Pearson Edexcel

INTERNATIONAL GCSE

Computer Science (9-1)

EXEMPLARS WITH EXAMINER COMMENTARIES

PAPER 1

Pearson Edexcel International GCSE in Computer Science (4CP0)

Contents

Introduction

1.1 About this booklet

This booklet has been produced to support teachers delivering the International GCSE Computer Science specification. The exemplar materials will enable teachers to support their students in the knowledge and skills required to successfully complete this course. The booklet looks at questions from the June 2019 examination paper, showing sample responses to questions and how examiners have applied the mark schemes to demonstrate how the responses were marked.

1.2 How to use this booklet

Actual student scripts have been used for exemplar responses, and each part contains:

- Question number and question in full
- Exemplar sample responses for each question
- Examiner commentary of the marker grading decision based on the June 2019 mark scheme

Centres should utilise the commentary on the exemplification of marker decisions to support their internal assessment of students and embed exam skills into the delivery of the specification.

1.3 Further support

A range of materials are available to download from the Computer Science page of the Pearson website to support you in planning and delivering the new specifications.

Centres may find it beneficial to review this document in conjunction with:

Teaching and learning materials including examination materials published on the Pearson Edexcel International GCSE Computer Science subject page.

Command words shown in red are further explained in Appendix 7: Taxonomy, page 47 in the specification. Multiple choice questions are not included.

Question 1 uses this context.
Computers are made up of both hardware and software components.

Question 1(a)

Computers use a three-step computational model.

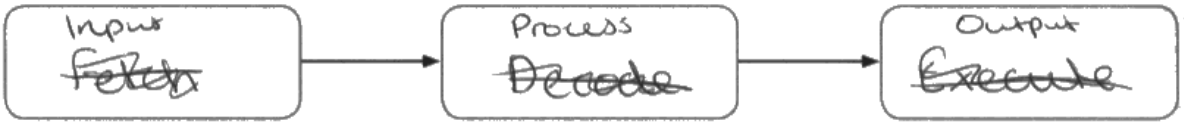
Complete the diagram with the names of the **three** steps.

(3)

Mark scheme

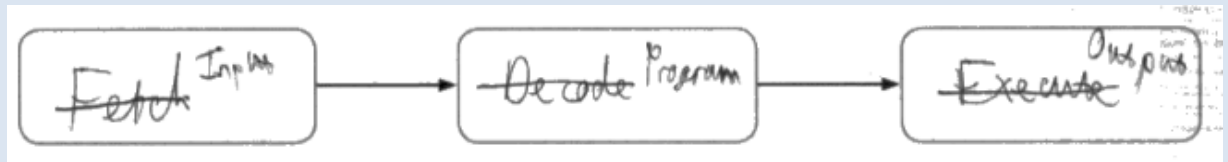
Question Number	Answer	Additional Guidance	Mark
1(a)	Award **one** from: Input, process, output in this order – **3 marks** Input, process, output in any order – **2 marks** At least one of input, process, output – **1 mark**		3

Sample response 1



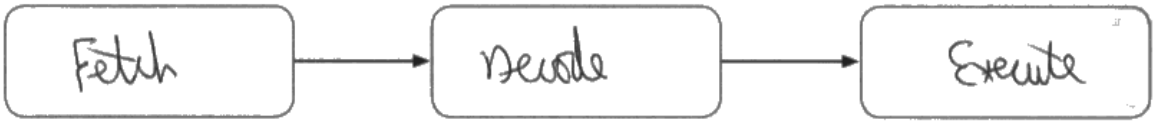
Commentary
This response achieved 3 marks. The three steps were correct and in the right order. Whilst the candidate had also included an incorrect response for each of the steps, these had been crossed out and replaced. **Total for (a) 3 marks**

Sample response 2



Commentary
The response achieved 1 mark. Two marks could not be awarded because all three steps were required in any order. Therefore, 1 mark was awarded because at least one step was correct. **Total for (a) 1 mark**

Sample response 3



Commentary
This response failed to score any marks. In this instance it could be that the candidate read question 1(b) and assumed question 1(a) related to that. **Total for (a) 0 marks**

Question 1(c)

Von Neumann developed the stored program concept that permits two different types of item to reside in memory.

Name these **two** types.

(2)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
1(c)	• Data (1) • Instructions (1)		2

Commentary
The response named both types of item correctly and so achieved 2 marks. **Total for (c) 2 marks**

Sample response 1

1 An address for each unit of storage (2)

2 A piece of data to go in each unit of storage

Commentary
The response correctly named 'data' as a type of item within the second response. However, the first response was incorrect. **Total for (c) 1 mark**

Sample response 2

1 ~~one cache~~ ROM

2 ~~one clock~~ RAM

Commentary
These responses were incorrect for both types of item. There was no markworthy content. **Total for (c) 0 mark**

Question 1(d)

Some computers use virtual memory. **Explain** how virtual memory works.

(2)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
1(d)	Any **two** from: 1. Virtual memory (VM) is used when RAM becomes full (1) (to hold all programs and data). 2. Virtual memory is used as (an extension to) main memory/RAM / works like RAM. (1) 3. Virtual memory is stored/created on (internal) secondary storage/HDD/SSD. (1) 4. Virtual memory is used as temporary storage. (1) 5. Instructions and data not currently being used are transferred from RAM to VM/HDD. (1) 6. When needed again, instructions and data are transferred back to RAM. (1)		2

Sample response 1

Virtual memory works like RAM but instead of using actual components it uses pre-existing memory like a harddrive or SSD

Commentary
This response achieved both marks. These were mark point 2 – virtual memory works like RAM and mark point 3 – virtual memory is stored on HDD/SSD. **Total for (d) 2 marks**

Sample response 2

when the RAM is full, then the currently used applications are stored in Virtual memory, ~~text~~ which is slower to fetch.

Commentary
The response achieved mark point 1 i.e. virtual memory is used when RAM becomes full. There was no other markworthy content. **Total for (d) 1 mark**

Sample response 3

virtual memory is information stored on the computer temporaraly

Commentary
There was no markworthy content. The response was not mark point 4 as virtual memory is created temporarily rather than information stored temporarily. **Total for (d) 0 mark**

Question 1(e)

An optical storage device writes data onto a CD or DVD. **Describe** how data is stored physically on optical media.

(2)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
1(e)	Any **two** from: 1. The disc surface is made out of polycarbonate. (1) 2. A laser (beam) is used. (1) 3. Data is stored as a series of tiny grooves arranged in tracks on the surface of the disc. (1) 4. Bumps/lands/flats/troughs/pits/dips imprinted/burnt on the disc. (1) 5. Bumps and flats (etc.) represent 1 and 0 (bits) / the reflection (of the laser) represents 1 and 0 (bits). (1)		2

Sample response 1

Data is stored using a laser to etch dips into the shiny surface of a CD or DVD. The CD is read using a laser and where there is a dip or no dip it will decide whether it is a 1 or a 0.

Commentary

This response achieved 2 marks. Mark point 2 was awarded for saying a laser is used. Mark point 4 was awarded for 'etch dips into the shiny surface'. Mark point 5 could also have been awarded i.e. 'decide whether it is a 1 or a 0'.

Total for (e) 2 marks

Sample response 2

It is burned onto the disk, uses lasers to encode onto the disk

Commentary

This response achieved 1 mark. Mark point 2 was awarded for 'uses lasers'. Mark point 4 was not awarded because 'it' at the beginning of the sentence is too vague.

Total for (e) 1 mark

Sample response 3

Data is 'borned' onto something like a CD or DVD to add speafic data onto it.

Commentary

No marks were awarded for this response as it is too vague i.e. burned with what?

Total for (e) 0 marks

Question 2 uses this context.
Zafer and Robert work for a company that makes washing machines.

Question 2(a)

Zafer writes user manuals for the washing machines.

He stores these documents in the cloud.

Zafer and the cloud storage provider share responsibility for data security.

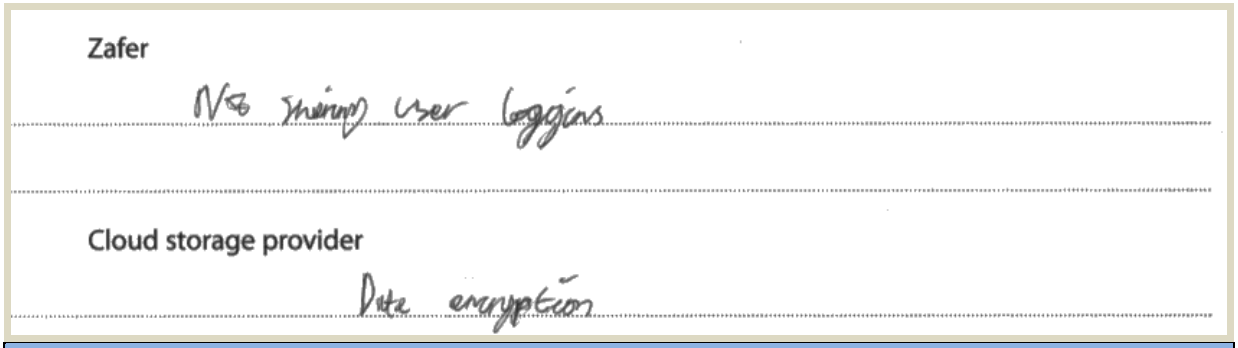
State **one** area of responsibility for each of them.

(2)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
2(a)	Award **one** from each: Zafer: 1. Choose strong (1) authentication credentials (username/password) 2. Not sharing his credentials (1) 3. Not having automatic login to cloud / leaving his machine unattended (1) 4. Changing password regularly (1) 5. Password protect documents (1) Provider: 1. Infrastructure (e.g. firewall/servers) must be secure from unauthorised access (1) 2. Keeping their security software up to date (1) 3. Policy and procedures effective in preventing an insider attack / a data breach (1) 4. Data protection laws in the resident country must be obeyed (1) 5. Backup and restore procedures (1) 6. Encryption (1)		2

Sample response 1



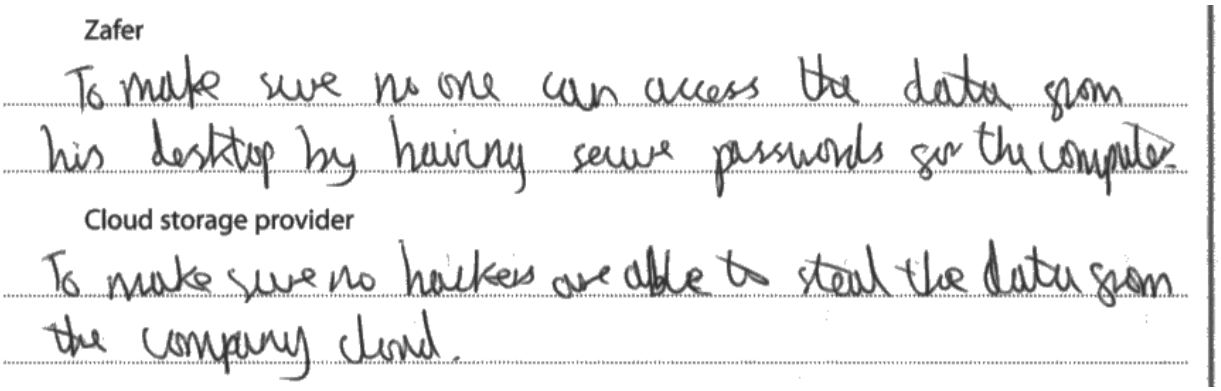
Commentary

This response achieved both marks. Mark point 2 was awarded for the response for Zafer. 'Not sharing user loggins.

Mark point 6 was awarded for the response for the provider for 'encryption'.

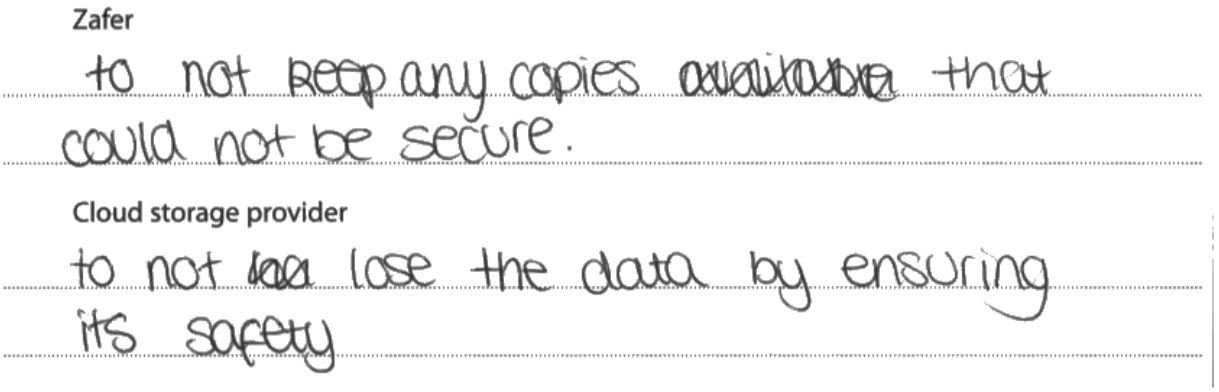
Total for (a) 2 marks

Sample response 2



Commentary
The response for Zafer was awarded mark point 1 'having secure passwords'. No marks were awarded for the response for the provider. In order to achieve a mark, the hacking would have needed to be related to one of the mark points and it was not. **Total for (a) 1 mark**

Sample response 3



Commentary
There was no markworthy content. The response did not mention how copies would be kept secure in terms of Zafer i.e. did not relate to any of the mark points and the same applies to the cloud storage provider response. **Total for (a) 0 marks**

Question 2(b)

Robert programs the robots that make the parts for the washing machines.

Zafer writes the user manuals.

Robert and Zafer have different levels of access to folders and files on the company network.

The different levels of access are Read, Write, Execute and None.

Complete the table to show the levels of access that each has.

(2)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
2(b)	**Two** marks if completely correct. **One** mark for any two correct cells. **Robert** / **Zafer** Washing machine design drawings: Read / Read A folder of manuals for new machines: None / Read, Write Or Write, Read	Ignore spelling mistakes	2

Sample response 1

	Robert	Zafer
Washing machine design drawings	Read	Read
A folder of manuals for new machines	None	~~Read/Write~~ Read/Write

Commentary

This response gave the correct levels of access for both Robert and Zafer in terms of both items. Full marks were awarded.

Total for (b) 2 marks

Sample response 2

(2)

	Robert	Zafer
Washing machine design drawings	Read	Read
A folder of manuals for new machines	None	Write

Commentary

This response did not achieve the full two marks as the access level for Zafer was incorrect in terms of the folder. 1 mark was awarded for having 'any two correct cells'. There were two instances where this mark occurred i.e. the access levels for both Robert and Zafer were correct for the drawings and the levels of access were correct for Robert in terms of both items.

Total for (b) 1 mark

Question 2(c)

Zafer uses a browser to view pages on Pearson's website by typing a uniform resource locator into the browser. This is shown in **Figure 1**.

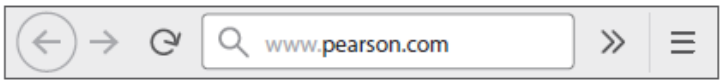


Figure 1

Pearson's machine	Zafer's machine
MAC address: 03-57-00-EC-4B-30	MAC address: 00-15-00-BC-9A-90
IPv4 address: 2.20.38.113	IPv4 address: 192.168.1.78
IPv4 Subnet Mask: 255.255.0.0	IPv4 Subnet Mask: 255.255.255.0
Website domain: www.pearson.com	Web browser
Main web page: https://www.pearson.com/uk/	Uniform resource locator: www.pearson.com

A domain name server is used in this process.

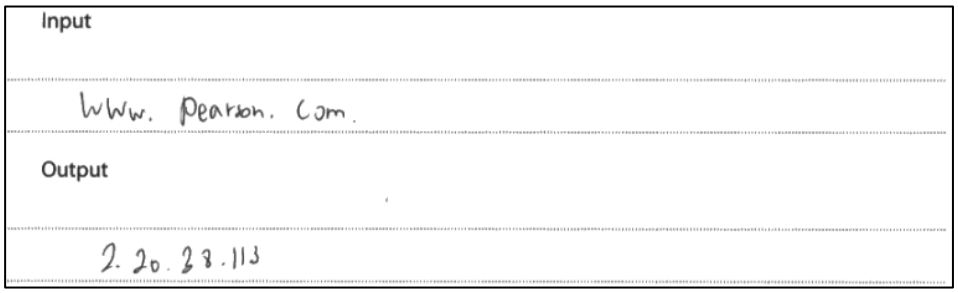
Identify the input to and output from the domain name server.

(2)

Mark scheme

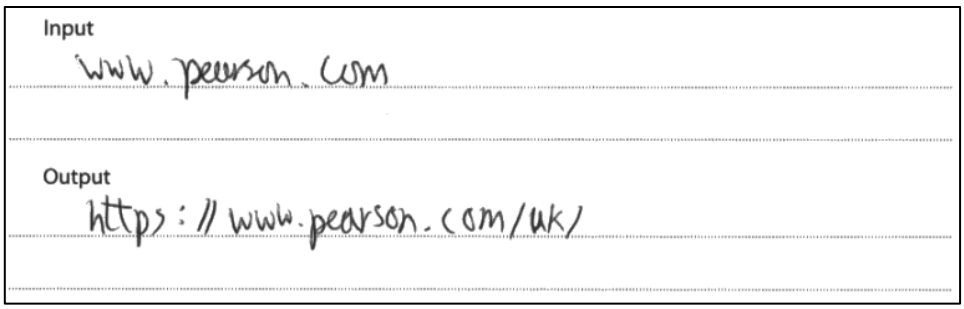
Question Number	Answer	Additional Guidance	Mark
2(c)	Award **one** mark from each category (maximum of 2) Input: • www.pearson.com / website domain (1) • Uniform Resource Locator / URL (of Pearson website) (1) Output: • 2.20.38.113 (1) • Pearson's machine IP(v4) address (1)	Don't penalise spelling or typos, especially in addresses	2

Sample response 1



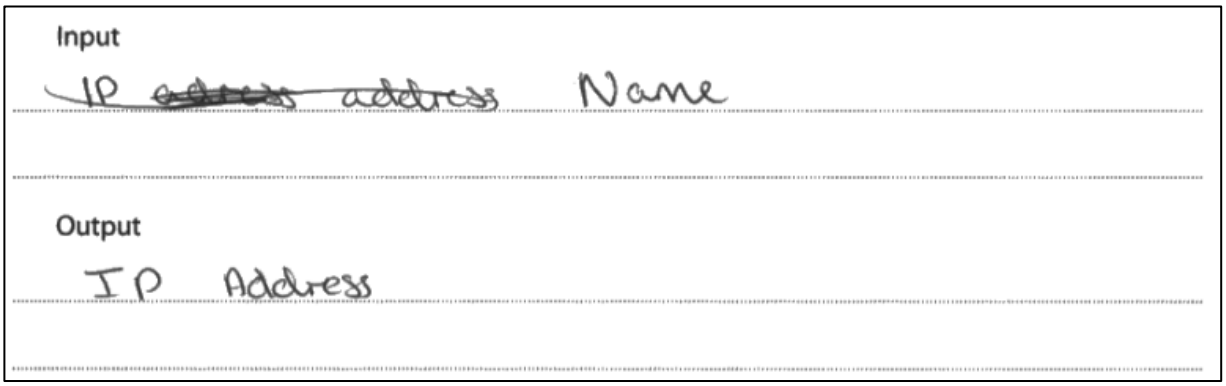
Commentary
The response was awarded mark point 1 in terms of input and mark point 1 in terms of output. **Total for (c) 2 marks**

Sample response 2



Commentary
The response was awarded mark point 1 for the input. However, the second mark was not awarded as the output given is incorrect. **Total for (c) 1 mark**

Sample response 3

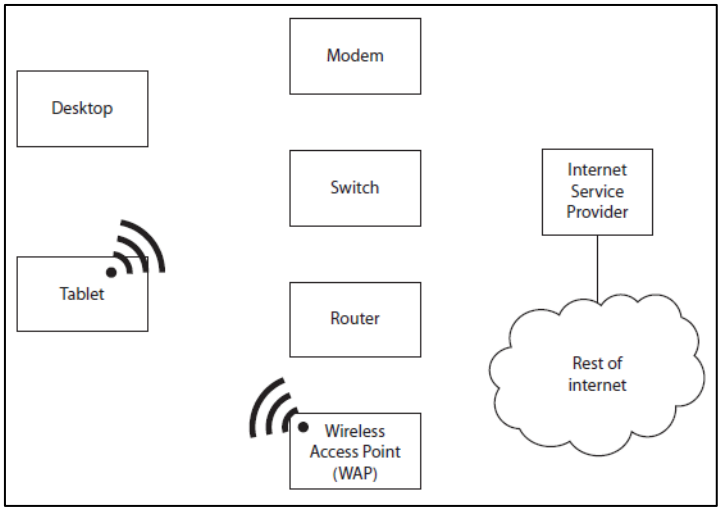


Commentary
There was no markworthy response for input. There was also not enough evidence present to award a mark for the output as it does not specify whose IP address i.e. it was too vague. **Total for (c) 0 marks**

Question 2(d)

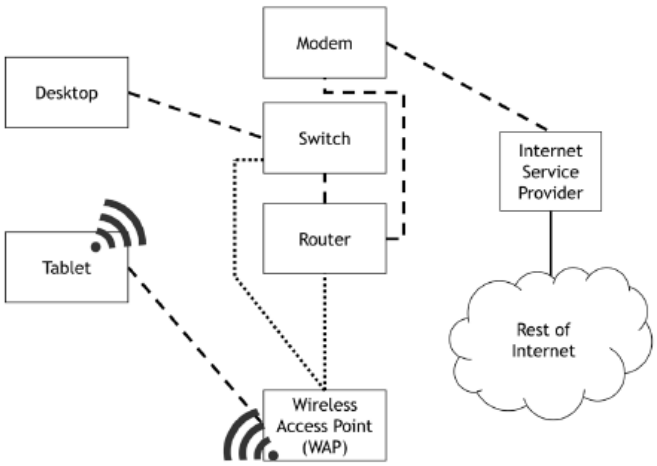
Zafer can use a desktop or a tablet computer to connect to the internet.
Only the tablet has wireless capabilities.
The diagram shows the components used to connect to the internet.

Complete the diagram to show how the desktop and the tablet are connected to the internet.

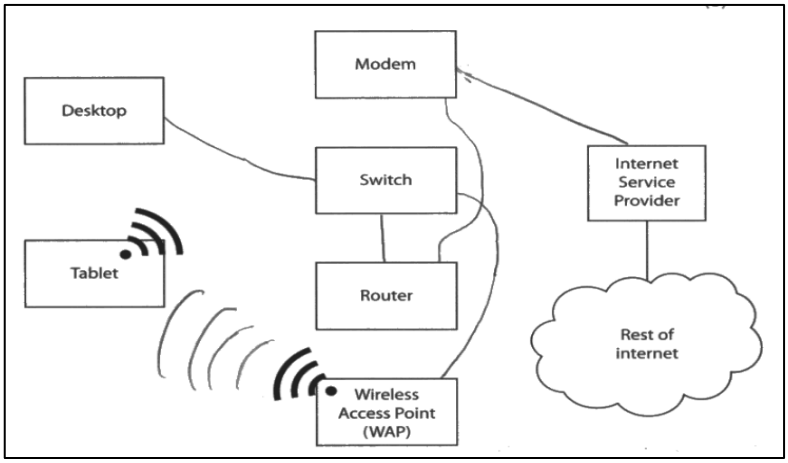


(6)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
2(d)	One mark for each dotted connection, correctly located. Maximum of 6 marks. Note: WAP can be connected to either the Switch or the Router, but not both 		6

Sample response 1

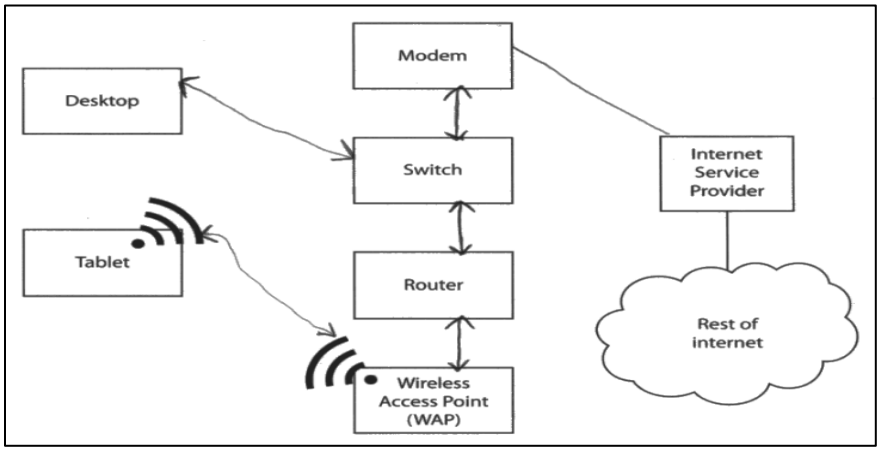


Commentary

1 mark was awarded for the connection between the **Desktop** and the **Switch**
1 mark was awarded for the connection between the **Tablet** and the **Wireless Access Point (WAP)**
1 mark was awarded for the connection between the **WAP** and the **Switch**
1 mark was awarded for the mark between the **Switch** and the **Router**
1 mark was awarded for the connection between the **Modem** and the **Router.**
1 mark was awarded for the connection between the **Modem** and the **Internet Service Provider**

Total for (d) 6 marks

Sample response 2

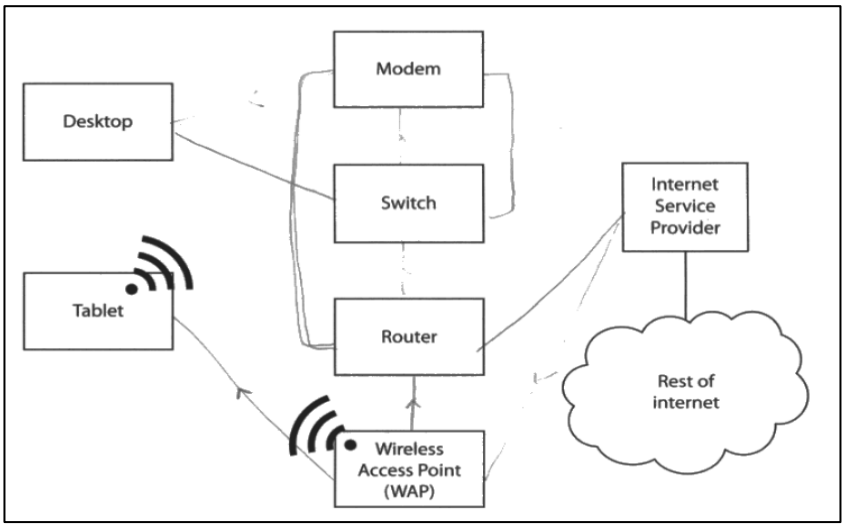


Commentary

1 mark was awarded for the connection between the **Desktop** and the **Switch**
1 mark was awarded for the connection between the **Tablet** and the **Wireless Access Point (WAP)**
1 mark was awarded for the connection between the **WAP** and the **Router**
1 mark was awarded for the mark between the **Switch** and the **Router**
0 marks were awarded for the connection between the **Modem** and the **Router.**
1 mark was awarded for the connection between the **Modem** and the **Internet Service Provider**

Total for (d) 5 marks

Sample response 3



Commentary
1 mark was awarded for the connection between the **Desktop** and the **Switch** 1 mark was awarded for the connection between the **Tablet** and the **Wireless Access Point (WAP)** 1 mark was awarded for the connection between the **WAP** and the **Router** 0 marks were awarded for the mark between the **Switch** and the **Router** as it had been rubbed out 1 mark was awarded for the connection between the **Modem** and the **Router.** 0 marks were awarded for the connection between the **Modem** and the **Internet Service Provider** **Total for (d) 4 mark**

Question 3 uses this context.
Isra works in an office building where she has access to different types of network.

Question 3(a) uses this context
Isra uses different types of networks for different tasks.

Question 3(a)(i)

Name the type of network she uses to print a document on the printer in the office next door.

(1)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	• LAN / Local area network (1) Allow PAN/Personal Area Network		1

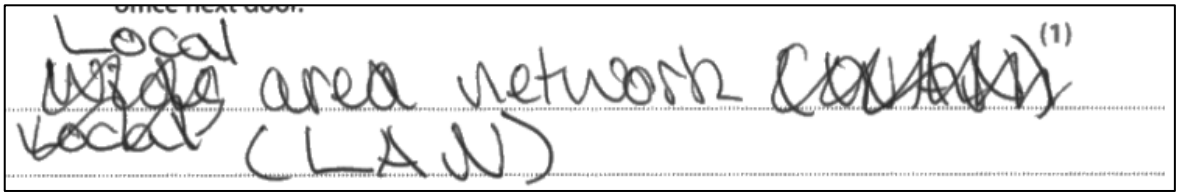
Sample response 1

Commentary

PAN is a markworthy response as it could be used to print a document under these circumstances.

Total for (a)(i) 1 mark

Sample response 2

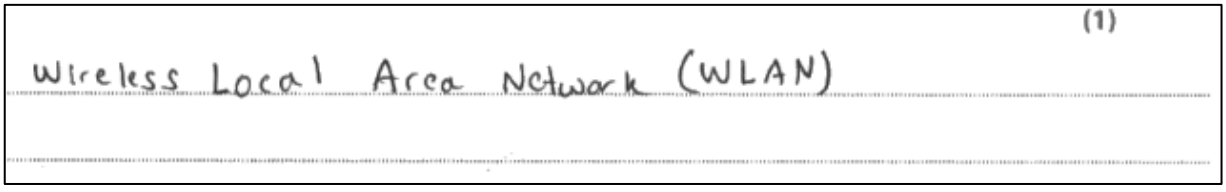


Commentary

LAN was also a markworthy response.

Total for (a)(i) 1 mark

Sample response 3



Commentary

A wireless local area network was also a markworthy response.

Total for (a)(i) 1 mark

Question 3(a)(ii)

Name the type of network she uses to order stationery from an online supplier

(1)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	• WAN / Wide area network (1)		1

Sample response 1

(1)

Wide Area Network

Commentary
Wide area network was the only suitable response for this question. 1 mark was awarded. **Total for (a)(ii) 1 mark**

Sample response 2

server to client.

Commentary
No marks were awarded as the response was not markworthy. The candidate appears to have misinterpreted the question. **Total for (a)(ii) 0 marks**

Question 3(c)

Isra uses her table computer and smartphone to access email.
She wants to set up a new email account.

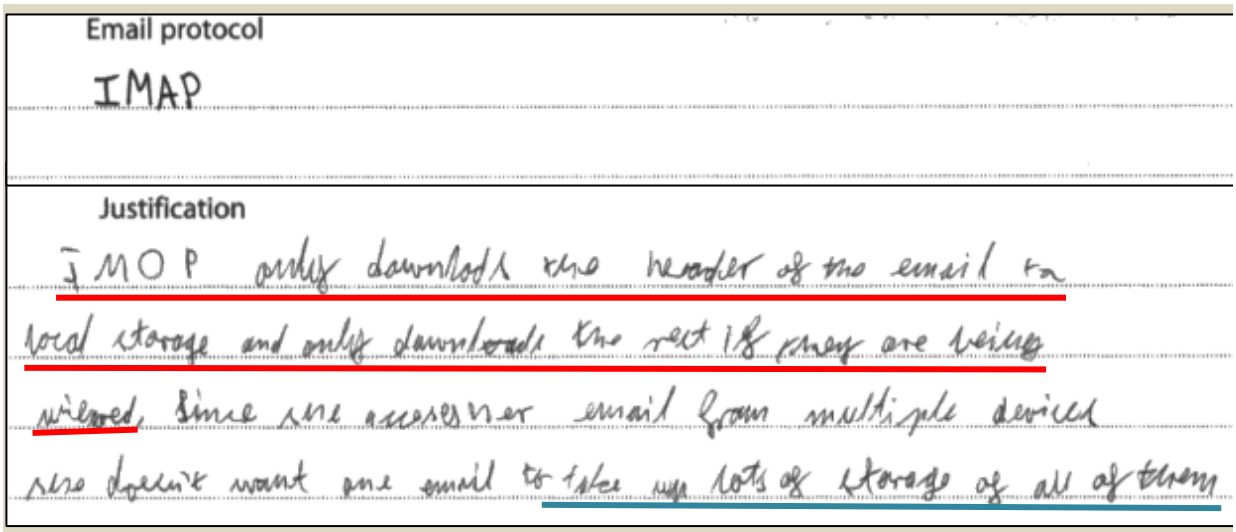
State the email protocol she should use.
Justify your choice.

(3)

Mark scheme

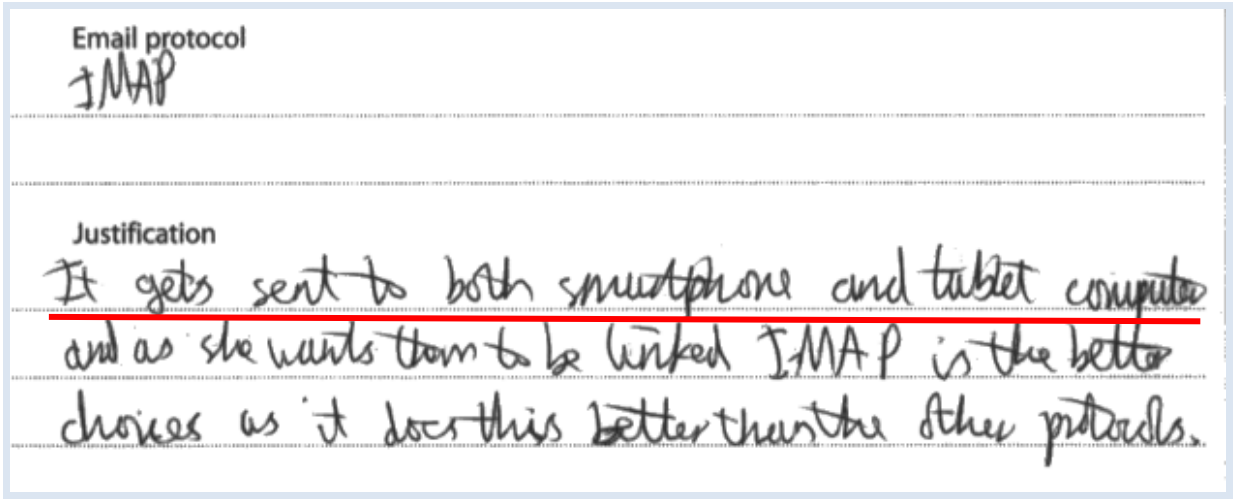
Question Number	Answer	Additional Guidance	Mark
3(c)	• IMAP (1) AND **one** from: • because changes are synced (1) with the mail server in real-time (1) • because the messages always reside on the email server (1) as she has limited storage (1) on her tablet and phone • it gets sent to both smartphone and tablet (1) **Alternative answer:** • POP3 (not awarded a mark) AND **one** from: • because storage limitations on server (1) and privacy issues (1) • because more CPU time (1) may be used when syncing (1) (a large number of messages).		3

Sample response 1



Commentary
IMAP was the most suitable protocol to be used in this context. This response achieved 1 mark for this. It then went on to provide justification. 1 mark was awarded for the first two lines of the response i.e these were taken as the message always residing on the email server. The final mark was awarded for linking the next to lines to this response. These were taken as her having limited storage. **Total for (c) 3 marks**

Sample response 2


Email protocol

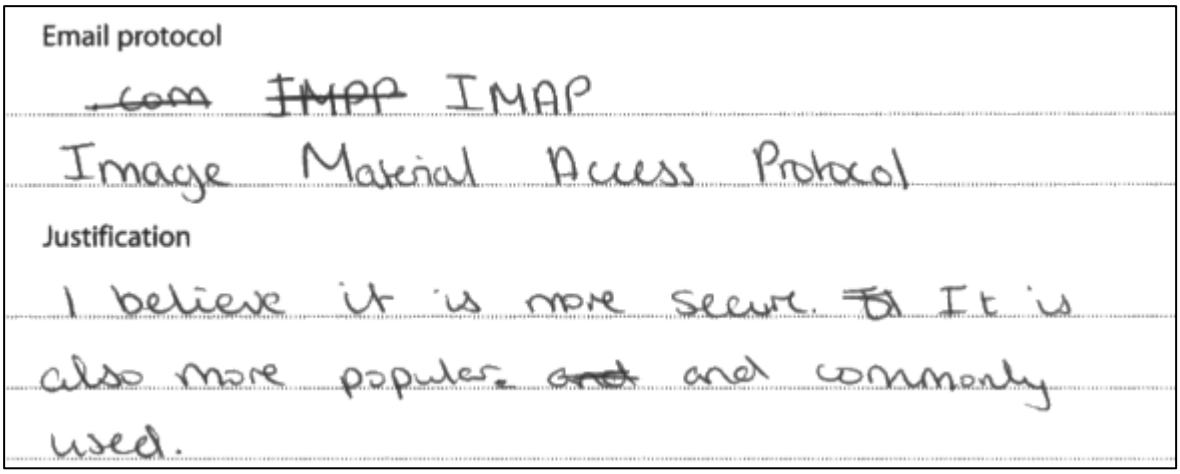
IMAP

Justification

It gets sent to both smartphone and tablet computer and as she wants them to be linked IMAP is the better choices as it does this better than the other protocols.

Commentary
This response achieved 1 mark for stating IMAP. The justification was awarded 1 mark i.e. 'it gets sent to both smarthphone and tablet'. There was no other markworthy content present. **Total for (c) 2 mark**

Sample response 3


Email protocol

~~.com~~ ~~IMAP~~ IMAP

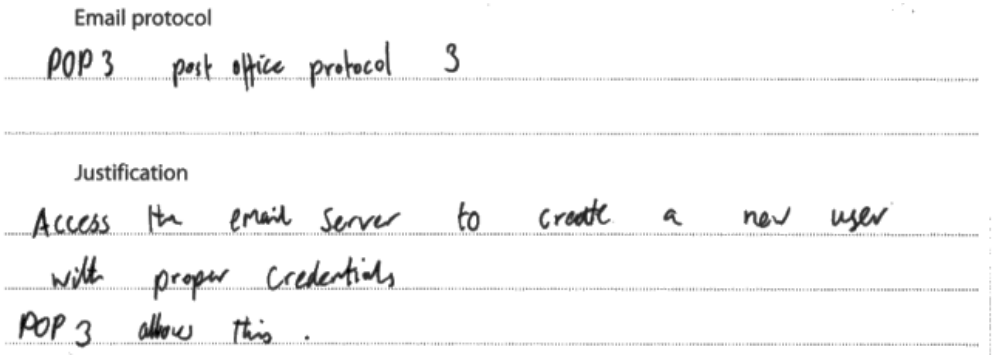
Image Material Access Protocol

Justification

I believe it is more secure. ~~It~~ It is also more popular. ~~and~~ and commonly used.

Commentary
The response achieved the first mark for the identification of IMAP. The second protocol was ignored (Internet Material Access Protocol). There was no markworthy content present within the justification response. **Total for (c) 1 mark**

Sample response 4



Commentary
This response was not awarded any marks. POP3 is not a suitable email protocol in this context as it was clear from the question, she uses multiple devices to access her emails. Whilst no mark could be awarded for naming POP3 as the protocol, if the candidate had given a markworthy justification as to why they named POP3 then up to two marks could have been awarded. However, there was nothing markworthy in this instance. **Total for (c) 0 marks**

Question 3(e)

Information sent across networks is represented in bit patterns.

(i) The bit pattern 1101 0001 uses sign and magnitude representation.

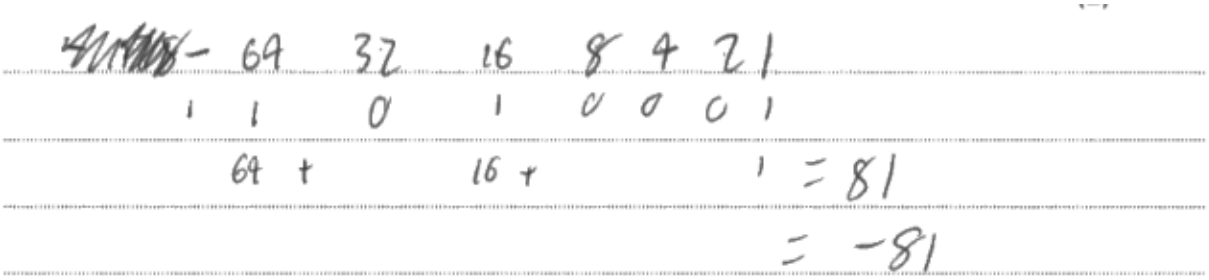
Convert this bit pattern to a denary number.

(2)

Mark Scheme

Question Number	Answer	Additional Guidance	Mark
3(e)(i)	-81 One mark for negative sign One mark for 81.		2

Sample response 1

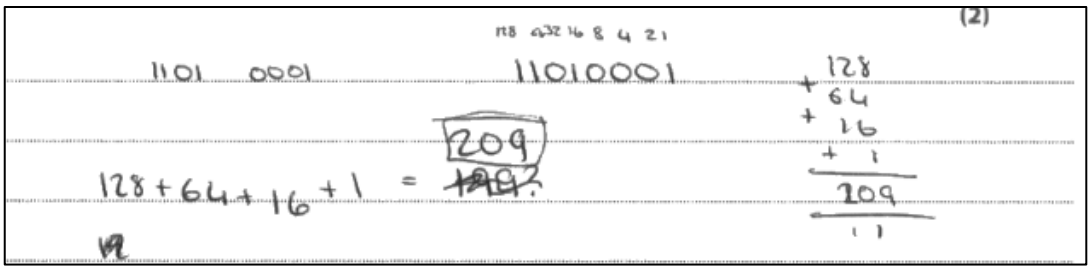


Commentary
This response achieved 1 mark for the – sign and 1 for 81, giving the full 2 marks. **Total for (e)(i) 2 marks**

Sample response 2

Commentary
This response achieved 1 mark for the – sign. However, it did not have the correct number (81) so did not achieve the second mark. **Total for (e)(i) 1 mark**

Sample response 3



Commentary
There was no markworthy content in this response. **Total for (e)(i) 0 marks**

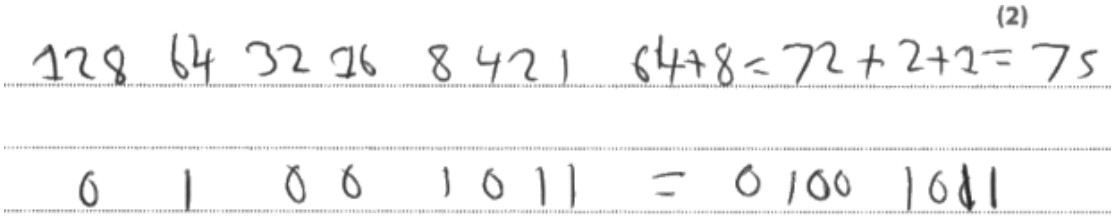
(ii) **Convert** the denary number 75 to 8-bit binary.

(2)

Mark scheme

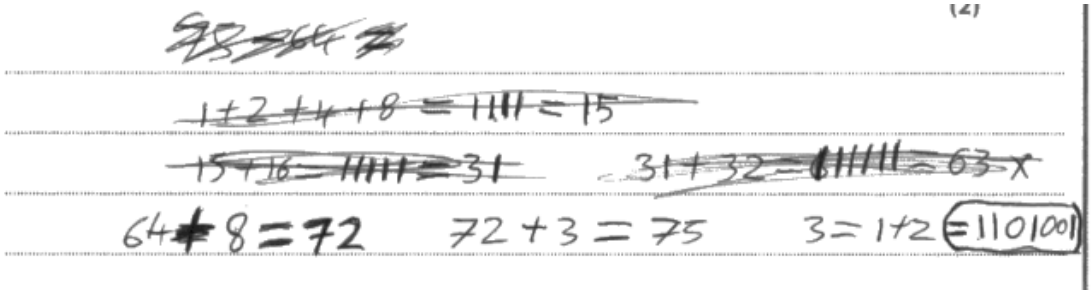
Question Number	Answer	Additional Guidance	Mark
3(e)(ii)	One mark for each nibble in correct order 0100 1011		2

Sample response 1



Commentary
This response achieved the first mark for 0100 in the correct position. It also achieved the second mark for 1011 in the correct position. **Total for (e)(ii) 2 marks**

Sample response 2



Commentary
The response was not markworthy. **Total for (e)(ii) 0 marks**

(iii) The addition of these two 8-bit binary patterns generates an error condition.

0	1	1	0	1	1	0	1	
1	1	0	0	0	0	0	0	+
0	0	1	0	1	1	0	1	

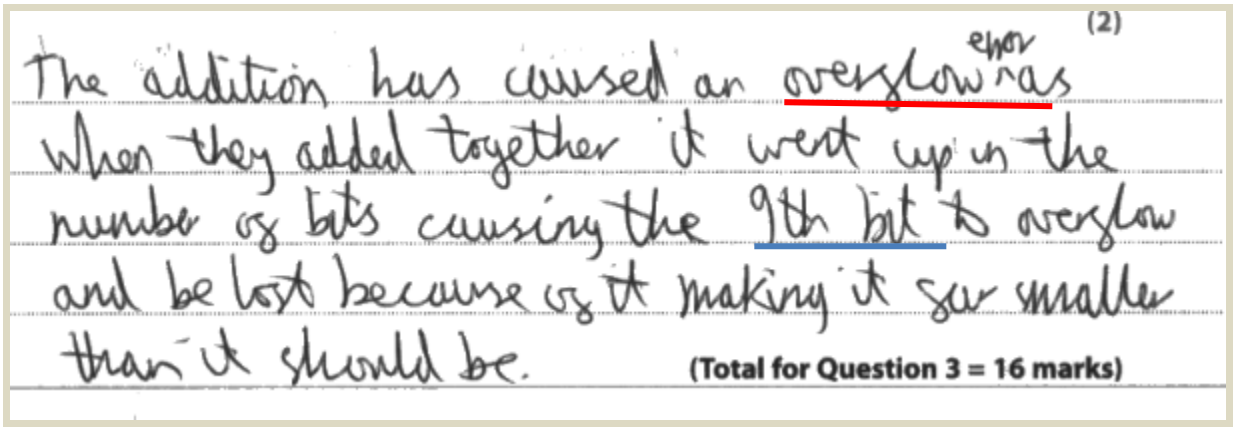
Explain this error condition.

(2)

Mark scheme

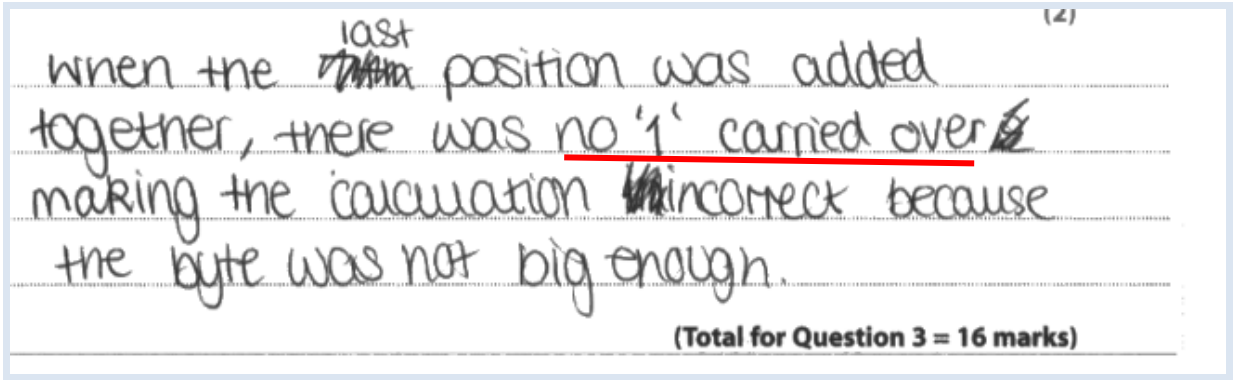
Question Number	Answer	Additional Guidance	Mark
3(e)(iii)	Any **two** from: 1. This is an overflow (1) error 2. It is caused by adding two 1s in the most significant bit (1) 3. The resulting number is too large to fit in the number of bits available / requires 9 bits / the number is larger than 2^8 / there is 1 that needs to be carried over (in MSB) / MSB gets discarded (1) 4. It can cause the program to crash or produce unreliable/incorrect results (1)		2

Sample response 1



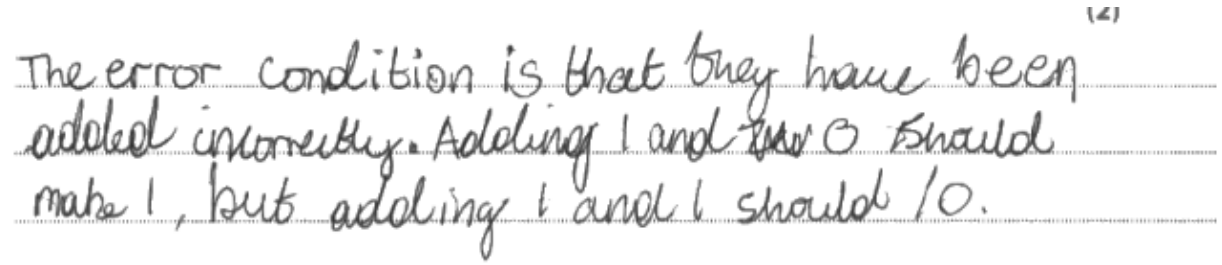
Commentary
Two marks were awarded. The first mark was awarded for identifying this is an overflow error (mark point 1). The second mark was awarded for the recognition that the number would require 9 bits though it could also have been awarded for 'making it far smaller than it should be' (mark point 4). **Total for (e)(iii) 2 marks**

Sample response 2



Commentary
One mark was awarded for 'no 1 carried over', which is mark point 3. No mark awarded for 'the byte was not big enough' because it falls under the same marking point. **Total for (e)(iii) 1 mark**

Sample response 3



Commentary
There was no markworthy content. The response was too vague i.e. adding which 1 and 0? **Total for (e)(iii) 0 marks**

Question 4 uses this context. One function of an operating system is file management.

Question 4(a)

Both kibibyte and kilobyte can be used as measures of file size.

Compare kibibyte and kilobyte.

(2)

Question Number	Answer	Additional Guidance	Mark
4(a)	Any **two** from: Kilobyte is a SI (physics/science) / International System of Units measurement, whereas Kibibyte is an IEC (computing) / International Electrotechnical Commission / International System of Quantities / ISO measurement (1) Kilobyte is equivalent to 1000 bytes, whereas a kibibyte is equivalent to 1024 bytes (1) Kilobyte is equivalent to 10^3 bytes, whereas a kibibyte is equivalent to 2^{10} bytes (1) Kilobyte is a base 10 measurement, whereas a kibibyte is a base 2 measurement (1)	Ignore units	2

Sample response 1

(2)

Kibibyte is 2^{10} a base 2 system where as kilobyte is 10^3 a base 10 system A kilobyte is 1000 bytes and a kibibyte is 1024 bytes.

Commentary

Two marks were awarded. The response actually has three credit worthy answers i.e. 2^{10} and 10^3, base 2 and base 10 and 1000 and 1024 are correct.

Total for (a) 2 marks

Sample response 2

(2)

A kibibyte is 1024 bytes whereas a kilobyte is 1000 bytes.

Commentary

One mark was awarded for identifying the correct bytes for both a kibibyte and a kilobyte.

Total for (a) 1 mark

Sample response 3

(2)

kibi = 1000 bytes kilo = 1024 bytes

Commentary

No marks awarded for this response as the bytes have been transposed i.e. a kibibyte should be 1024 and a kilobyte 1000.

Total for (a) 0 marks

Question 4(b)

An image is 2322 pixels high and 4128 pixels wide.

The image is stored with a 16-bit colour depth.

The metadata for the image is 975 bytes.

Construct an expression to show how the file size, in megabytes, is calculated.

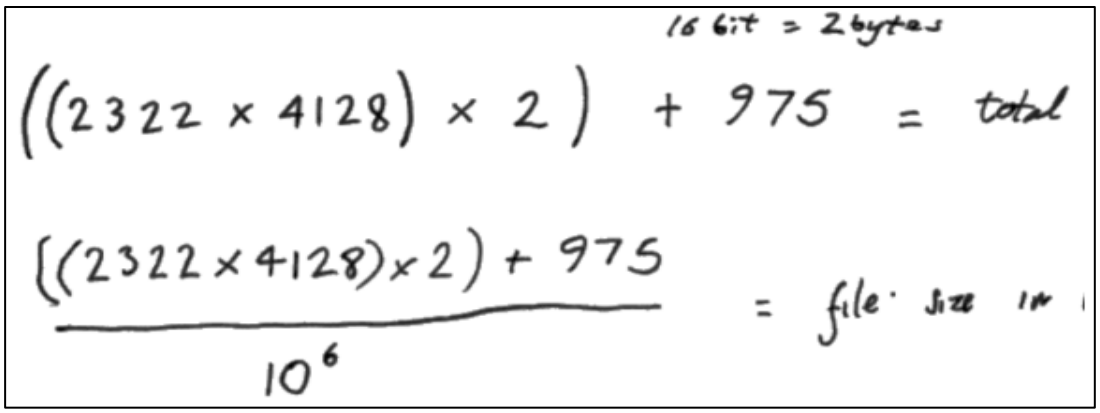
You do **not** need to do the calculation.

(4)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
4(b)	Award **4 marks** for 19.17 or **One** mark for each of: • Calculates correct bits/bytes(1) • Adds metadata (1) • Calculates correct megabytes (1) • Completely correct response (1) Examples: $\frac{\frac{2322 \times 4128 \times 16}{8} + 975}{1000 \times 1000}$ $\frac{(2322 \times 4128 \times 2) + 975}{1000 \times 1000}$ ((2322 x 4128 x 16 bits per colour) ÷ 8 bits per byte) + 975 bytes --- 1000 bytes per KB x 1000 kilobytes per MB ((2322 x 4128 x 2 bytes per colour) + 975 bytes --- 1000 bytes per KB x 1000 kilobytes per MB	• Arithmetic precedence rules must be clearly followed • Units are not required • Equivalent expressions are accepted • Calculations not explicit (8x1000x1000) but expressed (8000000) gain the mark	4

Sample response 1



Commentary
The maximum of 4 marks were awarded. 1 mark was awarded for an expression that would determine the bytes, 2322 * 4128 * 2 (16 bits are 2 bytes) (mark point 1). 1 mark was awarded for adding the metadata, + 975 (mark point 2). 1 mark was awarded for the expression that would determine the megabytes (1000 x 1000) (mark point 3). The final mark was awarded for a fully correct expression (mark point 4). **Total for (b) 4 marks**

Question 4(c)

Operating systems often include compression software for reducing file sizes.

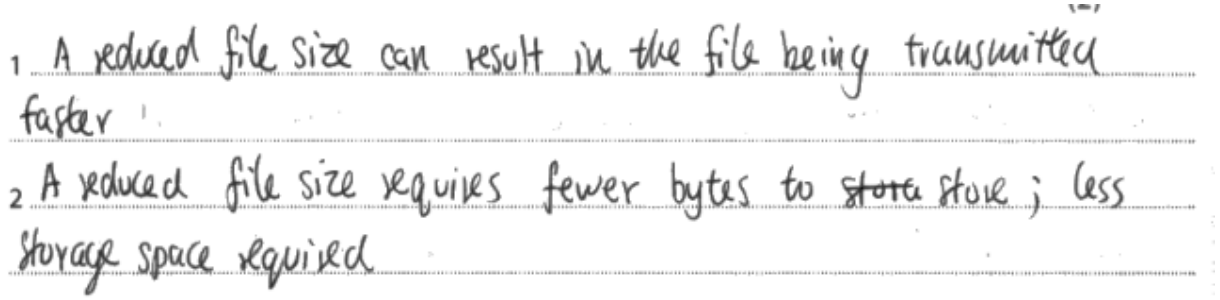
(i) **Give two** reasons for reducing file sizes.

(2)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	Any **two** from: • To save disc/storage space (1) • Reduce transmission time (1) • Meet email attachment size restrictions (1)		2

Sample response 1



Commentary
Two marks awarded. 1 mark was awarded to the first response i.e. 'the file being transmitted faster' (mark point 2). 1 mark was awarded to the second response 'requires fewer bytes' or 'less storage required' (mark point 1). **Total for (c)(i) 2 marks**

Sample response 2

Commentary
1 mark was awarded for the first response 'saves data storage' (mark point 1). There was no other markworthy content. **Total for (c)(i) 1 mark**

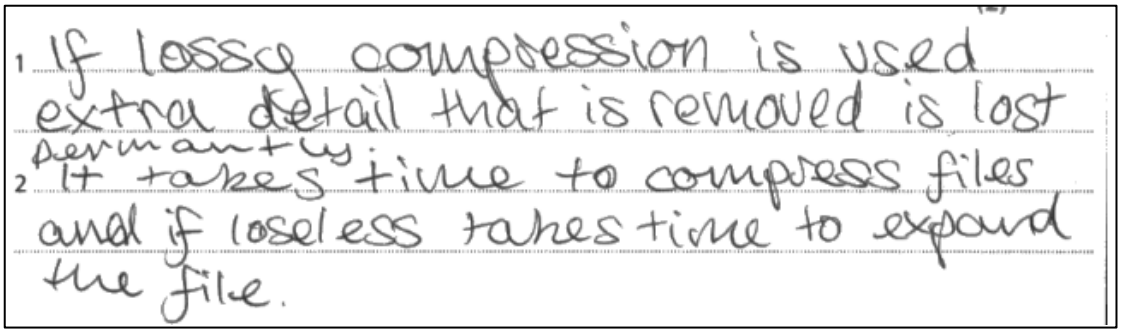
(ii) **Give two** drawbacks of using compression software.

(2)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	Any **two** from: • Compressing / decompressing the file takes execution time (1) • Both compressing and decompressing have to be done with compatible software / both ends of transmission have to use compatible software (1) • (If the compression utility uses a lossy algorithm then) some of the data will be permanently removed / it won't be possible to reconstruct the original file. (1) • Can affect the quality of the file (1) • File size can increase (1)		2

Sample response 1

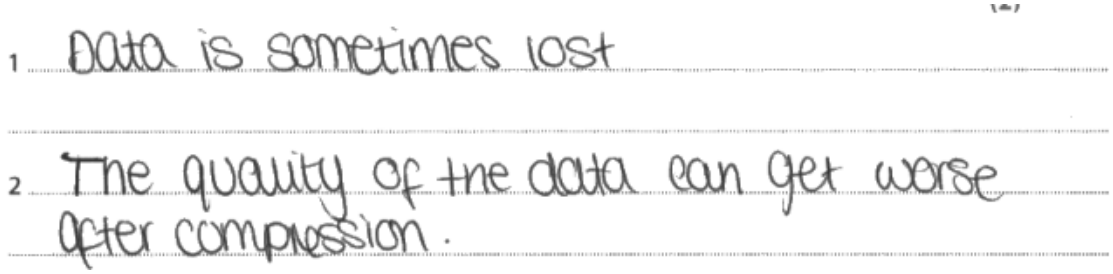


Commentary

Two marks awarded. 1 mark was awarded for the first response i.e. permanent data removal (mark point 3). 1 mark was awarded for response 2 i.e. compression takes time (mark point 1).

Total for (c)(ii) 2 marks

Sample response 2



Commentary

One mark was awarded for response two i.e. affecting quality (mark point 4). The second response was not awarded a mark as it should have said 'permanently' removed.

Total for (c)(ii) 1 mark

Sample response 3

1 Sometimes data can be lost.

2 it can be expensive.

Commentary
There was no markworthy content in this response. Mark point 3 was not awarded for the first response as it should have said 'permanently'. **Total for (c)(ii) 0 marks**

Question 4(d)

A text file is stored on a hard disc.
The file holds information about one side of a sheet of paper.
The sheet of paper is represented as a grid, 80 columns wide and 66 rows long.
Each cell in the gird contains a single 2-byte Unicode character.
The file also contains 40 characters of metadata.
The hard disc allocated space in block of 1024 bytes.

Construct an expression to show the number of blocks required to store the file.

You do **not** need to do the calculation.

(4)

Mark scheme

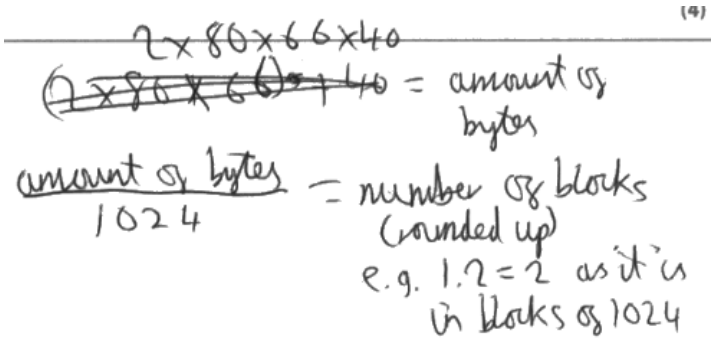
Question Number	Answer	Additional Guidance	Mark
4(d)	Award 4 marks for 11 Award 3 marks for a value between 10 and 11 **One** mark for each: • 80 x 66 x 2 or 80 x 66 x 16 ÷ 8 (1) • + 40 or + 80 (1) • ÷ 1024 (1) • Ceiling or RoundUp (1)	• Arithmetic precedence rules must be clearly followed • Units are not required • Alternative notations for ceiling are accepted • If 16 bits per Unicode character is not awarded, then allow follow through error • Allow follow through error, if interim calculations attempted • Equivalent expressions are accepted	4

Sample response 1

$$\frac{((80 \times 66) \times 2) + 40}{1024}$$ = (rounded up) number of blocks needed to store the file.

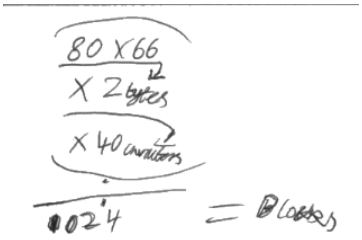
Commentary
The maximum of four marks were awarded. 1 mark was awarded for the expression to calculate the bytes 80 * 66 * 2 (mark point 1). 1 mark was awarded for the addition of the metadata +40 (mark point 2). 1 mark was awarded for the expression to calculate the number of blocks / 1024 (mark point 3) The final mark was awarded for recongising that the number of blocks would need to be rounded up (mark point 4). **Total for (d) 4 marks**

Sample response 2



Commentary
Three marks awarded. 1 mark was awarded for the expression to calcualte bytes 2 * 80 * 66 (mark point 1) 1 mark was awaded for determining the number of blocks / 1024 (mark point 3) 1 mark was awarded for rounding up the number of blocks (mark point 4). The mark point for adding the metadata was not awarded as x40 was used as opposed to +40 **Total for (d) 3 marks**

Sample response 3



Commentary
Two marks were awarded. 1 mark was awarded for determining the bytes required 80 * 66 * 2 (mark point 1) The final mark was awarded for determing the number of blocks / 1024 (mark point 3) **Total for (d) 2 marks**

Question 5 uses this context.
Ships carry cargo around the world in containers.

Question 5(a) uses this context
Containers come in two sizes.

Figure 2 shows an algorithm written using flowchart symbols.

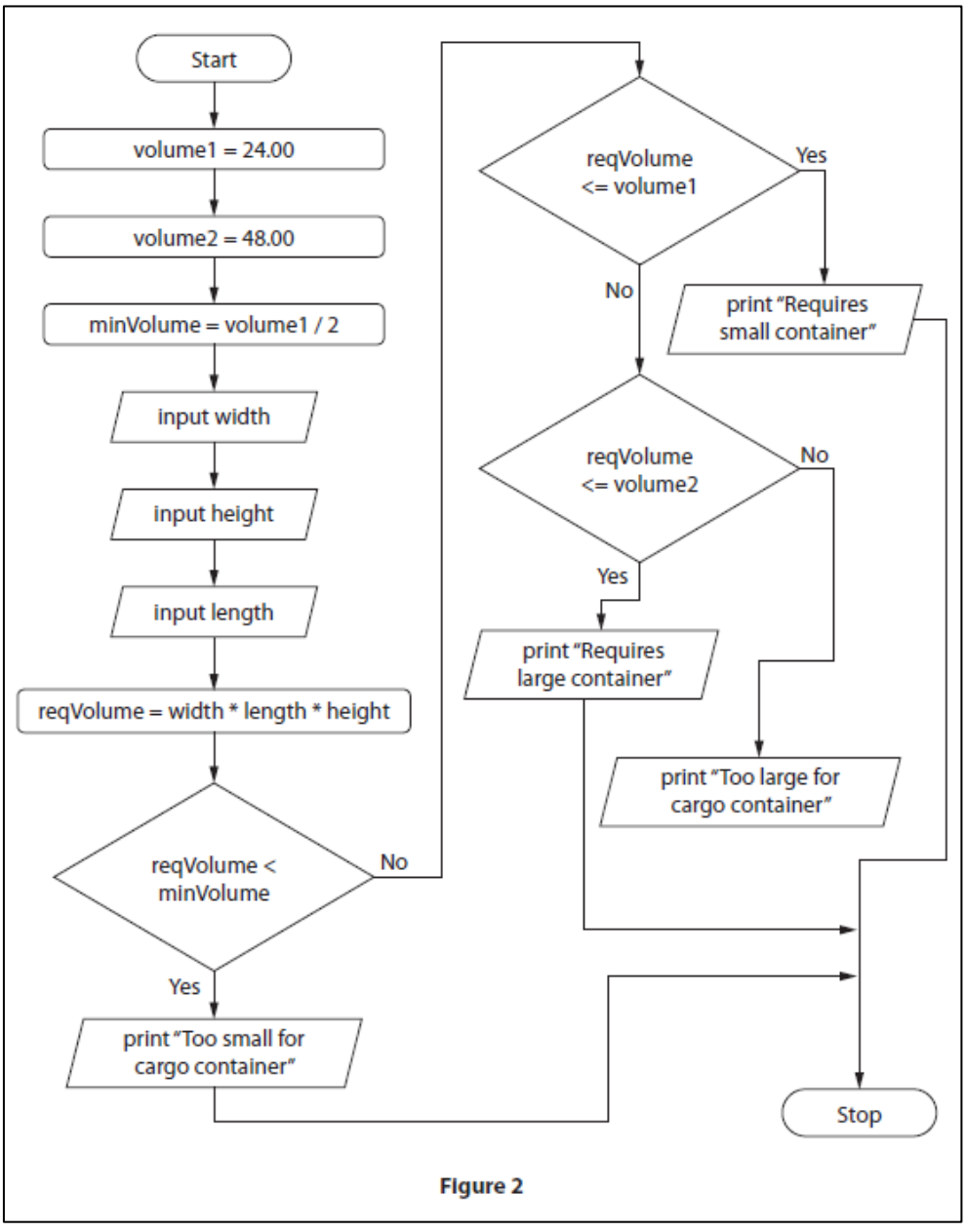


Figure 2

Question 5(a)(i)

Complete the table to show the output for each cargo item.

(3)

Cargo Item			Output
width	length	height	
4	4	2	
2	2	2	
3	8	5	

Mark scheme

Question Number	Answer	Mark
5(a)(i)	One mark for each correct row **Width** / **Length** / **Height** / **Output** 4 / 4 / 2 / Requires large container (1) 2 / 2 / 2 / Too small for cargo container (1) 3 / 8 / 5 / Too large for cargo container (1) Do not penalise spelling	3

Sample response 1

Cargo item			Output
width	length	height	
4	4	2	"Requires large container"
2	2	2	"Too small for cargo container"
3	8	5	"Too large for cargo container"

Commentary
The full three marks were awarded. The response correctly identified row 1 required a large container (mark point 1), row 2 was was too small for a large container (mark point 2) and row 3 was too large for a cargo container (mark point 3). **Total for (a)(i) 3 marks**

Sample response 2

Cargo item			Output
width	length	height	
4	4	2	Too small for cargo container
2	2	2	Too small for cargo container
3	8	5	To large for cargo container

Commentary
Two marks were awarded. Row 1 did not contain the correct output so mark point 1 could not be awarded. Rows 2 and 3 were correct for mark points 2 and 3. **Total for (a)(i) 2 marks**

Question 5(a)(ii)

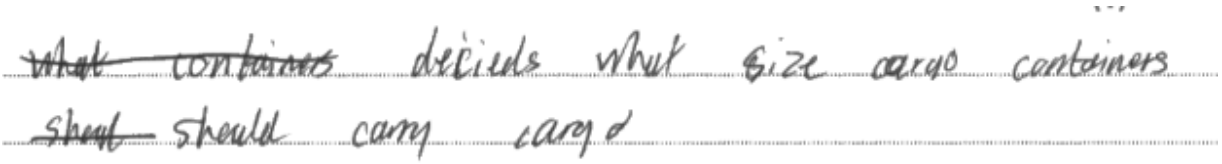
State the purpose of the algorithm in **Figure 2.**

(1)

Mark scheme

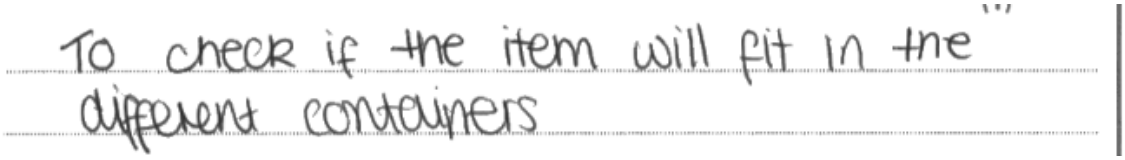
Question Number	Answer	Additional Guidance	Mark
5(a)(ii)	Any response that indicates the concept of: Determining which size shipping container is needed for the indicated cargo.		1

Sample response 1



Commentary
One mark awarded for 'decides what size' **Total for (a)(ii) 1 mark**

Sample response 2



Commentary
No mark awarded because the response does not include any concept of 'size'. **Total for (a)(ii) 0 marks**

Question 5(b)

Each ship is registered to a state.

Figure 3 shows a partially completed algorithm written in pseudocode.

The completed algorithm must:

- Print each state to the display on a new line
- Count the number of states
- Create a message as a single string (e.g. there are *number* states)
- Print the message to the display

Complete the algorithm in the space provided in **Figure 3.**

(4)

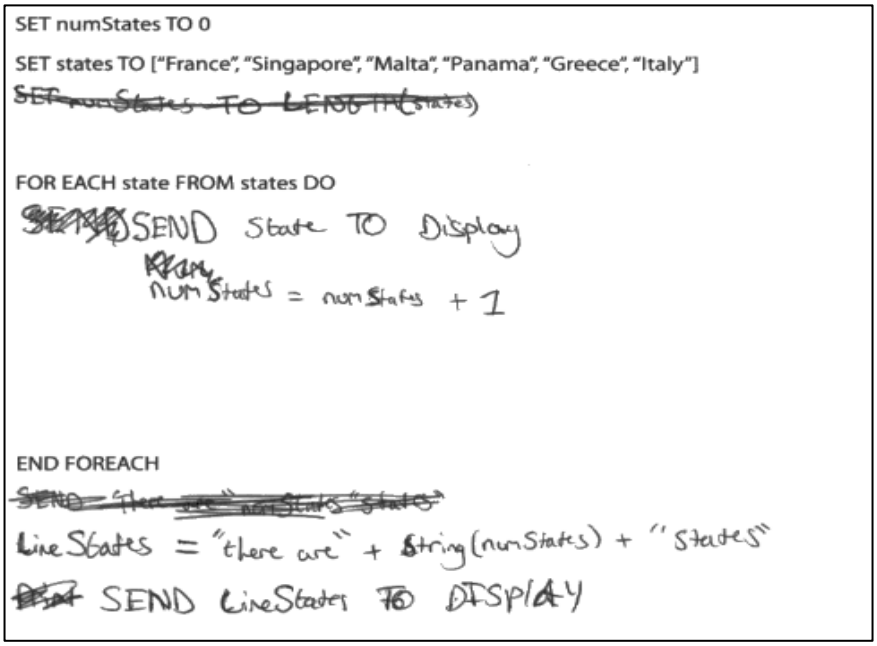
```
SET numStates TO 0
SET states TO ["France", "Singapore", "Malta", "Panama", "Greece", "Italy"]


FOR EACH state FROM states DO




END FOREACH
```

Figure 3

Mark scheme

Question Number	Answer	Additional Guidance	Mark
5(b)	SEND states [numStates] TO DISPLAY (1) or SEND state TO DISPLAY (1) SET numStates TO numStates + 1 (1) or LENGTH(states) (1) Concatenation of message and variable uses " and & & numStates & TO DISPLAY (1) or & LENGTH(states) & TO DISPLAY (1) or STRING(numStates) TO DISPLAY (1) Pseudocode is correct (1)	• Accept , or + in place of & • Ignore capitalisation of commands •	4

Sample response 1 with commentary

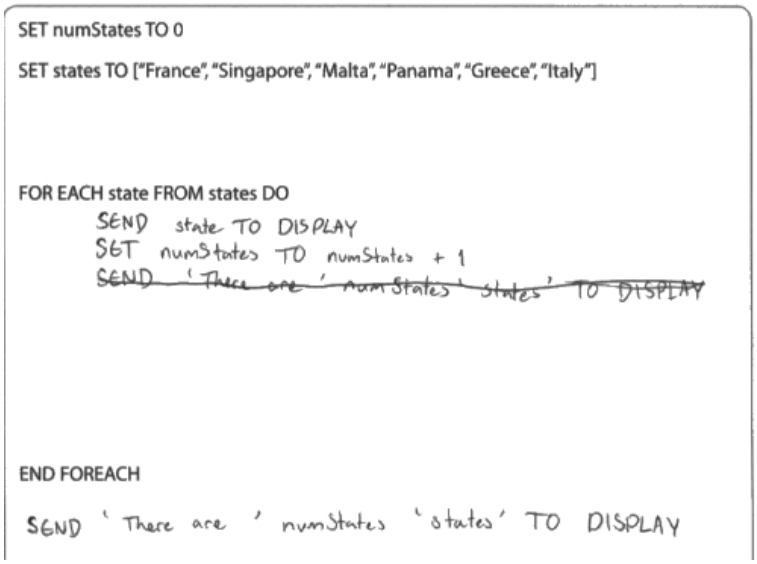


Commentary

Marks were awarded for any pseudocode command set providing the logic was correct.
Mark point 1 was awarded for sending the State to the display within each iteration.
Mark point 2 was awarded for incrementing the numStates variable by 1 within each iteration.
Mark point three was awarded for the last two lines of pseudocode i.e. concatenating the message with the number of states appropriately and displaying the message.
The candidate was awarded mark point 4 as pseudocode was correct.

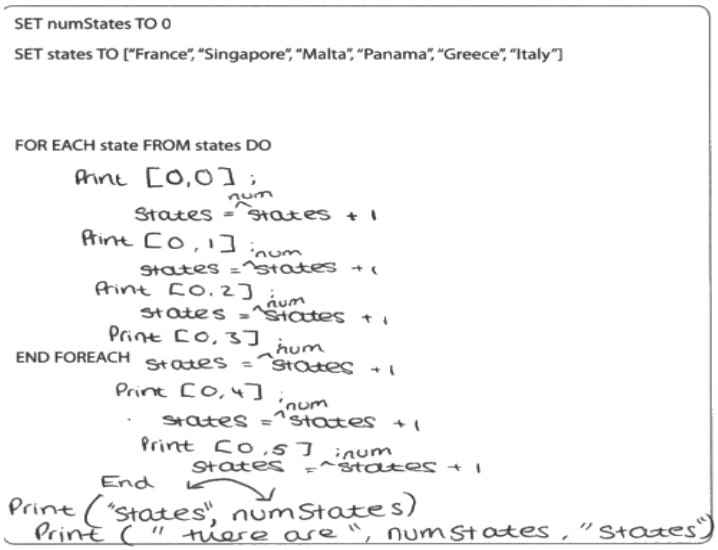
Total for (b) 4 marks

Sample response 2 with commentary



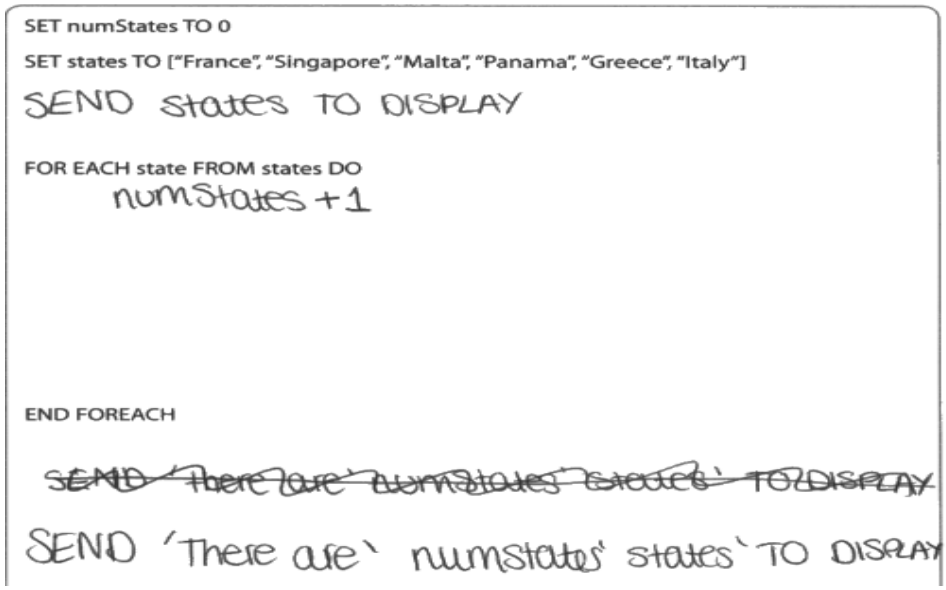
Commentary
Mark point 1 was awarded for displaying the current State within each iteration. Mark point 2 was awarded for incrementing the numStates variable by 1 within each iteration. Mark point 3 was not awarded as the output message and number of states were not concatenated correctly. Any suitable concatenation character could have been used e.g. & + , Mark point 4 could not be awarded as the pseudocode was not fully correct. **Total for (b) 2 marks**

Sample response 3 with commentary



Commentary
Mark point 3 was awarded for correctly concatenating the output message with the numStates variable. No further marks could be awarded as the logic did not make sense and would not do what the question asked for. **Total for (b) 1 mark**

Sample response 4 with commentary



Commentary
There was no markworthy content in this response. Sending the state to display was outside of the loop and it should have been ***state*** or ***states[numState]*** Incrementing the numStates variable was incorrect i.e. the new value was not stored in the numStates variable. The final output was incorrect as there was no attempt to concatenate the numStates variable with the text. **Total for (b) 0 marks**

Question 5(c)(i)

Cargo ships have maximum weight loads.

Figure 4 shows an algorithm written in pseudocode.

The algorithm should identify the size of the cargo ship required for any load.

There is an error on line 9.

```
2   SET loadWeight TO [20000, 28000, 40000, 50000]
3   SET index TO 0
4   SET found TO FALSE
5
6   SEND "Enter cargo weight" TO DISPLAY
7   RECEIVE target FROM (INTEGER) KEYBOARD
8
9   WHILE (NOT found) DO
10      IF (loadWeight [index] >= target) THEN
11          SEND loadWeight [index] TO DISPLAY
12          SET found TO TRUE
13      ELSE
14          SET index TO  index + 1
15      END IF
16  END WHILE
17
18  IF (NOT found) THEN
19      SEND "No ship available" TO DISPLAY
20  END IF
```

Figure 4

Trace tables are used to identify errors in algorithms.

Complete the trace table for an input of 50500 to show what happens due to the error on line 9 in the pseudocode in **Figure 4**.

You may not need to fill in all the rows in the table.

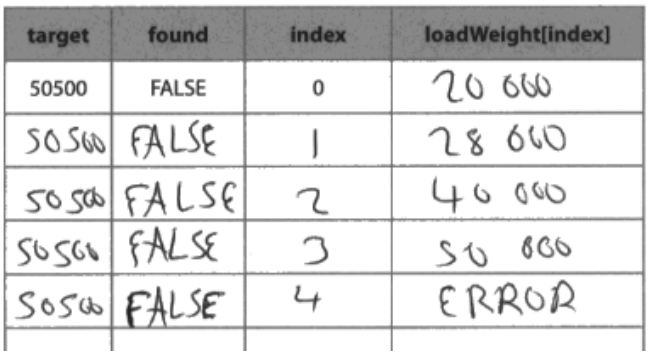
(2)

target	found	index	loadWeight[index]
50500	FALSE	0	

Mark scheme

Question Number	Answer	Additional Guidance	Mark
5(c)(i)	Showing that index goes up to 4 and does not exceed 4 (1) Showing correspondence between values of index and loadWeight[index] (1)	• There does not have to be an explicit indication of the out-of-bounds / crashing error. • Ignore target and found columns • Allow two rows per loop with matching index and loadWeight values	2

Sample response 1



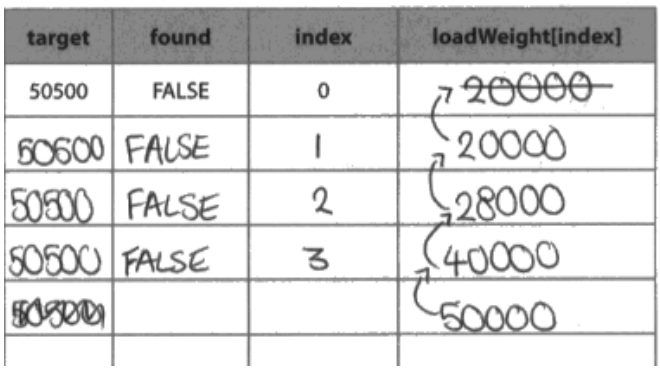
target	found	index	loadWeight[index]
50500	FALSE	0	20 000
50500	FALSE	1	28 000
50500	FALSE	2	40 000
50500	FALSE	3	50 000
50500	FALSE	4	ERROR

Commentary

Full marks were awarded.
The response had the correct index values (mark point 1) and the correct load weight for each index (mark point 2)

Total for (c)(i) 2 marks

Sample response 2



target	found	index	loadWeight[index]
50500	FALSE	0	~~20000~~
50500	FALSE	1	20000
50500	FALSE	2	28000
50500	FALSE	3	40000
~~50500~~			50000

Commentary

One mark was awarded. Mark point 1 was not awarded as index value 4 was missing.
Mark point 2 was awarded as the load weight values were correct for each index. These make it correct.

Total for (c)(i) 1 mark

Question 5(c)(ii)

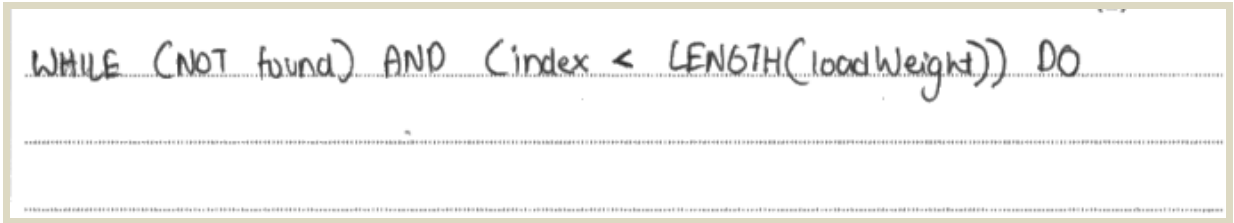
Construct a single line of pseudocode to correct line 9.

(2)

Mark scheme

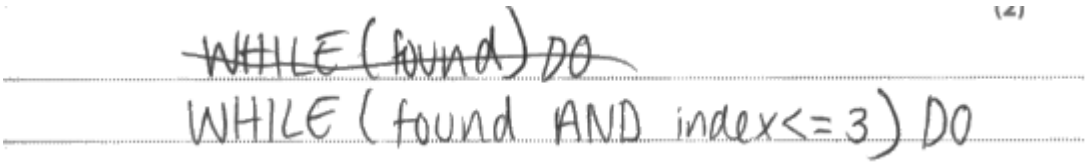
Question Number	Answer	Additional Guidance	Mark
5(c)(ii)	1. Use of AND operator (in the test of relevant conditions) (1) 2. Use of suitable function to find the length of the array using a correct comparison to index (1) Example: WHILE ((NOT found) AND (index < LENGTH (loadWeight))) DO	• Do not penalise pseudocode syntax • Ignore changes to first condition as long as meaning is not lost	2

Sample response 1



Commentary
Two marks were awarded. 1 mark awarded for the AND operator in between the two relevant conditions (mark point 1). The second mark was awarded for the comparison of index with the length of array. **Total for (c)(ii) 2 marks**

Sample response 2



Commentary
One mark awarded for the AND operator in between two relevant conditions. The change to Found were ignored. **Total for (c)(ii) 1 mark**

Question 6 uses this context.
A train company uses ticket vending machines at each station.

Question 6(a) uses this context.

The machines use embedded systems.

Question 6(a)(i)

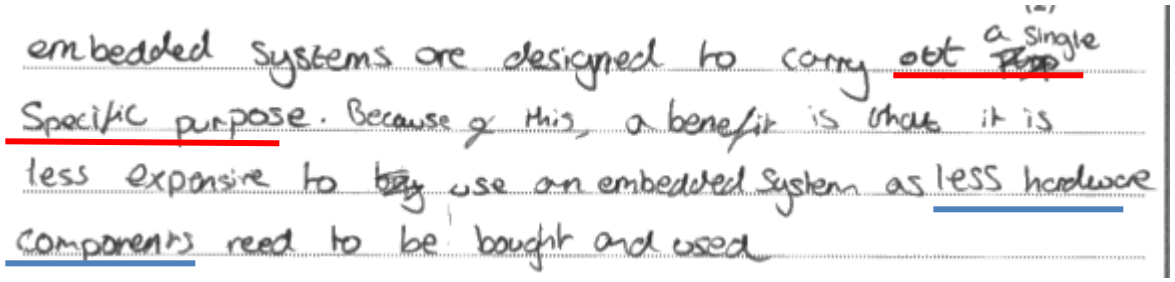
Explain one benefit of using an embedded system in these machines.

(2)

Mark scheme

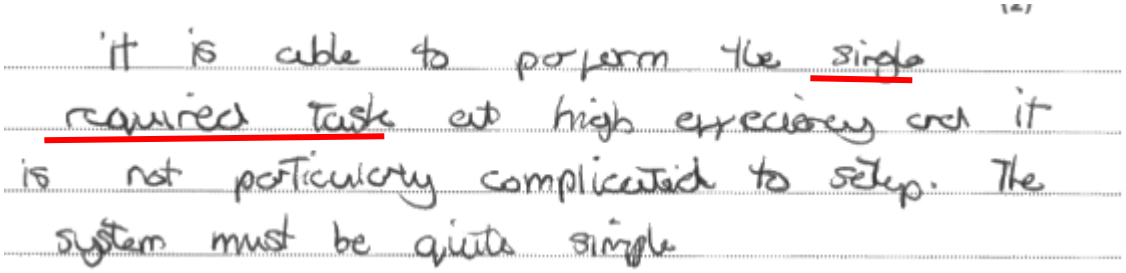
Question Number	Answer	Additional Guidance	Mark
6(a)(i)	Features such as power consumption / processor / memory / number and type of components / physical size (1) can be optimised / chosen to fit just one specific task. (1)		2

Sample response 1



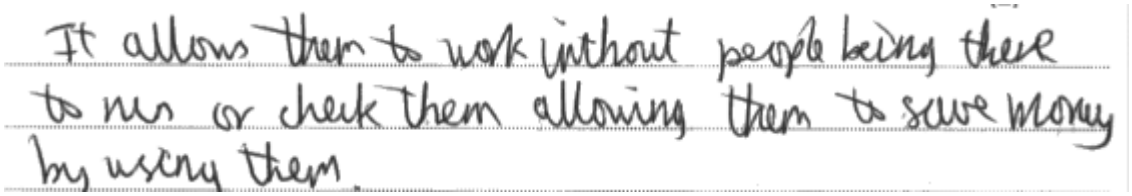
Commentary
Two marks were awarded. 1 mark was awarded for 'carry out a single specific purpose' and the other was for recognising this would mean 'less hardware components' would be needed. **Total for (a)(i) 2 marks**

Sample response 2



Commentary
One mark awarded for 'single required task'. There was no further markworthy content. **Total for (a)(i) 1 mark**

Sample response 3



Commentary
This response appears to have misunderstood the focus of the question was 'in these machines' rather than the company. There was no markworthy content. **Total for (a)(i) 0 marks**

Question 6(a)(ii)

Customers use a touch screen to select their destination. They can pay by cash or bank card. Their tickets and a receipt are printed.

The touch screen is controlled by an embedded system.

Give two other hardware components in the ticket machine that are controlled by embedded systems.

(2)

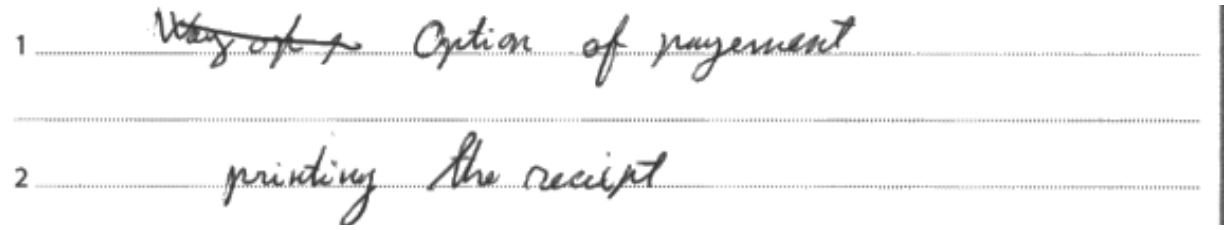
Mark scheme

Question Number	Answer	Additional Guidance	Mark
6(a)(ii)	Any **two** from: • Printer (1) • Bank card (magnetic strip) reader/scanner (1) • Bank card contactless/NFC reader/scanner (1) • Cash input and giving change device (1)	Allow any hardware that relates to paying by cash for MP4	2

Sample response 1

Commentary
Two marks were awarded. The first mark was awarded for 'printer' (mark point 1) and the second for 'bank card scanner (mark point 2). **Total for (a)(ii) 2 marks**

Sample response 2



Commentary
No marks were awarded. Neither response is an item of hardware **Total for (a)(ii) 0 marks**

Question 6(a)(iii)

The ticket machine uses data encryption when a customer pays using a bank card.

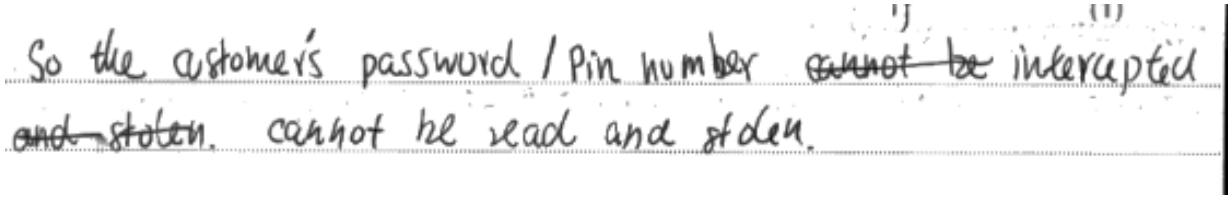
State why data encryption is used in this case.

(1)

Mark scheme

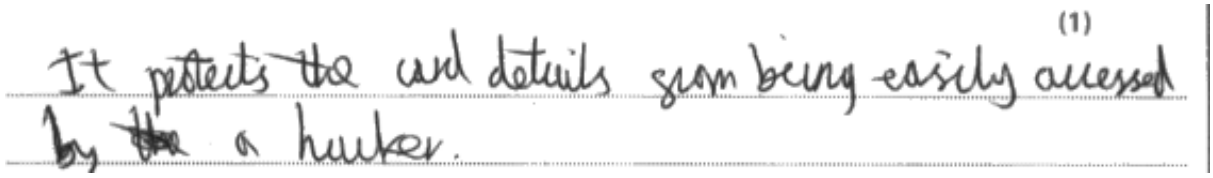
Question Number	Answer	Additional Guidance	Mark
6(a)(iii)	To prevent unauthorised people from reading / understanding the bank card information (1)	Do not award 'to keep it from being hacked / accessed'.	1

Sample response 1



Commentary
One mark awarded for stating that the data 'cannot be read'. **Total for (a)(iii) 1 mark**

Sample response 2



Commentary
No marks were awarded. Responses had to be about encryption and data transmission i.e. not being able to read or understand the data. **Total for (a)(iii) 0 marks**

Question 6(b)

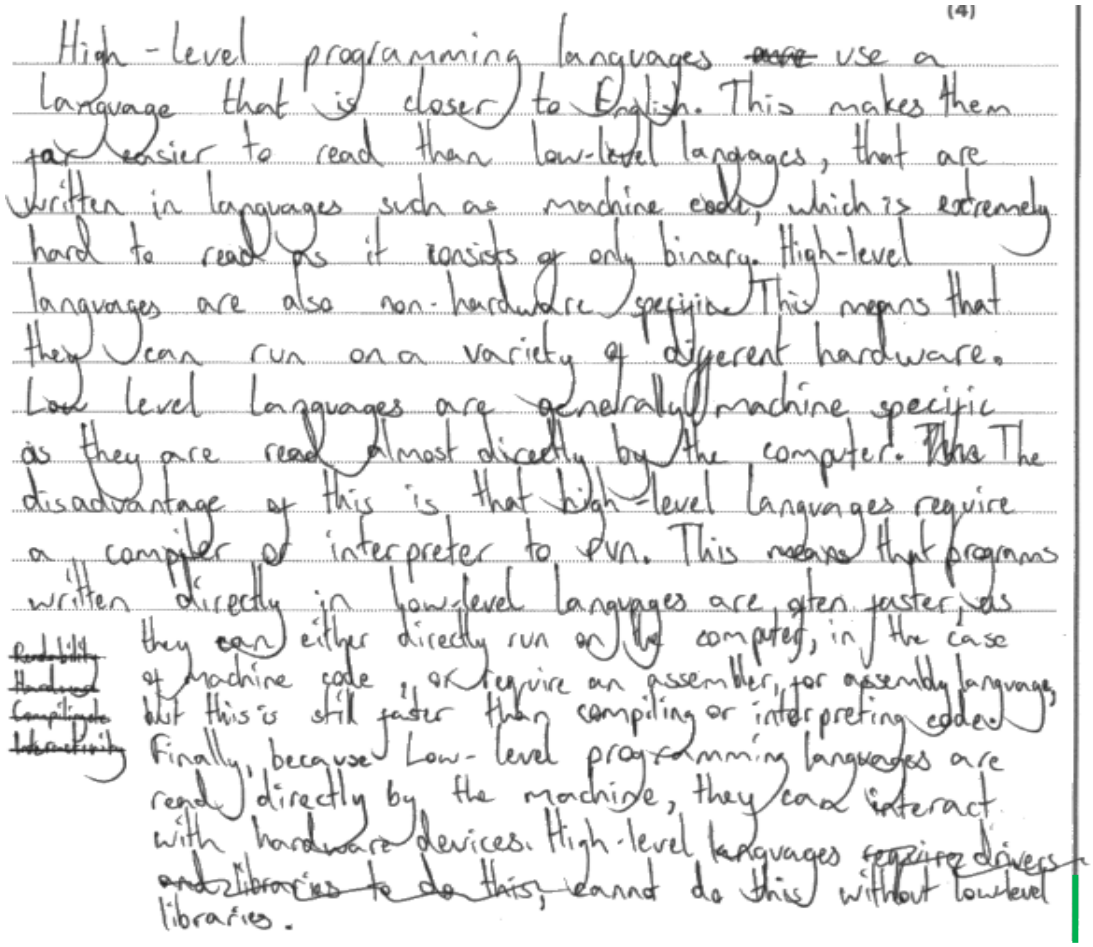
Compare **four** features of high-level and low-level programming languages.

(4)

Mark scheme

Question Number	Answer	Additional Guidance	Mark
6(b)	Award **one** mark for each of (maximum of 4): 1. Readability: high-level language is easily readable by a human because it is designed to look like English whereas a low-level language is binary patterns / mnemonics / abbreviations. (1) 2. Portability: code written in a high-level language is easily transportable across machines whereas a low-level language is designed for a specific microprocessor / piece of hardware. (1) 3. Uses: low-level languages are commonly used to write programs for hardware or devices, like printers, whereas high-level languages are commonly used for to write higher-level applications, such as word processors. (1) 4. Optimisation: low-level languages are used to improve performance, especially of hardware, whereas high-level languages have to go through multiple layers of software to get to the hardware, e.g. the need for HLL to be compiled/interpreted makes programmes run slower than LLL, HLL has a higher level of abstraction removing unnecessary detail (one to many), LLL keeps more of a detail (one to one) (1) 5. Ease of use: high-level languages usually have tools, functions, libraries and development environments which are accessible, even by those with little knowledge, whereas, low-level languages are often challenging to work with and require expertise and depth of knowledge. (1)	For each mark point: • the general feature is followed by exemplification • needs to be a comparison, which may be implicit	4

Sample response 1

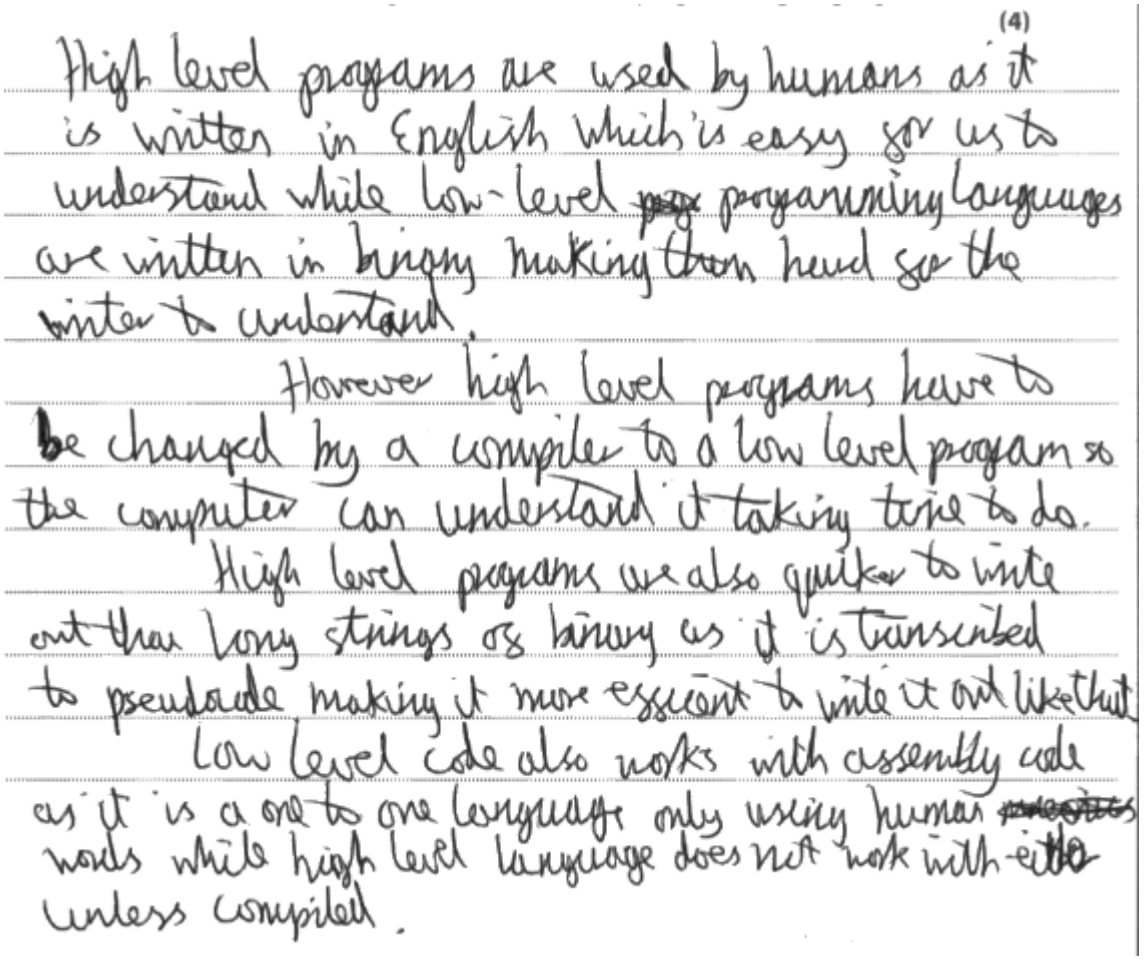


(4)

High-level programming languages ~~are~~ use a language that is closer to English. This makes them far easier to read than low-level languages, that are written in languages such as machine code, which is extremely hard to read as it consists of only binary. High-level languages are also non-hardware specific. This means that they can run on a variety of different hardware. Low level languages are generally machine specific as they are read almost directly by the computer. ~~This~~ The disadvantage of this is that high-level languages require a compiler or interpreter to run. This means that programs written directly in low-level languages are often faster, as they can either directly run on the computer, in the case of machine code, or require an assembler, for assembly language, but this is still faster than compiling or interpreting coded. Finally, because Low-level programming languages are read directly by the machine, they can interact with hardware devices. High-level languages ~~require drivers and libraries to do this~~, cannot do this without low level libraries.

Commentary
Candidates needed to compare four out of the five features i.e. readability, portability, uses, optimisation and ease of use. The candidate did that in this response. 1 mark was awarded for readibility (the first two sentences). The candidate has said that high level languages use a language close to English and that low level languages are written in machine code. That is not enough for the mark, however, the candidate has included the fact that this 'makes them far easier to read than low level languages'. (mark point 1) 1 mark was awarded for the third and fourth sentences i.e. portability. The candidate has said that high level languages are not hardware specific whereas low level are generally machine specific. (mark point 2) 1 mark was awarded for optimisation i.e. the candidate has said that low level programs 'are often faster' as high level need compiling or interpreting. (mark point 4) Finally, 1 mark was awarded for uses. The candidate has said that low level languages can interact directly with the hardware and has said that high level languages cannot do this without low level libraries. This was deemed enough to achieve the mark. (mark point 3). **Total for (b) 4 marks**

Sample response 2



(4)

High level programs are used by humans as it is written in English which is easy for us to understand while low-level ~~pro~~ programming languages are written in binary making them hard so the writer to understand.

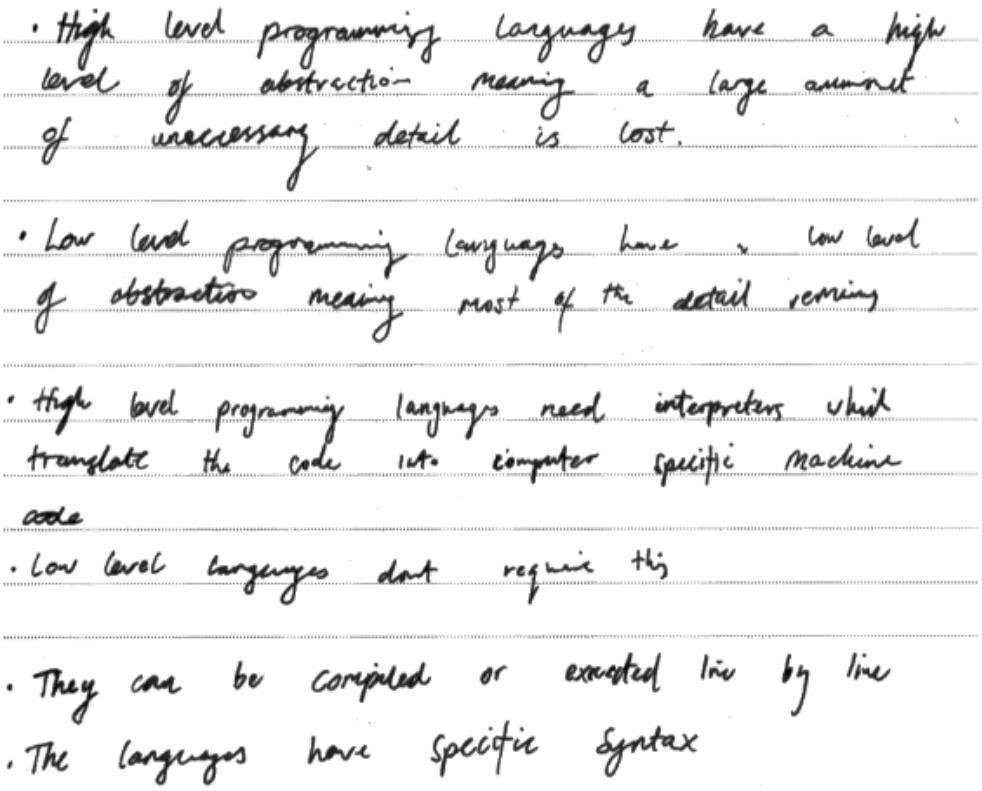
However high level programs have to be changed by a compiler to a low level program so the computer can understand it taking time to do.

High level programs are also quicker to write out than long strings of binary as it is translated to pseudocode making it more esscient to write it out like that.

Low level code also works with assembly code as it is a one to one language only using human ~~words~~ words while high level language does not work with either unless compiled.

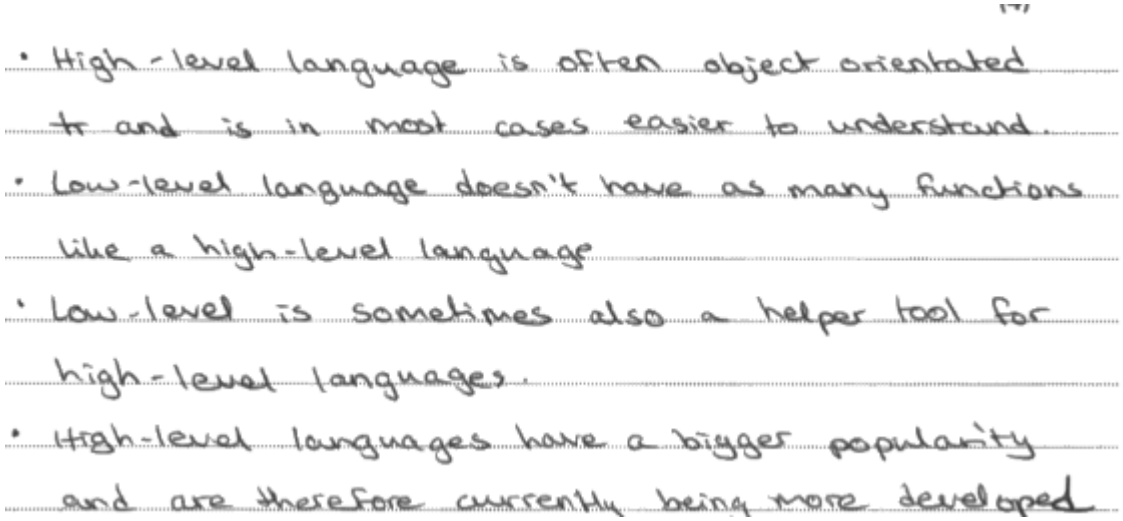
Commentary
Two marks were awarded. The first paragraph was awarded the mark for readability (mark point 1). The thrid paragraph include an ease of use response (mark point 5). Optimisation (mark point 4) was not awarded for either paragraphs 2 or 4 because high level programs are not changed to the low level programs, they are changed to machine code and candidate has not discussed one to many i.e. they were both vague responses. **Total for (b) 2 marks**

Sample response 3



Commentary
This response has only really focussed on optimiation i.e. the first four bullet points all relate to that. One mark was awarded.
Total for (b) 1 mark

Sample response 5



Commentary
This response does relate to the question but there is not enough content for any of the mark points.
Total for (b) 0 marks

Question 6(c)

Artificial intelligence (AI), in many forms, has an increasing impact on our lives.

Discuss this statement considering characteristics, uses and ethical issues.

(6)

Mark scheme

Question Number	Answer	Mark
6(c)	Indicative content: Characteristics – Any of the following: • Implemented in software. • Could involve the use of neural networks / clustering / modelling • Algorithms are trained by exposure to data that has been validated / checked • Algorithms learn by identifying commonalities between the validated / checked data • Algorithms make predictions for new data based on prior learning • Algorithms may incorporate recursive self-improvement Uses – Any of the following: • Game playing (opponents) • Analytics (analyse buying patterns, predicting behaviours, predictive text, targeted advertising, personalised news feeds, friend suggestions) • Image / Audio processing (recognising objects/patterns, face recognition) • Logistics (scheduling, order fulfilment) • Control systems (cars, manufacturing, weapons, navigation • Diagnostic systems (medical, mechanical, electrical) • Natural languages processing (chatterbots, chatbots, speech recognition, personal assistants) • Robotics (dangerous situations, help aged or disabled) Ethical issues – Any of the following: • Training sets could include data that should not be used to make decisions (race, religion, gender, etc.) that could cause biased outcomes • Is a computer to be trusted to make decisions (life-death)? • If a computer discovers something that humans can't prove, should it be accepted as truth? • How do we know that the answer produced is correct? • Will people be comfortable interacting with machines that are considered intelligent? • Some jobs may be at risk, especially those requiring human skills such as empathy or creativity.	6

Level	Mark	Descriptor
	0	No rewardable content.
Level 1	1–2	Basic, independent points are made showing elements of knowledge and understanding of key concepts/principles of computer science. The discussion will contain basic information with little linkage between points made.
Level 2	3-4	Demonstrates adequate knowledge and understanding of key concepts/principles of computer science. The discussion shows some linkages and lines of reasoning with some structure.
Level 3	5-6	Demonstrates comprehensive knowledge and understanding by selecting relevant knowledge and understanding of key concepts/principles of computer science to support the discussion being presented. The discussion shows a well-developed, sustained line of reasoning which is clear, coherent and logically structured.

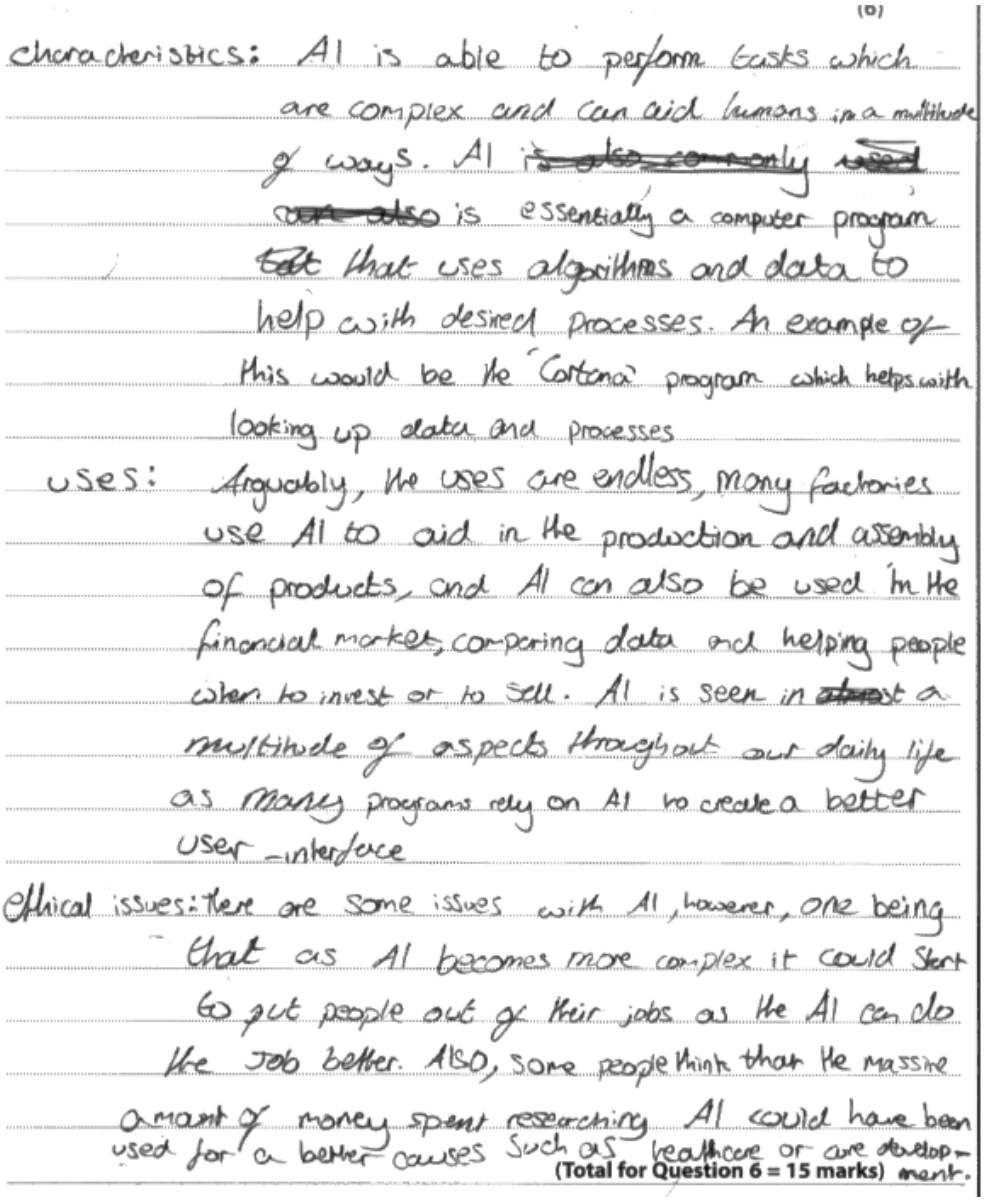
Sample response 1

Artificial inteligence has become more and more important for various technologies in recent years, and it seems AI will be a key part of our lives in the future. It is currently being used to develop financial monitors, driverless cars, facial recognition software, and much more. Artificial inteligence is when a programme capable of making human-like decisions. It is often used with machine learning so the system is able to improve itself. It's use in the development of driverless cars raises some ethical issues, such as when a crash is certain, how should a computer program get to decide who lives and dies. Artificial inteligence programs need to be given certain rules to follow to ensure the safety of the people working with them, and they cannot be connected to the internet as this would be dangerous. In the future, it is very possible AI will replace humans for various jobs which could also be a problem as it would lead to mass unemployment. Most people now interract with artificial inteligence on a daily basis as it is present in many forms of software such as searchengines, and facial media networks as well as other things. There are also diffferent levels of artificial inteligence, and we are currently only beginning to discover what it is capable of. There is a type of AI called ASI or artificial super inteligence which is able to improve itself. It would be dangerous to create ASI without a carefully planned and selected set of rules for it to follow.

(Total for Question 6 = 15 marks)

Commentary
This question is a levels-based question. The response fully meets the descriptors for level 3. It has included some of the characteristics of artificial intelligence and has also discussed the uses and ethical issues. In the time available to answer this question the response is comprehensive and quite clearly shows understanding of key concepts of computer science. The discussion is also well-developed. **Total for (c) 6 marks**

Sample response 2



(6)

characteristics: AI is able to perform tasks which are complex and can aid humans in a multitude of ways. AI ~~is also commonly used~~ ~~are also~~ is essentially a computer program ~~that~~ that uses algorithms and data to help with desired processes. An example of this would be the 'Cortana' program which helps with looking up data and processes

uses: Arguably, the uses are endless, many factories use AI to aid in the production and assembly of products, and AI can also be used in the financial market, comparing data and helping people when to invest or to sell. AI is seen in ~~almost~~ a multitude of aspects throughout our daily life as many programs rely on AI to create a better user-interface

ethical issues: there are some issues with AI, however, one being that as AI becomes more complex it could start to put people out of their jobs as the AI can do the job better. ALSO, some people think that the massive amount of money spent researching AI could have been used for a better causes such as healthcare or are develop-ment.

(Total for Question 6 = 15 marks)

Commentary
This question is a levels-based question. The response has included characteristics, uses and ethical issues. Level 3 and 5 marks were awarded taking into account that all three areas were discussed and that, overall, it was quite well balanced and developed as a response. However, the limited discussion of ethical issues and of impact were not sufficient for a mark of 6 to be awarded. **Total for (c) 5 marks**

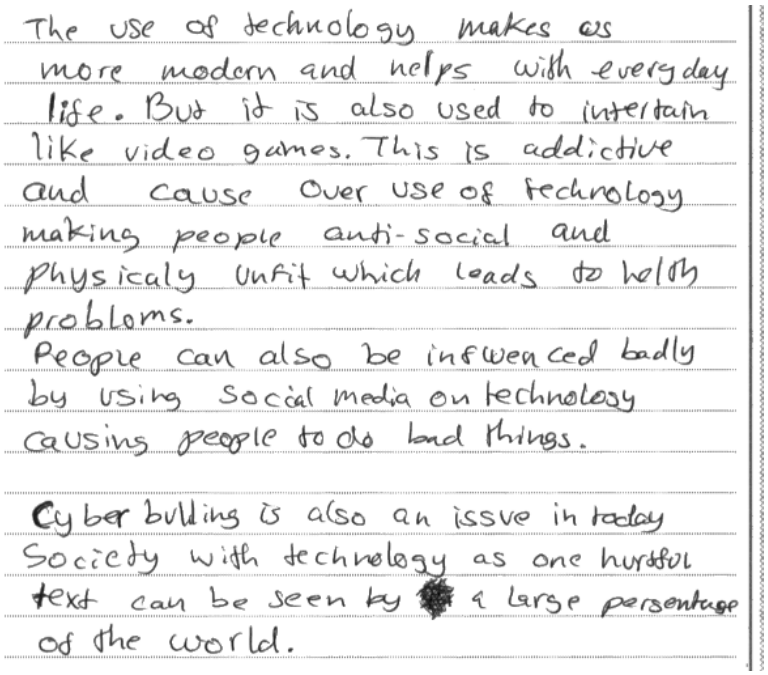
Sample response 3

AIs are very common in the modern day as most people have one like siri, on their phone or an Alexa at home. They tend to be very helpful and usually relatively fast and aid us in simple chores like setting times or calling someone. ~~Beca~~ They are especially useful as they can respond to voice, allowing others to do multiple things at the same time. Many people find them to be useful due to this, however some also have doubts. ~~Dude~~ Due to them being able to respond to your voice, they must always be listening which allows some people to believe that AIs are a ~~form~~ way ~~the~~ for the government to monitor a person's every day life. This has caused some ~~disagreeance~~ problems about whether AIs are ethically okay as they can be ~~to~~ considered an invasion of privacy if someone does not want to be heard. Of course, this is up to those who buy them. Due to AIs also being extremely intelligent and self-sufficient, some ~~belie~~ people fear them.

(Total for Question 6 = 15 marks)

Commentary
This is a levels-based question. The response does not meet level 3 because the discussion is quite narrow, focusing on one aspect throughout. However, there is clear evidence of 'adequate knowledge and understanding'. Full marks in level 2 were awarded. **Total for (c) 4 marks**

Sample response 4



The use of technology makes us more modern and helps with everyday life. But it is also used to intertain like video games. This is addictive and cause over use of technology making people anti-social and physicaly unfit which leads to helth problems.
People can also be influenced badly by using social media on technology causing people to do bad things.

Cyber bulling is also an issue in today Society with technology as one hurtful text can be seen by a large persentage of the world.

Commentary
There was no markworthy content as the candidate has not answered the question. **Total for (c) 0 marks**

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