

**GCSE (9-1)**

**Examiners' report**

# COMPUTER SCIENCE

**J277**

For first teaching in 2020

**J277/01 Summer 2024 series**

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## Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate responses is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

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## Paper 1 series overview

Component 1 focuses on theoretical concepts of Computer Systems including:

- systems architecture
- memory and storage
- computer networks, connections and protocol
- network security
- systems software
- ethical, legal, cultural and environmental concerns.

There were a large number of candidates who took this examination and produced a range of responses across the questions. Candidates were often able to demonstrate their understanding of key elements and express these succinctly. Some candidates found the requirements of application more challenging and gave generic responses without consideration for the scenario.

To do well in this examination candidates needed to recall knowledge about computers, hardware, network and storage, as well as consider how these related to the given scenarios. In the quality of extended response question candidates had to consider the different licence options and how they applied to the given scenario, explaining the benefits and drawbacks of both open source and proprietary software and justifying which they would recommend.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
<ul style="list-style-type: none"> <li>• applied their understanding to scenarios when given in the question</li> <li>• gave a recommendation in Question 4 and justified this decision</li> <li>• used examples to help justify or explain their points</li> <li>• planned their response to Question 4 to make sure all requirements in the question were covered.</li> </ul>	<ul style="list-style-type: none"> <li>• gave short responses that were ambiguous as to what was meant, for example 'core' instead of the number of cores.</li> <li>• provided points on a topic without consideration of the scenario and without linking responses to the question.</li> </ul>

## Question 1 (a)

1

(a) The following table has either the binary or denary value of 3 numbers.

Complete the table by converting the 8-bit binary number into denary and the denary number into 8-bit binary.

8-bit Binary	Denary
11110000	
	105
00011110	

[3]

Candidates were often able to correctly convert the numbers between the two forms. The conversion from binary to denary was most commonly accurate with more candidates inaccurately converting from denary to binary.

## Question 1 (b)

(b) Complete the table by writing the answer to each statement.

Statement	Answer
The smallest denary number that can be represented by a 4-bit binary number	
The largest denary number that can be represented by a 6-bit binary number	
The maximum number of different colours that can be represented with a colour depth of 7-bits	
The minimum number of bits needed to represent 150 different characters in a character set	

[4]

This question required candidates to consider the storage of denary numbers in binary in ways other than converting them. Candidates commonly gave the correct smallest denary number, although a common error was giving 1 instead of 0. Some candidates used 7-bit or 8-bit binary numbers for the second response or gave the next value of 64. Candidates found the third response more challenging with many giving 256 for an 8-bit binary number or giving the largest value of 127. The final response had the greatest variance of answers ranging from 1, 2 up to 16 or even 32.

## Question 1 (c)

(c) Show the result of a left binary shift of 4 places on the binary number 00001111.

..... [1]

Candidates often gave the correct response by shifting the digits accurately. Some candidates did not shift the correct number of places, for example moving 3 places.

## Question 1 (d)

(d) Describe how to convert a 2-digit hexadecimal number into denary.

Use an example in your answer.

.....

.....

.....

.....

.....

..... [3]

Candidates that did well on this question used the example to show how they converted a value from hexadecimal to denary. They included annotations to show what they were doing at each stage. Candidates often chose a hexadecimal value that included a letter. Some candidates chose hexadecimal values that were straightforward to convert, for example A0 where they multiplied 16 by 10 and then added 0. Some candidates chose a more complicated calculation and did not always calculate the correct result.

## Question 1 (e)

(e) Add these two 8-bit binary numbers using binary addition.

Show your working out.

$$\begin{array}{r}
 0 \ 1 \ 1 \ 0 \ 1 \ 0 \ 1 \ 1 \\
 + \ 0 \ 0 \ 0 \ 0 \ 1 \ 1 \ 1 \ 1 \\
 \hline
 \\
 \hline
 \end{array}$$

[2]

Most candidates attempted to show their working, commonly by including the carries in an appropriate place. Where the working was correct the answer was also often accurate. Some candidates converted the binary numbers to denary, added them and then converted the result back into denary. This method allowed them to get the answer but did not gain the working marks.

## Question 2 (a) (i)

2 An airport has computers that are connected together on a Local Area Network (LAN).

(a) Each computer has an IP address and a MAC address.

(i) Give **one valid** example of an IPv4 address and **one valid** example of an IPv6 address.

IPv4 .....

.....

IPv6 .....

.....

[2]

Many candidates found this question challenging with few candidates giving valid IP addresses. IPv4 was more commonly accurate, although a common error was giving numbers greater than 255.

Few candidates were able to give an IPv6 address. Common errors including giving 6 groups of numbers and separating each group with a full stop.

## Question 2 (a) (ii)

(ii) Describe the format of a MAC address.

.....

.....

.....

..... [2]

The most common responses given marks included identifying that it is usually in hexadecimal and that the groups are separated by colons or hyphens. Some candidates identified the two separate parts of the MAC address.



## Question 2 (b) (i)

(b) The airport currently has wired connections in their Local Area Network.

(i) Describe **two** benefits to the airport of using wired connections in their network.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

Candidates were often able to identify benefits of wired connections but did not include application to the airport. For example, identifying that data was more secure but then repeating this same point by saying data is less likely to be intercepted. To gain the extra marks candidates needed to consider why each point was important in the airport, for example security is important due to the sensitive or private data that is being transmitted around the airport, or the high risk data that could potentially interfere with flights.

The most common benefits included the faster transmission speed and the increased security.

**Question 2 (b) (ii)**

- (ii) Explain the reasons why the airport should also allow the network to be accessed using a wireless connection.

.....

.....

.....

.....

.....

..... [3]

In this question candidates needed to consider why wireless connections should also be allowed. Some candidates inaccurately took this as instead of wired and explained why this should be used instead, for example because they won't need any cables in the airport. A common response was that wireless was cheaper than wired, when there was already a wired connection so adding a wireless connection as well would be an extra cost instead of saving money.

Common responses included the ability to move around and stay connected, as well as the larger number of devices that could connect. Some candidates identified that devices may not have ports that allow for a physical wired connection.

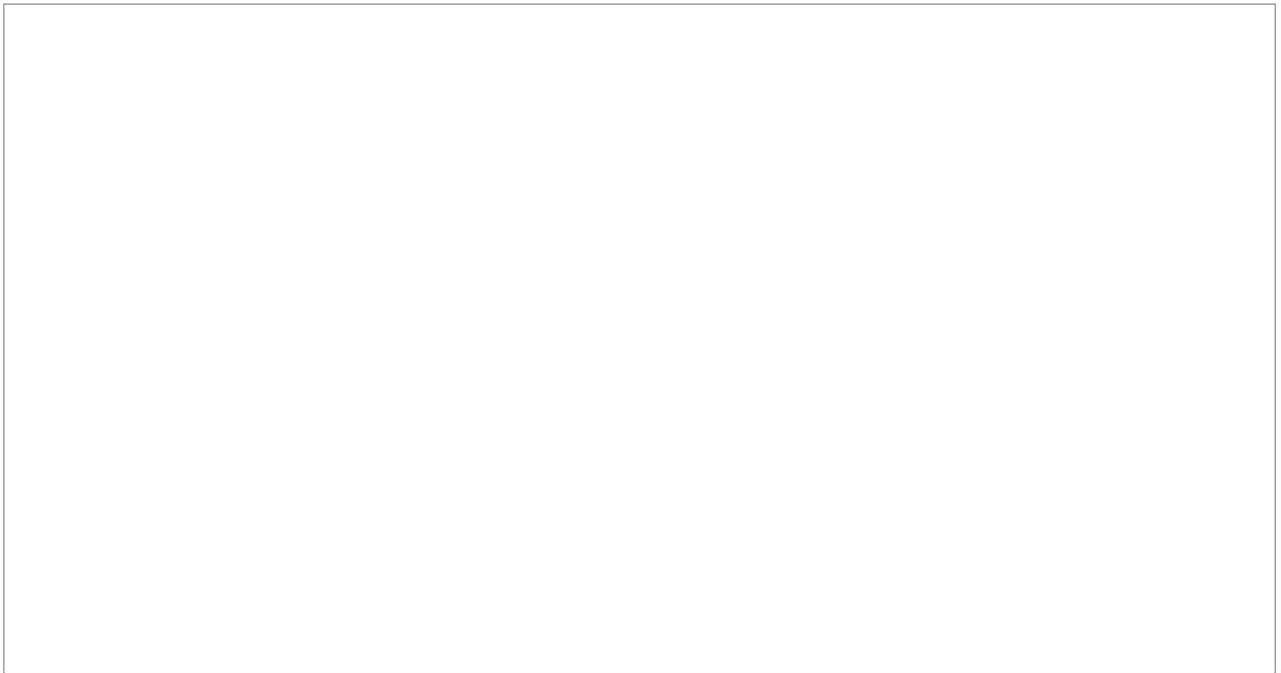
The stronger responses included direct application to the airport, for example identifying the need for staff to respond to problems whilst in different areas of the airport such as tracking luggage or communicating problems.

## Question 2 (c) (i)

- (c) One office in the airport has five computers connected to one switch. There are two printers in the office that can be accessed by all computers.

The computers are connected using a star topology.

- (i) Draw a diagram to show how the five computers, switch and two printers are connected in a star topology.



[3]

Many candidates were able to draw a diagram that included the five computers, the switch and the two printers. Some candidates did not label these items, instead drawing eight boxes without identify which device each one represented.

Candidates often joined these devices to the switch, with printers occasionally being connected to other computers that were then connected to the switch. Some candidates did not identify the central device, or incorrectly included an extra central device such as a router or a server.

Some candidates then included extra connections that created a mesh network instead of a star topology.

## Question 2 (c) (ii)

- (ii) Give
- one**
- benefit and
- one**
- drawback of the office using a star topology instead of a mesh topology.

Benefit .....

.....

Drawback .....

.....

[2]

Candidates were often able to give an appropriate benefit, most commonly that it was easier to add a new computer to the network. Candidates also commonly identified the drawback that the network is dependent on the central device.

## Question 2 (c) (iii)

- (iii) Describe the role of the switch in the star topology.

.....

.....

.....

.....

.....

..... [3]

Candidates commonly identified that the data from each computer in the network is sent directly to the switch, as well as this data then being sent to the destination. Some candidates confused a switch with a hub and identified that the data was sent to all devices connected to it.

Some of the stronger responses identified how the switch records the MAC addresses of devices connected to it and used these to identify which device the data needed to be transmitted to.

## Misconception



A common misconception was that a switch performed the same role as a server, with candidates incorrectly identifying that the switch stored the data for devices in the network and that the switch provided services to the connected devices.

### Question 3 (a)

**3** A computer has an operating system and utility software.

**(a)** The table contains operating system functions and a task that each function performs.

Complete the table by writing the two missing function names and a task performed by the two given functions.

Function	Task
	Moves data from secondary storage to RAM
Peripheral management	
	Allows the user to create, name and delete folders
User interface	

**[4]**

Candidates were often able to identify the function of memory management and file management for the given tasks.

Few candidates were able to identify a task performed by peripheral management. Candidates often rephrased 'peripheral management' for example stating that it managed the peripherals or managed the hardware without identifying what this involved. The stronger responses identified the role of device drivers to allow for communication between the computer and the peripherals.

Candidates often gave a suitable task for the user interface, most commonly that it allowed the user to communicate with the computer or hardware.

## Question 3 (b)

- (b) Complete the description of utility system software using the words provided in the box. Not all words are used.

access	amount	apart	compression	consecutive
defragmentation	deleted	encryption	key	lock
quantity	separate	speed	understood	

..... software changes data using a ..... . If the changed data is intercepted, it cannot be ..... . This software does not stop the data from being intercepted.

..... software analyses the data on a disk to find files that have been split and stored in separate locations. The split files are moved to be ..... in storage and the free space is moved together. This does not provide more storage space on the disk, instead it makes the ..... of the data faster because the read head does not have to move as far to access the next part of the file.

[6]

Candidates were often able to accurately identify some of the missing words. The spaces for encryption were more often accurate, with a common error being the use of a lock to change the data instead of a key.

Candidates often identified defragmentation accurately but the remaining spaces were more often inaccurate with access or separate often given in the next space.

## Question 4\*

- 4\* A computer programmer has developed a computer game that they want to release for users to download over the internet. The programmer needs to decide whether to release the game as open source or proprietary software.

Discuss the features, benefits and drawbacks of each type of licence for this program and make a recommendation to the programmer.

You should include the following in your answer:

- features of each licence
- legal and ethical issues of each licence
- benefits and drawbacks of each licence.

[8]

This question required candidates to provide an extended response. An extended response can be given in the form of paragraphs, key points as well as a table of points. Candidates need to make sure they are covering the three bullet points in the question for both the open source licence and proprietary. The question also asked for a recommendation to the programmer.

Candidates were often able to identify the features of each licence, for example if the source code was provided. Candidates often included benefits and drawbacks, for example being able to edit the program to tailor it to their needs, the potential of misuse of the program code. Candidates often covered legal and ethical issues within their benefits and drawbacks without explicitly identifying them.

Fewer candidates included a recommendation for the programmer. Candidates described each in turn without identifying which one should be used. Some candidates suggested that both were suitable and it was the programmer's decision, but the question asked for a recommendation.

The stronger responses discussed each licence in turn and then in the final paragraph started with a clear recommendation and justified the reasons for this by providing a summary of the points they had discussed in detail previously.

## Exemplar 1

bringing safety to the program. Moreover, the programmer can earn money ~~the~~ from people using the programs, as they can charge ~~the~~ a fee. Furthermore, a license is required to use or share the program, ensuring that it's under the Copyright law. However, due ~~the~~ to the fee, it may not be accessible to all, and since no one can access the source code, feedback may not be as good, disabling it from improving. Overall, the programmer should release it as proprietary software, seeing as though they can earn money, and the program cannot be altered. Furthermore, a license is required to use and share it, something open source software don't need, ensuring the originality of the program ~~is~~ remains.

This response has a clear recommendation at the end of the response. They have stated that the programmer should use proprietary and provided a summary of the reasons (discussed previously) as to why they think this is the most appropriate recommendation.



## Question 5 (a) (i)

5 A musician uses a computer to make and record music.

(a)

(i) Tick (✓) **one** box to identify the correct description of sound sampling.

☐

The frequency of the wave is measured a set number of times each second.

☐

The amplitude of the wave is measured at set intervals.

☐

The digital sound wave is measured a set number of times each second.

☐

The analogue sound wave's resolution is measured at set intervals.

[1]

Some candidates were able to correctly identify that it was the amplitude that is measured at set intervals. A common error was that the frequency of the wave is measured, the frequency is a technical sound term that relates to the pitch of the wave, or the number of times the wave changes.

## Question 5 (a) (ii)

(ii) Explain how changing the bit depth will affect the sound file.

.....

.....

.....

..... [2]

This question was answered well by many candidates who were most commonly able to identify that the file size would change. Many candidates gave this through an example that when the bit depth increases the file size also increases.

Candidates also often identified that the quality of the sound would increase, or that the sound would become more accurate when compared to the sound being recorded.

Some candidates incorrectly identified that the bit depth would result in more samples being taken per second.

**Question 5 (b) (i)**

- (b)** The musician has run out of storage space on their secondary storage device and needs to buy a replacement.
- (i)** Identify whether the musician should buy a magnetic secondary storage device or a solid state secondary storage device for their computer.

Justify your choice.

Type .....

Justification .....

.....

.....

.....

.....

**[4]**

This question required candidates to identify which of the two choices they would make and to justify their choice. Either choice was appropriate and candidates were given marks for explaining why they had made the choice they did.

There was no common choice with both often being selected.

Choices were often suitably justified. Common points included the amount of data that could be stored with some candidates also linking this to the need for sound files to have a high capacity. Candidates often identified that solid state has a faster access speed than magnetic, although some responses just stated that it was faster without identifying what it was faster at.

When justifying solid state candidates often identified the robustness of the device and linked this to the musician possibly needing to move the device.

Magnetic justifications often identified that although they had slower access speed than solid state this would still be sufficient. They also identified that it does have moving parts, but if the device is not being moved then the durability of solid state is also not required.

### Misconception



A misconception is that solid state devices have more longevity than magnetic, that they have an unlimited life span and will outlast magnetic.

**Question 5 (b) (ii)**

**(ii)** Identify **one other** type of secondary storage.

..... [1]

Some candidates found this question challenging and were not able to give a different type of secondary storage, often repeating magnetic or solid state from the question. Candidates quite often did not provide a response to this question.

**Question 5 (b) (iii)**

**(iii)** Tick (✓) **one** box to identify the smallest secondary storage capacity.

☐

2.1 GB

☐

300 MB

☐

200 000 KB

☐

0.0021 TB

[1]

Some candidates were able to correctly identify the smallest capacity of 200 000KB. 300MB was often inaccurately selected.

### Question 5 (b) (iv)

- (iv) The musician's recordings have an average (mean) file size of 3 MB. The musician has 1000 recordings.

Calculate an estimate of the storage space in GB that the 1000 files will require, assuming they are each 3 MB in size. Show your working out.

Working space:

Answer: ..... GB

[2]

Candidates were often able to gain a mark for partial working, for example by multiplying 3 and 1000 even if other parts of the working then performed incorrect calculations.

### Question 6 (a)

- 6 A computer has a Central Processing Unit (CPU).

- (a) Describe what happens during the fetch-execute cycle.

.....

.....

.....

..... [2]

Candidates often correctly identified that data is fetched from memory, or from RAM, and are then processed. Some candidates gave a more technical description including the role of the registers in this process. The stronger responses included clear references to data or instructions being processed. Some candidates inaccurately identified that information was processed, or that programs were fetched from memory.

### Question 6 (b)

- (b) Complete the table by writing the name of **two** registers used in the fetch-execute cycle **and** the purpose of each register.

Register	Purpose

[4]

Candidates were often able to identify one or two registers that are used in the F-E cycle. Fewer candidates were able to give a purpose in the F-E cycle.

Some candidates identified that the registers were involved in the fetching or transmission of data, for example that the MAR transmits the address to RAM..

#### Misconception



A common misconception is that the program counter keeps track of how many programs have run or counts the instructions that are being processed.

### Question 6 (c)

- (c) Give **three** characteristics of a CPU that can affect its performance.

- 1 .....
- 2 .....
- 3 .....

[3]

Candidates were often able to identify at least one characteristic of a CPU, most commonly the clock speed and number of cores. Some responses were not precise enough as to the characteristics, for example stating 'clock' or 'core' without reference to the speed of the clock, or the number of cores, which were too ambiguous.

## Question 7 (a)

**7** A car has a 'Follow Me' system that uses a cruise control feature to allow the car to follow the car in front of it. It will keep the same speed and distance without the driver's intervention. The cruise control system is an example of an embedded system.

**(a)** Explain the reasons why the 'Follow Me' system is an example of an embedded system.

.....

.....

.....

.....

.....

..... [3]

This question required candidates to apply their understanding of embedded systems to a different system.

Candidates were often able to identify the key features of embedded systems that were relevant to this scenario. The most common points being that the system has a single purpose. Some candidates also identified that the system is built within a larger system, being the car.

Fewer candidates were able to provide a third point. Those that did most commonly identified the dedicated hardware or gave an example such as the sensors are only providing data for this system.

## Question 7 (b) (i)

**(b)** The car's system has Read Only Memory (ROM) and Random Access Memory (RAM).

**(i)** State **two** items that will be stored in the ROM for the 'Follow Me' system.

1 .....

2 .....

[2]

Many candidates were able to identify that ROM stores the start-up instructions or gave an example of these instructions.

Some candidates were also able to identify that an embedded system runs firmware, or gave a description of the program for this system being stored in the ROM.

## Question 7 (b) (ii)

(ii) The RAM will store currently running data and instructions.

State **three** items of data that will be stored in the RAM for the 'Follow Me' system.

1 .....

2 .....

3 .....

[3]

Candidates were told that the system stores currently running data and instructions in RAM and required an application of that data to the given scenario.

The most common responses related to the speed of the car and the distance between the cars. Some candidates identified that the speed of the car in front was stored as well as the current speed of that car.

Some candidates identified other data that could be stored in the RAM, for example whether the driver has control, if the system is currently active as well as data that would be needed to identify which car is being followed.

## Question 7 (b) (iii)

(iii) Explain why the 'Follow Me' system does not need virtual memory.

.....

.....

.....

..... [2]

Many candidates were able to identify that VM is used when a system is short of RAM, they were then able to apply this to the given system, i.e. that the current system will not run out of RAM. Some candidates expanded this by also identifying that very few data items would be stored in RAM.

Some of the stronger responses included an acknowledgement that the embedded system is unlikely to have secondary storage and therefore cannot create VM.

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