

**GCSE (9-1)**

**Examiners' report**

# COMPUTER SCIENCE

**J277**

For first teaching in 2020

**J277/01 Summer 2022 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 answers are 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.

### Advance Information for Summer 2022 assessments

To support student revision, advance information was published about the focus of exams for Summer 2022 assessments. Advance information was available for most GCSE, AS and A Level subjects, Core Maths, FSMQ, and Cambridge Nationals Information Technologies. You can find more information on our [website](#).

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## Paper 1 series overview

This was the first examination series of the updated specification J277.

This component focuses on theoretical concepts including:

- Systems architecture
- Memory and storage
- Computer networks, connections and protocol
- Network security
- Systems software
- Ethical, legal, cultural and environmental concerns

Paper 01 now includes some content from Paper 02 of the previous specification. The most significant is data storage which includes units, numbers, characters, images and sound representation.

This examination was taken by a wide mix of candidates. There was some good understanding of the concepts and this was expressed in a range of ways depending on candidate's preferences.

In this examination series, a wider range of candidates were considering both sides of the QWC Question 4. More candidates gave both positive and negative features with some good examples of application to the given scenario.

Areas of weakness often came from a lack of precision in responses. For example, some candidates stated that something is fast without reference to the aspect they are referring to (is it fast at starting up? Is it fast at accessing data? Is it fast to break? Is it fast at running the 100m?).

To do well in this paper candidates need a secure understanding of the given topics. Candidates need to consider any given scenario in the question, and then select their response based on this scenario, justifying in context where applicable.

Candidates who did well on this paper generally did the following:	Candidates who did less well on this paper generally did the following:
<ul style="list-style-type: none"> <li>• used technically terminology consistently</li> <li>• considered the scenario in all questions and used this explicitly in their arguments</li> <li>• gave a balanced positive and negative discussion in the QWC Question 4</li> <li>• considered the command word and other requirements in each question, for example, explaining why something is <b>not</b> suitable.</li> </ul>	<ul style="list-style-type: none"> <li>• answered the QWC Question 4 about generic AI without a focus on the scenario of social media post monitoring</li> <li>• gave short responses without clarifying understanding, for example a reason to choose an object because 'It is fast' or 'It is cheap'</li> <li>• did not show their working for binary conversions.</li> </ul>

## Question 1 (a)

1 Computers represent data in binary form.

- (a) Tick (✓) **one** box in each row to identify the binary unit equivalent of each of the given file sizes.

File size	2 megabytes	2 petabytes	2 kilobytes	2 bytes	2 gigabytes
2000 bytes					
2000 terabytes					
16 bits					
4 nibbles					

[4]

Candidates needed to calculate each file size into a different binary unit to identify which is the equivalent. This question was often answered well by candidates who were able to accurately identify the equivalent binary units. Most commonly accurate were the 200 bytes into kilobytes and 16 bits into 2 bytes. Fewer candidates converted 2000 terabytes into 2 petabytes.

## Question 1 (b)

- (b) Convert the denary number 221 into 8 bit binary. Show your working.

.....

.....

.....

..... [2]

Candidates were required to convert 221 into binary and to include their working. Most candidates included. Candidates used a range of methods to calculate the 8 bit binary number.

A common method was to write the binary header numbers and then use subtraction from 221.

Some candidates put the binary header numbers the wrong way around, going from left to right, getting the binary number reversed.

Some candidates did not accurately double the binary header numbers each time, including additional numbers such as 24.

### Question 1 (c)

(c) Convert the hexadecimal number 2F into denary. Show your working.

.....

.....

.....

..... [2]

Candidates needed to convert the hexadecimal number 2F into denary and to show their working. Candidates showed a range of methods, most commonly converting each digit into 4-bit binary and then adding the sum of the final binary number.

Some candidates did not accurately convert F to binary, for example giving 1101 instead of 1111 which then left the final conversion incorrect.

### Question 1 (d)

(d) Convert the binary number 10110000 into hexadecimal.

.....

..... [1]

This required the conversion of a binary number into hexadecimal. Working was not required to be shown to gain the mark available.

A common error was giving the final hexadecimal number as B, with the 0 missing. As 0 is the right most digit this will alter the value produced. When converting numbers between bases some candidates might find it beneficial to use their final answer to do the reverse calculation as a check. For example, if a candidate got the answer B, they then convert B back into binary which gives them 1011. 1011 does not equate to 10110000.

### Question 1 (e)

(e) Identify how many unique values can be represented by 4 bits.

..... [1]

There were a range of responses to this question, commonly 15, 8, 4 and 2 were given. Candidates who gave 15 often had calculations to identify the highest number that can be represented in 4 bits; missing the number 0 that can also be represented.

## Question 1 (f)

- (f) Perform a binary shift of 3 places right on the binary number 10001110.

..... [1]

This question was often answered well with many candidates correctly shifting the number. Some candidates attempted to include a binary point to show where the binary numbers moved to. This is not part of the specification and should not be included.

## Question 2

- 2 Complete the table by writing the missing definition or name of each of the common CPU components and registers.

CPU component or register	Definition
	Stores the address of the next instruction to be fetched from memory. Increments during each fetch-execute cycle.
CU (Control Unit)	
	Stores the address of the data to be fetched from or the address where the data is to be stored.
	Performs mathematical calculations and logical operations.

[4]

This question required candidates to consider the definitions and identify the component or register that was being defined, as well as giving a definition for the CU.

The ALU was often correctly identified.

Common errors included giving MAR for the first definition in place of the PC and then following on with the MDR for the third row because the MAR had already been given by the candidate.

Many candidates demonstrated a good understanding of the CU, most commonly identifying that it controls the flow of data, that it controls the FDE cycle or that it decodes instructions.

**Misconception**

A common error was stating that the Control Unit actually performs the FDE cycle, or that it executes the instructions.

**Question 3 (a) (i)**

**3** A library has a LAN (Local Area Network).

**(a)** The LAN allows access by both wired and wireless devices.

Users have reported that the network sometimes runs very slowly.

**(i)** Explain why the number of devices using the network at the same time can affect the performance of the network.

.....

.....

.....

.....

.....

..... [3]

Most candidates took the approach of describing how more devices affected the performance of the network. Candidates could often explain how more devices meant more traffic, which then used up the bandwidth.

Some candidates were able to identify that each device would have less dedicated time. More candidates described the bandwidth as being split and having less of it for each device.

Some responses required more precision. A common response was that the performance would decrease, or the speed would decrease. The question asked why the performance was affected, so stating that it was affected was not enough to answer the question.

Answers such as the network is slower, or the network runs slower do not specify what part of the network – networks contain many components and devices and answers needed to demonstrate and understanding of which part was affected.



## Exemplar 1

- (i) Explain why the number of devices using the network at the same time can affect the performance of the network.

The more devices connected to a LAN means that the LAN will run slower. This means that the performance will decrease overall on the LAN network.

[3]

This response states that the LAN will run slower and that the performance will decrease. This is not enough to explain why the performance is affected.

## Exemplar 2

The network has a limited amount of bandwidth. ~~is more device~~ Each device uses some bandwidth. ~~It is more devices~~ <sup>connect</sup> ~~connected~~ to the network each device gets less bandwidth and cannot send as much data as if there was less devices.

This candidate has identified that the bandwidth is split between the devices and then expanded this to identify that each device therefore has less bandwidth.

## Question 3 (a) (ii)

- (ii) Identify **one** other factor that can affect the performance of the network.

[1]

This question was often answered well. The most common responses were the bandwidth or interference.

## Question 3 (b)

(b) Users can access websites from the library computers.

Complete the description of accessing websites using the given list of terms. Not all terms will be used.

0	1	127	128	255	256	Colon
Domain Name Server		Embedded systems		File server		Full stop
Hyphen		Internet protocol		MAC address		Router
Uniform Resource Locator			Web server		Clients	

A website is hosted on a ..... . The computers that access the websites are called .....

The user enters the ..... into a web browser. The web browser sends a request to the ..... for the matching IP (Internet Protocol) address. If found the IP address is returned. A request is then sent to this IP address.

An IPv4 address is made of 4 groups of digits. Each group can be between the denary values ..... and ..... . The groups of digits are separated by a .....

[7]

Candidates were often able to accurately identify the first four missing terms. Some candidates confused the web server with the domain name server.

Where terms are provided, candidates need to make sure they are using these. For example some candidates stated a website is hosted on a server – which was insufficient to identify a web server because file server was an alternative term they were provided.

Few candidates were able to accurately identify the denary values that can be used in an IPv4 address. 256 was a common error for the highest number, and 1 was also often given as the lowest number.

The answer for the final space was often given as a colon or a hyphen. Few candidates were able to accurately identify the full stop as being the separator.

### Question 3 (c)

- (c) The wired connection is an Ethernet connection. Ethernet is considered a standard.

Explain why Ethernet is a standard.

.....

.....

.....

..... [2]

Many candidates found this question challenging and gave a description of what Ethernet is, or why it is a protocol.

Some candidates explained what a standard is, and some candidates gave the features of Ethernet and why this makes it appropriate as a standard. For the latter the most common responses were that it was reliable and has a fast transmission speed.

Some candidates were able to define a standard in terms of all devices using it, and some described it appropriately as a requirement for compatibility between these devices.

## Question 3 (d)

(d) The network has several routers.

Identify **three** tasks carried out by a router.

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

[3]

This question was challenging for many candidates.

Some candidates described the purpose of the router, in other words- what its purpose is within a network – rather than identifying tasks that it carries out.

The most common correct responses were that the router receives packets from devices and that it sends packets to devices. Some candidates also identified that it sends the packets towards the intended destination i.e. it looks at the destination and does not send to all connected devices.

## Exemplar 3

- 1 ... Provides a connection to the devices on the network to the internet.
- 2 ... provides 'an IP (internet protocol) address if requested.
- 3 ... Improves performance on devices.

This response has given a generic purpose of a router in their first answer, providing a connection is the purpose and not a specific task it carries out. The second point was rarely given by candidates but is accurate that a router gives devices in its network an IP address.

## Question 3 (e)

- (e) The library does not use encryption when data is transmitted through the network.

Give **two** reasons why the library should use encryption.

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

[2]

Some candidates were able to identify that encryption makes it impossible to understand the data.

Some candidates stated the data could not be read. This was not precise enough. The data can still be intercepted and read but that this data will be meaningless.

Some candidates also appropriately applied their answers to this scenario, identifying that it meant the data the library was transmitting, e.g. personal/sensitive data, could not be stolen or used inappropriately.

### Misconception



A common misunderstanding was that encryption stops data being intercepted. The data can still be intercepted, but when opened it will be meaningless.

## Question 3 (f)

- (f) Protocols are used to transmit data through the network and over the internet.

Identify **one** protocol that can be used to perform each of the following tasks:

Send an email .....

Access a website securely .....

[2]

This question was often answered well. Many candidates correctly identified HTTPs for the second protocol. However, some candidates did miss the required 's' to indicate it was being accessed securely.

Many candidates also correctly identified SMTP for sending an email, although more candidates gave incorrect email protocols such as POP3.

## Question 4

**4\*** Social networking websites use artificial intelligence (AI) to monitor posts from users.

Discuss the positive and negative uses of AI by social networking websites including:

- Legal issues
- Ethical issues
- Privacy issues

.....

.....

.....

.....

.....

.....

..... **[8]**

This question was a quality of written communication question. This means that candidates need to consider how they structure their response to make sure it has a clear narrative, and to consider their grammar and spellings throughout. This does not mean that an essay is required, some of the stronger responses used headers and bullet points that clearly identified which issues were positive, negative, related to legal, ethical or privacy. By doing this candidates were also making sure that they knew they had covered all requirements. These bullet points were not single words, they included appropriate descriptions and explanations where required (sometimes as sub-bullet points).

Some responses evolved into generic answers about AI in the world, for example developing into robots that are living organisms, instead of focusing on the use of AI for monitoring posts on a social networking website. Many responses were heavily negative, identifying a lack of privacy and trust, without identifying many positive features, such as faster identification of inappropriate content.

The stronger responses gave a balanced argument of positive and negatives, often identifying a use, e.g. Looking for inappropriate content, and then giving the positive expansions and then the negatives. This ensured that they had identified at least one point for legal, ethical and privacy, and had a balanced response.



## Exemplar 4

Using artificial intelligence to monitor posts is much more effective than a person monitoring, due to the fact that an AI can monitor multiple posts at once. A negative to using AI is that users can bypass the AI monitoring because in most cases, they look for key words or phrases to be able to punish users. This means that users can misspell words or phrases to bypass the AI.

There are major privacy issues which could accompany the AI, as users do not know what sort of information that a piece of artificial intelligence can access. This could lead to users feeling unsafe, ~~therefore~~ therefore they could leave the website or complain.

Secondly, Ethical issues could also be a problem because users could feel as if a website is not properly ~~being~~ monitored by the AI if it was faulty or

not properly set up. This could lead to issues with the website where certain posts can go through without being noticed by the AI.

Finally, there are legal issues with letting AI monitor the posts from users because the AI could be set up for malicious purposes, which violates the Computer Misuse Act, 1990. This is a negative as the website could be taken down.

This response has some valid points but they are not all accurate. For example, suggesting the AI can access other data from the users would suggest it is doing something other than it is designed to do.

The candidate has identified that if it is not set up it might not work correctly, but this is the same as using people to monitor the posts.

They also suggest it could be set up maliciously - which is beyond the scope of the question. The question states that the AI is only used to monitor posts.

The response is primarily negative and the positive points are limited in their content and expansions.



## Question 5 (a)

**5** A software development company wants to protect their computer systems and data from unauthorised access.

**(a)** Identify **two** methods of physical security that the company could use to protect their computer systems.

1 .....

.....

2 .....

.....

**[2]**

Some candidates gave software-based security methods in response to this question instead of physical. The most common responses included locking doors, CCTV and guards to physically prevent access to a computer.

## Question 5 (b)

- (b) Identify **and** describe **two** software-based security methods that the company can use to protect their computer systems and data.

Method 1 .....

Description .....

.....

.....

.....

Method 2 .....

Description .....

.....

.....

.....

[6]

Many candidates answered this question well. Strong responses correctly identified software-based security methods; most commonly anti-malware/anti-virus, firewalls, passwords and encryption.

The descriptions of anti-malware, anti-spyware and anti-viruses were often stronger than those that gave firewalls and encryption.

## Question 5 (c)

- (c) Tick (✓) **one** box on each row to identify the legislation that would cover each of the given events.

Event	The Data Protection Act (2018)	Computer Misuse Act (1990)	Copyright Designs and Patents Act (1988)
A company transmits personal data to another company without the individual's permission.			
A school accidentally publishes their students' addresses on the school website.			
The interface for a piece of software is replicated by a rival company.			
A user leaves a computer logged on and another person leaves them a message on their desktop.			
A student guesses their teacher's password and accesses their computer account.			

[5]

This question was answered well by many candidates who correctly identified the legislation that applied to each event.

## Question 6 (a) (i)

**6** A student is creating a range of documents for a school project.

**(a)** The student records a podcast about computer science.

**(i)** Describe how an analogue sound wave is converted into digital form.

.....

.....

.....

.....

.....

..... **[3]**

This question required candidates to describe how an analogue sound wave is measured and converted into digital. Many candidates were able to identify that the sound wave is sampled, with some also identifying that it was the amplitude (or wave height) that is sampled.

### Misconception



A common misunderstanding is that the wave frequency is used. The frequency in sound sampling is the number of samples taken each second or in sound waves is the number of times the wave has high and low amplitudes within a given time. It is not the number of changes in a second that is recording, it is the height of the wave.

## Question 6 (a) (ii)

- (ii) Tick (✓) **one or more** boxes on each row to identify the effect(s) that each change will have on the sound file.

Change	File size increases	File size decreases	Accuracy increases	Accuracy decreases
Duration changes from 10 minutes to 20 minutes				
Sample rate changes from 44 kilohertz to 8 kilohertz				
Bit depth changes from 8 bits to 16 bits				

[3]

Many candidates were able to correctly identify that the increase in duration increases the file size.

The additional two changes were also often given accurately, but some candidates only gave one tick on each row for these, for example correctly identifying the change in file size but not accuracy.

## Question 6 (b) (i)

- (b) The student writes a report about volcanoes.

- (i) The computer stores text using the ASCII character set.

Part of the ASCII character set is shown:

Character	ASCII denary code
M	77
N	78
O	79
P	80
Q	81

Identify the character that will be represented by the ASCII denary code 84.

..... [1]

This question was answered by many candidates who correctly gave the capital letter T. Some candidates clearly gave a lowercase t which would have a different ASCII code and was therefore incorrect.

## Question 6 (b) (ii)

- (ii) Identify a second character set.

..... [1]

Unicode was the most commonly given second character set given.

## Misconception



Some candidates gave an additional character, e.g. U and its associated ASCII code demonstrating a misunderstanding as to what a character set is.

## Question 6 (c)

- (c) The student takes a photograph of their science experiment. The image file includes metadata.

Identify **three** pieces of metadata that is often stored with an image.

1 .....

2 .....

3 ..... [3]

This question was answered well with many candidates identifying examples of metadata for an image.

There were a wide range of correct responses. The most common responses were the bit or colour depth, the resolution and the file size.

Some candidates focused on the device that took the image originally, for example the type of camera, the GPS location or the time and date it was taken.

## Question 6 (d) (i)

(d) The student compresses all their documents before emailing them to their teacher.

(i) Give **two** benefits of compressing the data before it is emailed.

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

[2]

This question required candidates to consider the reasons why the data is compressed before emailing it.

Many candidates answered this well with most identifying the reduction in file size and that this allows the email to be received faster.

Some candidates were not precise enough in their response. For example, stating 'It is faster' without identifying what is faster, in the context of the question this would be the compression is faster and hence incorrect.

Some candidates gave the same point multiple times i.e. the transmission of the email, by stating that it could also be downloaded faster. It can be downloaded faster because the transmission from the email server to the computer is faster, and hence the same reason.

A second common response was that 'It takes up less space', space on its own is not enough because the candidate is not identifying what this 'space' is, for example it could be space on the screen. For this question candidates needed to identify that it was the storage or memory space.

## Question 6 (d) (ii)

- (ii) Explain why lossy compression may **not** be appropriate to compress all of the student's files.

.....

.....

.....

..... [2]

This question required application to the question to demonstrate candidate's understanding. The compression is used to compress all of the student's files in the question. This includes a sound file, text document and image.

Lossy is usually appropriate for images and sound, but is not appropriate for text documents. Some candidates were able to identify this appropriately but some candidates inaccurately stated that the letters would be blurry, or some of the letters or words would not be displayed.

Lossy compression would not change the display of the letters and would not select words to be removed, instead the file would be corrupted.

## Question 7 (a) (i)

- 7 A smart television allows the user to search the Internet and watch videos online.

- (a) The smart television has both RAM and ROM.

- (i) State the difference between RAM and ROM.

.....

..... [1]

This question was answered well with many candidates correctly identifying that RAM is volatile and ROM is not-volatile.

When a difference is required candidates must make sure they are giving both sides of the difference. For example RAM is volatile is not enough on its own.

Some candidates gave the purpose of RAM and ROM. This is a difference in the use and not a fundamental difference between the two.



## Question 7 (a) (ii)

(ii) Give **two** examples of data that the smart television could store in RAM.

1 .....

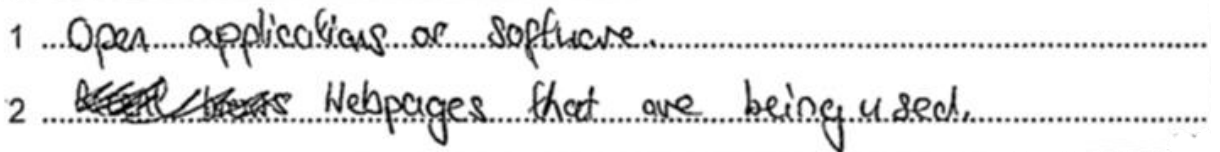
2 ..... [2]

Some candidates found this question challenging.

Many responses were generic applications such as a streaming service, a tv programme, etc. A TV programme will not be stored in RAM, but the parts of it currently/about to be watched would be stored in RAM. Likewise, an application in its entirety will not be stored in RAM, but the parts that are being used will be.

The most commonly correct responses were the recording currently being watched, the data received from the remote control and the websites being accessed.

## Exemplar 5



1 ...Open applications or software...

2 ...~~Webpages~~ Webpages that are being used.

This candidate has identified two suitable examples of data and has given more than just identifying, e.g. applications. They have stated that it is the open applications, and webpages being used, which both demonstrate their understanding of when RAM is used.

## Question 7 (b) (i)

(b) The smart television has secondary storage.

(i) State, using an example, why the smart television needs secondary storage.

.....

.....

.....

..... [2]

This question was answered well by many candidates.

Many candidates correctly identified an example, most commonly downloaded videos, the operating system, or applications. Fewer were able to expand this as to why, for example stating that it was needed for the computer to work.

**Misconception**

A common misunderstanding was that it is needed as a backup for when the television fails.

## Question 7 (b) (ii)

- (ii) Identify **one** appropriate type of secondary storage for the smart television. Justify your choice.

Secondary storage type .....

Justification .....

.....

.....

.....

.....

.....

[4]

Many candidates were able to correctly justify their choice of secondary storage.

A few candidates gave a type of storage, instead giving a specific device such as a hard drive.

There were some good examples of application in responses. For example, expanding the feature of high capacity to the need to download high-definition movies which can take up large amounts of storage. Another application commonly given was the need for a responsive television which was provided by the fast data access speeds.

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