Computer Science (9-1)

1.5 – Systems software
Antony Gallagher

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **63**.
- The total number of marks may take into account some 'either/or' question choices.

1 Julian buys a new laptop with a system information utility and a diagnosis utility.

Describe, using examples, the purpose of the system information and diagnosis utilities.

System information utility

Example

Diagnosis utility

Example

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[4]

2 Xander's tablet computer comes with system software, including an operating system and utility system software.

The utility system software provides compression software. Xander uses this to compress an image.

(i) Explain how the compression software will compress the image file.

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[4]

(ii) Give the name of **two** other types of utility system software.

1 ---

2 ---

[2]

3 A restaurant has a computer-based ordering system which is running slowly. A technician has said that the hard disc drive is fragmented. The technician has suggested using utility software to defragment the drive.

Explain how defragmentation software could overcome the issue of the slow computer system.

---

[3]

4 Apu has a handheld e-book reader that allows him to store and read electronic books.

The manufacturer of the e-book reader provides proprietary software, which Apu can use to transfer the e-book from the CD-ROM to the e-book reader.

(i) Describe what is meant by proprietary software.

[2]

(ii) Explain **one** advantage to the manufacturer of providing proprietary software instead of open source software.

[2]

5 Eve's computer has system software including an Operating System and Utility Software.

Eve runs the defragmentation program on her computer.

Explain why Eve's computer is more efficient after the program has been run.

[3]

6 A restaurant has a computer-based ordering system which is running slowly. A technician has said that the hard disc drive is fragmented.

Explain how defragmentation software could overcome the issue of the slow computer system.

---

[3]

7 Eve's computer has system software including an Operating System and Utility Software.

Tick (✓) **one** box in each row to identify which function of the Operating System deals with each action.

Action	Memory management	Peripheral management	File management	User management
Creating a new folder to store documents in				
Moving data from Virtual Memory to RAM				
Renaming a file				
Reading data from a scanner				
Changing the password required to log on to the computer				

[5]

8 Amin buys a new computer with an operating system and some utilities.

Some of the software in Amin's computer is open source.

Describe what is meant by open source software.

---

[2]

9(a) Security on a computer can be provided directly by the operating system or by using utility programs.

Utility programs include antivirus, file transfer, firewall and system cleanup.

State which **two** of these utilities can be used for security.

1

2

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[2]

(b) Identify and describe **two** methods by which the operating system can provide additional security directly.

1

2

---

[4]

10(a) Ali's tablet computer has an operating system.

Ali runs defragmentation analysis on his magnetic hard disk. Parts of the results are shown.

	File 1
	File 2
	File 3
	Free space

(i) Explain how defragmentation will change how the files and free space are arranged on Ali's hard disk.

[3]

(ii) After defragmentation, Ali's computer is able to access files faster.

Explain why Ali's computer can access the files faster after defragmentation.

[2]

(iii) Give **three** additional examples of utility programs.

1 ----------

2 ----------

3 ----------

[3]

(b) Complete the following description of the functions of an operating system by selecting the appropriate missing words from those in the box.

user	drivers	directories	hardware	interface	multitasking
output	peripherals	printers	processor	RAM	utility
ROM	running	passwords	faster	volatile	virtual

The operating system provides a user ..... . This displays the

output to the user and allows the user to interact with the ..... .

The operating system controls the movement of data from secondary storage to

..... and vice-versa. This is known as memory management.

The operating system can only perform one process at a time, but by managing the memory

the computer can appear to be completing more than one process at a time. This is known as

..... .

An operating system allows device ..... to be installed to allow

an external piece of hardware to interact with the ..... .

The operating system provides security through user accounts and

..... . It also creates and maintains a file system to organise files

and ..... .

[8]

11 Xander's tablet computer comes with system software, including an operating system and utility system software.

The operating system provides file management.

Identify **three** ways that Xander can make use of the file management facility.

1 _____

_____

2 _____

_____

3 _____

_____

[3]

12 Hamish stores confidential documents on his laptop.

If unauthorised access does occur, Hamish would like to use encryption to add another layer of protection to his documents.

(i) Explain how encryption helps to protect Hamish's documents.

---

[2]

(ii) One encryption method is a Caesar cipher.

This Caesar cipher moves each letter of the alphabet **one** place to the right.

The following table shows the original letters in the first row, and the new letters in the second row.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A

For example, if the message read: `HELLO`

This would be stored as: `IFMMP`

The following pseudocode algorithm takes a string of uppercase letters as input and uses the Caesar cipher to encrypt them.

The functions used in the algorithm are described in the table:

Function	Description

`ASC(character)`	Returns the ASCII value for *character* e.g. `ASC("A")` returns 65
`CHR(ASCIIvalue)`	Returns the single character for *ASCIIvalue* e.g. `CHR(65)` returns "A"
`subString(Value, Number)`	Returns the *Number* of characters starting at position *Value* (where 0 is the first character)

Complete the pseudocode algorithm to perform a Caesar cipher.

```
01  message = input("Please enter your string")
02  newMessage = " "
03  messageLength = message.length
04  for count = 0 to ........................................
05      ASCIIValue = ASC(message.subString(.............,1))
06      ASCIIValue = ASCIIValue + ............................
07      if ASCIIValue >90 then
08      ASCIIValue = ............................. – 26
09      endif
10      newMessage = ............................. + CHR(ASCIIValue)
11  next count
```

[5]

(iii) The algorithm needs adapting. An extra line (line 12) is needed to output the encrypted message.

Write line 12 to output the encrypted message in pseudocode or programming code.

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[1]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1			System information: • displays important data about the current state of the computer • e.g. temperature, free memory, network speed, % processor used Diagnosis: • attempts to detect / resolve items that are not working correctly • e.g. missing drivers, network connection	4	1 mark each for explaining “system information” and “diagnosis” + 1 mark for each example – accept relevant examples, but not examples related to virus / malware for diagnosis. Examples should be specific examples of the use of these utilities rather than general descriptions. Examiner's Comments In this part, many candidates appeared not to have a clear understanding of system information and diagnostic utilities which were featuring here for the first time, whereas they have previously performed well on questions about other system utilities in the specification. Centres may need to reconsider how they address this topic to broaden candidates’ understanding. Candidates should also ensure that they demonstrate their understanding in their answers. Responses such as “a system information utility provides information about the system” do not enable the examiner to assess what the candidate understands and were not awarded marks. Candidates, on the whole fared better on describing the purpose of diagnostic utilities, although in the example examiners expected the diagnosis of system faults rather than the presence of malware. Some candidates misunderstood the requirement to provide an example – they gave an example of brand names of utilities, rather than an example of the use of the utility. Candidates should be aware that brand names will never be required as answers to examination questions. Answers that were expected were of the form “System information utilities display the current state of the computer” with as a possible example “the amount of RAM available”.
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
2		i	1 mark per bullet to max 4 e.g. • Use an algorithm • …to remove **repeated/unnecessary** data • Could use lossy/lossless • **lossless** will not remove data permanently // **lossless** means original file will be restored • **lossy** is **permanent** deletion // **lossy** means original file will not be restored • Reduce number of pixels // reduce resolution • Record the changes in the colour for each pixel • … instead of the colour • Run length encoding • … record the colour and number of consecutive pixels of that colour • … instead of the colour of every pixel • Decrease colour depth//decrease number of colours	4 AO2 1a (2) AO2 1b (2)	• 'lossy removes unnecessary data permanently' gets 3 marks, 1 for lossy, 1 for 'removes unnecessary data' if not already awarded and 1 for lossy = permanent • Do not award 'not noticeable to the human eye', or 'keeps same/reduces quality' - this does not explain **how** the file is compressed. • Do not accept information for data. <u>Examiner's Comments</u> This question required candidates to demonstrate their understanding of compression to image files. Many candidates were able to convey an understanding of generic compression; for example, the application of an algorithm, and the use of lossy/lossless compression. Many candidates were also able to apply this to an image file; commonly the reduction of resolution/pixels and colour. Some candidates did not answer the question of how it compresses the file, instead incorrectly answering why compression was used to reduce the file size. **Exemplar 3** (i) Explain how the compression software will compress the image file. Colour Depth It will remove some of the colours that the human eye could not recognize making the image take up less space, it could also reduce the size of the picture which will get more space and also it could reduce the number of pixels as the human eye would not notice as it. The candidate has identified that some colours are removed, or that the number of pixels would be removed. They have not expanded on these or explained the type of compression that is being used.

Question			Answer/Indicative content	Marks	Guidance
		ii	1 mark per bullet to max 2 E.g. • Defragmentation software • Encryption software • Backup software • Anti-virus • Firewall • Anti-spyware • Disk checker/cleaner • Auto-update • Disk formatting	2 AO1 1a (2)	• Do not accept compression • Accept anti-malware <u>Examiner's Comments</u> This question was answered well by many candidates who were able to identify two different examples of utility software. The most common answers included encryption and defragmentation. Some candidates did not read the requirements for 'other' types i.e. **not** compression and gave compression as one of their answers.
			Total	6	
3			• Files on the hard disk drive are moved (1) • Empty spaces collected together (1) • Files are moved to be stored together (1) • Fewer disc accesses are needed (1)	3 (AO1 1b)	Up to a maximum of 3 marks.
			Total	3	

Question			Answer/Indicative content	Marks	Guidance
4		i	• Source code not made available/ Only compiled code is published • Licence restricts the copying / modifying / distribution of the software	2	The mention of a licence is not sufficient. Candidate should state that the licence restricts copying / modifying / distributing. “closed source” is not enough because it just gives an alternative term for “proprietary” without a description of what we mean by “closed” Examiner's reports This part was intended as a more difficult question to differentiate the top candidates, was generally poorly answered. It had been expected that more candidates would be able to provide a definition of proprietary software for part (i) but many candidates appeared unfamiliar with the term in the context in which it is used in the specification. For those who were aware of the term, several common misconceptions were repeated such as the idea that proprietary software is always sold at a cost.

Question			Answer/Indicative content	Marks	Guidance
		ii	eg • Stops competing companies copying their software (or hardware / ebooks) • … and producing similar / better products. • Ensures compatibility (with the e-book reader)… • … as they can ensure that no modifications have been made (mark points in pairs).	2	The first mark is for identifying a relevant advantage *to the manufacturer*, and the second for details expanding this point. Accept answers about preventing reverse engineering the company's product or piracy of the company's software or e-books (e.g. DRM) as referring to the first set of answers. <u>Examiner's Comments</u> This part was intended as a more difficult question to differentiate the top candidates and was generally poorly answered. Because of the general misunderstanding of the concept, and the necessity to apply it in this specific context and give advantages to the manufacture of the e-book reader in (ii), few candidates gained marks here. A common incorrect answer suggested that the manufacturer would benefit from selling the software to e-book users, when it was indicated in the question that the software is provided with the reader. Other incorrect answers appeared to be making points from a previous question about the use of open source software in schools, which did not apply in this context.
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
5			1 mark per bullet to max 3 • Takes less time to read/access a file because the data/files/pages are contiguous • …. so it does not need to move as far to read the next piece of data/file/page • …because it is in the next memory location • Takes less time to save new data/files because there is larger free space together • …so it does not need to split the data/file • … and can store them in contiguous spaces	3	
			Total	3	
6			• Files on the hard disc drive are moved (1) • Empty spaces collected together (1) • Files are moved to be stored together (1) • Fewer disc accesses are needed (1)	3	Up to a maximum of 3 marks.
			Total	3	

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>7</td><td></td><td></td><td>1 mark per row

<table><tr><th>Action</th><th>Memory management</th><th>Peripheral management</th><th>File management</th><th>User management</th></tr><tr><td>Creating a new folder to store documents in</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>Moving data from Virtual Memory to RAM</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>Renaming a file</td><td></td><td></td><td>✓</td><td></td></tr><tr><td>Reading data from a scanner</td><td></td><td>✓</td><td></td><td></td></tr><tr><td>Changing the password required to log on to the computer</td><td></td><td></td><td></td><td>✓</td></tr></table></td><td>5</td><td>No mark awarded if 2+ ticks on each row</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
<tr><td>8</td><td></td><td></td><td>• The source code is distributed with the software
• The customer can modify the source code
• The customer can redistribute the source code (with the same licence / restrictions)</td><td>2</td><td><u>Examiner's Comments</u>

It was pleasing to see a reduction in the common misapprehension that being free of charge is an essential or defining characteristic of open source software. This shows, to some extent, that centres have taken note of the feedback provided from previous sessions.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
</table>

Question			Answer/Indicative content	Marks	Guidance
9	a		• antivirus • firewall	2	
	b		e.g. • (User name and) password • Only allows you to use the system if you are authorised • Encryption • Prevents hackers from understanding any data if accessed (e.g. passwords) • Access rights • To prevent files from being modified / deleted • User access control • Prevents users from making changes to the system Marks in pairs	4	*Accept any security measure that is provided by the operating system itself but not by standard utility programs (even if the utility program is normally bundled with operating systems).* *The first bullet is for identifying or a brief description of a measure.* *The second bullet is for a further more detailed description or a description of how the measure ensures security.* Any reasonable biometrics is acceptable.
			Total	6	

Question			Answer/Indicative content	Marks	Guidance
10	a	i	1 mark for: • Collate free space together Max 2 from • Collate file fragments together/contiguously • All of **file 1** will be stored **consecutively** • All of **file 2** will be stored **consecutively** • All of **file 3** will be stored **consecutively**	3	Allow diagram Do not award gives more free storage space. Do not award 'similar' files are grouped together.
		ii	1 mark per bullet to max 2 • When one page is read it does not have to search for second page // does not have to search through all the pages // does not need to reassemble the individual pages • Does not have to physically move as far to get the next part of the file • Less physical movement saves time • Multiple locations do not need accessing // fewer individual accesses	2	Answer must relate to why it is faster.
		iii	1 mark for each example e.g. • Backup • Encryption • Compression • Firewall • Anti-virus // anti-malware • Anti-spyware // anti-malware	3	Only award anti-malware once.

Question			Answer/Indicative content	Marks	Guidance
	b		1 mark for each correct word The operating system provides a user **interface**. This displays the output to the user and allows the user to interact with the **hardware**. The operating system controls the movement of data from a hard drive to **RAM** and vice-versa. This is known as memory management. The Operating system can only perform one process at a time, but by managing the memory the computer can appear to be completing more than one process at a time. This is known as **multitasking**. An operating system allows device **drivers** to be installed to allow an external piece of hardware to interact with the **processor**. The operating system provides security through user accounts and **passwords**. It also creates and maintains a file system to organise files and **directories**.	8	BOD hardware with peripherals/processor/printer
			Total	16	

Question			Answer/Indicative content	Marks	Guidance
11			1 mark per bullet to max 3 e.g. • He can place his files into folders/directories • He can (re)name files/folders • He can move his files/folders • He can copy/transfer/export files/folders • He can delete his files/folders • He can set permissions/access rights • He can search for files • He can view file details/extensions/file size/type • He can create files/folders • He can sort files/folders // he can put files into a specific order // by example • He can open files/folders	3 AO2 1a (3)	• Answers must be clear as to what the answer is applied to i.e. 'you can open it' - what is it? • Mark first answer on each section. • Do not award: ◦ defragment ◦ view files ◦ download ◦ compression ◦ preview ◦ edit/read/write files • 'Organise files' without what into - is not enough. Examiner's Comments Candidates found this question challenging. Many candidates identified incorrect features such as compression and encryption. Some candidates were able to identify one or two ways; commonly deleting files or transferring files. Only a few candidates were able to identify three correct ways.
			Total	3	

Question			Answer/Indicative content	Marks	Guidance
12		i	1 mark per bullet to max 2 • Uses an algorithm to • … jumble/scramble/mix up the data // turns it into cypher text // by example • If it is accessed it cannot be **understood** // it is **unintelligible** • Use of keys to encrypt/decrypt data	2 AO1 1a (1) AO2 1b (1)	• 'Need the key to understand the data' can get both MP2 and 3 • Cannot read the data // data is unreadable is NBOD Examiner's Comments This question was answered well by many candidates who were able to identify that encryption scrambles data and that a key is required to read it.

		ii	1 mark for each completed piece of code
			
			`message = input("Please enter your string")`
			`newMessage = ""`
			`messageLength = message.length`
			`for count = 0 to` **`messageLength - 1`**`//` **`message.length - 1`**
			`  ASCIIValue = ASC(message.subString` **`count`**`,1))`
			`  ASCIIValue = ASCIIValue +` **`1`**
			`if ASCIIValue > 90 then`
			`  ASCIIValue =` **`ASCIIValue`** `- 26`
			`  endif`
			`  newMessage =` **`newMessage`** `& CHR(ASCIIValue)`
			`next count`
				5
				AO3 2b (5)
					• For `messageLength - 1` in loop accept `messageLength` or `message.length`
					
					• Spelling must be exact, do not penalise case.
					
					Examiner's Comments
					
					This question tested candidates' understanding of algorithms and the use of strings in programming.
					
					A noticeable number of candidates did not attempt the question.
					
					The most common correct response was the first space to identify the number of iterations. The final space was also often answered correctly, identifying that the string is concatenated with the rest of the message.
					
					Fewer candidates were able to identify the character being selected, or the value to add to ASCIIValue within the loop.

Question			Answer/Indicative content	Marks	Guidance

		iii	1 mark for suitable output
			e.g.
			
			`output(newMessage) //`
			`print(newMessage)`
				1
				AO3 2b
				(1)
					• Must logically work. Do not accept "" around `newMessage`.
					
					• Parentheses not required.
					
					• Do not accept:
					• `newMessage = output(newMessage)` or similar
					
					• Accept any output method
					
					• Bod - if the candidate outputs something extra it must be valid i.e. a variable from the program, or additional text in a string with suitable concatenation e.g. `print(newMessage + asciiValue)` is ok but `print(newMessage is the new message)` is not.
					
					<u>Examiner's Comments</u>
					
					This question required candidates to identify the variable from part bii that stores the final encrypted message and to output it using any identifiable output keyword.
					
					A common error was putting speech marks around new message i.e. 'newmessage' which would mean the words 'newmessage' would be output instead of the contents of the variable.

			Total	8	