets must be in the correct order, except BP2, which can come anywhere from BP2 onwards</p>
		ii	<ul style="list-style-type: none"> • C 	<p>1 AO1.2 (1)</p>	
			Total	5	
20			<p>One from</p> <ul style="list-style-type: none"> – read / written to, using a laser – read / written onto a reflective surface – data is stored using pits and lands <p>Plus example</p> <ul style="list-style-type: none"> – Eg. Blu-Ray / CD <p>(1 per - , max 2)</p>	<p>2 AO1.1</p>	<p>Accept legacy media such as laserdisc and videodisc. Do not accept DVD variants (DVD-R, DVD-RW etc)</p>
			Total	2	

Question		Answer/Indicative content	Marks	Guidance
21		<ul style="list-style-type: none"> - The CPUs can work in parallel - ... on the same problem - try multiple keys simultaneously... - ...to break the code (1 per -, max 2)	2 AO3.3 (2)	<p><u>Examiner's Comments</u></p> <p>Only a few candidates scored well on both parts of this question. In the first part of the question, candidates rarely stated or described parallel processing. Those who did, then did not contextualise their response.</p>
		Total	2	
22		<i>advantage</i> <ul style="list-style-type: none"> - Costs less to design/produce. <i>because</i> <ul style="list-style-type: none"> - Requires less cooling to be built in. - (If battery powered) can run off smaller battery. - Has fewer instructions than other (CISC) processors. - Simpler (circuit/hardware) design/manufacture. - Fewer transistors. (1 per -, max 2, 1 max from 'because' group)	2 AO2.1 (2)	<p><u>Examiner's Comments</u></p> <p>Some candidates did not gain credit because the advantage stated was not specific to the company, as the question asked. Candidates should be reminded to read the question carefully.</p>
		Total	2	

Question	Answer/Indicative content	Marks	Guidance
23	<p>Mark Band 3–High Level (7-9 marks)</p> <p>The candidate demonstrates a thorough knowledge and understanding of a wide range of ways a computer’s performance can be improved and justifies how these measures improve performance; 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. The candidate provides a thorough discussion which is well-balanced. Evaluative comments are consistently relevant and well-considered.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Mark Band 2 –Mid Level (4-6 marks)</p> <p>The candidate demonstrates reasonable knowledge and understanding of a range of methods of improving a computer’s performance and justifies how many of these improve performance; 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.</p>	<p>9 AO1.1 (2)</p> <p>AO1.2 (2)</p> <p>AO2.1 (2)</p> <p>AO3.3 (3)</p>	<p>AO1: Knowledge and Understanding</p> <p>The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive:</p> <p>Methods of improving performance</p> <ul style="list-style-type: none"> – Replace CPU with faster CPU – Add more/Faster RAM – Add a graphics card – Upgrade to faster secondary storage – Update OS – Install a lighter weight OS – Defragment the hard disk – Check for viruses and spyware. <p>AO2.1: Application</p> <p>The selected knowledge/examples should be directly related to the specific question. The example below is not prescriptive or exhaustive:</p> <ul style="list-style-type: none"> – A newer CPU may have a faster clock speed and so execute more instructions per second. It may have multiple cores and so be able to execute several programs simultaneously (or one in parallel). It may have more cache meaning comparatively slower RAM can be accessed less frequently. – More RAM means more programs can be open simultaneously without the need to use much slower virtual memory. – Adding a graphics card will speed up the rendering of 3D graphics as GPU has specialist instructions and can apply the same instruction to multiple pieces of data simultaneously. – The slower the secondary storage the longer it takes to load

Question	Answer/Indicative content	Marks	Guidance
	<p><i>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</i></p> <p>Mark Band 1-Low Level (1-3 marks)</p> <p>The candidate demonstrates a basic knowledge of how a computer's performance can be improved. Limited understanding is shown of how these measures improve performance; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides a limited discussion which is narrow in focus. Judgments <u>if made</u> are weak and unsubstantiated.</p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 marks</p> <p>No attempt to answer the question or response is not worthy of credit.</p>		<p>files/program/data. A faster secondary storage device can improve this. May choose to use flash memory (i.e. SSD)</p> <ul style="list-style-type: none"> - OS makers often release updates and some of these will improve performance. - Some lighter weight operating systems use fewer system resources allowing the system to devote more to running the user's applications. - A fragmented HDD runs slowly as time is spent finding parts of the files. This is reduced by defragmenting and storing the parts of the file contiguously. - Malware can slow down a computer. Removing it will improve performance. <p>AO3.3: Evaluation</p> <p>The following is indicative of possible evaluation points that candidates may refer to but is not prescriptive or exhaustive:</p> <p>Hardware improvements (i.e. CPU, RAM, secondary storage and GPU) have costs attached but likely to have most impact.</p> <p>The higher performance the hardware, the more cost incurred.</p> <p>(NB candidates aren't expected to know relative costs of components.)</p> <p>GPU unlikely to benefit student in this scenario (unless their course requires graphics processing).</p> <p>Defragmenting HDD is free and so should be performed.</p>

Question			Answer/Indicative content	Marks	Guidance
					<p>Running anti-malware programs is free/low cost and should be done as a precaution against losing data anyway.</p> <p>Moving to lighter weight software can potentially be free if the user considers open source software.</p> <p><u>Examiner's Comments</u> Candidates were assessed on the quality of their extended response in this question. Most candidates could cite some methods for improving performance but not all managed to then appropriately apply these to the question. Many candidates did recommend one or more measures although some cases needed to include justification. This resulted in some very good responses and marks awarded spanning the range of marks available.</p>
			Total	9	
24			<ul style="list-style-type: none"> • Storing documents being / waiting to be printed. • reduced buffering 	1	<p>Accept 'storing information about print jobs'</p> <p>Examiner's Comments This question was well answered, with most candidates achieving the mark.</p>
			Total	1	

Question		Answer/Indicative content	Marks	Guidance
25		<ul style="list-style-type: none"> • Control bus... • ...transmits control signals from the control unit (to other parts of the processor) • Data bus... • ...carries the data (from one place to another) • Address bus... • ...carries the location address (register) where the data is going (to or from) 	6	<p>These are the expected responses as they are the buses listed in the specification, however, other responses are acceptable, for example named buses like 'EIDE, a local bus' and 'Video bus to maintain screen display'. Serial and parallel buses are not acceptable because they are not named. Not a memory bus. Control bus does not send program instructions. Examples would include interrupt signals / read / write operation carried out</p> <p>Examiner's Comments</p> <p>Understanding of the purpose of the three bus types named in the specification continues to improve although there is still the desire among candidates to imbue them with rather more power than they have got. Typical is the desire to say that the bus 'stores' something rather than acting as a conduit. On a base level candidates can picture data being sent around the processor in the data bus and the details of where it is being sent to are carried in the address bus. The control bus simply passes the control signals to the registers from the control unit.</p>
		Total	6	

Question			Answer/Indicative content	Marks	Guidance
26		i	Calculations are done by the maths co-processor... ...so processing is faster ...when using floating point arithmetic	2	Examiner's Comments Both this and the next question were well answered by candidates who knew that a co-processor is for floating point calculations.
		ii	No increase in speed... ...as co-processor not suitable for task / as there are no calculations	2	Examiner's Comments For this part there was a wide variety of inventions as to how a co-processor could control a print queue, not answered well by those who did not grasp the first part of the question.
			Total	4	