Chhetri Academy

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GCSE COMPUTER SCIENCE

1.2

OCR J277 | Specification point 1.2.1

Primary storage (memory)

Untiered

Answers and examiner comments

8	2014-2024	Untiered
question groups	available papers	tier

Using this booklet

1. Answer numbers match the companion question booklet.
2. Follow the original question number on marking tables.
3. Examiner comments are included where available.

Name _____ **Date** _____

Some entries use full source marking material in an appendix. Any unavailable mark schemes are identified beside the relevant answer.

2	a		• 1GB	1	Accept 1.024 The units are not necessary
	b		• Operating system • Other programs that are running / in current use • Data in current use	2	Accept examples for the second and third bullet points as long as it is clear that the programs/data are currently in use Accept instructions for programs
	c		• Using the hard disk/secondary storage • Used as RAM/to store the contents of RAM/main memory • Needed when there isn't enough physical memory	3	Note that these points may be worded differently. E.g. "items are taken from memory and stored on the hard disk until needed" achieves the first two bullet points.

Question			Answer	Mark	Guidance

4	(a)		1 mark per bullet to max 2 per register
			• MAR // memory address register
			• Stores the address/location where data will be **read/written/accessed/fetched**
			// address/location of data/instruction being **processed**
			// address/location of data/instruction next to be **processed**
			
			• MDR // memory data register
			• Stores the data/instruction that is **fetched/read** from memory
			// stores the data that is to be written to memory
			// stores the data/instruction from the address in the MAR
			// data/instruction next to be **processed**
			
			• Program counter
			• Stores the address/location of the next instruction to be run
			// stores the address/location of the current instruction being run
			
			• Accumulator
			• Stores the result of manipulation/process/calculation
				4
				AO1 1a (2)
				AO1 1b (2)
					MAR stores address is not enough for description
					MDR stores the data is not enough for description
					
					Allow:
					• Current instruction register // IR
					• Stores the instruction currently being processed
					
					Accept MBR // Memory buffer register for MDR

4	(b)		1 mark per bullet to max 2 • The number of FDE cycles run per given time/second // the frequency that the clock 'ticks' • 3.8 billion cycles/instructions … • …per second	2 AO1 1b (1) AO2 1a (1)	Do not award: how fast the computer is // speed of CPU 3.8 = 3,800,000,000

Question			Answer	Mark	Guidance

4	(c)		1 mark per bullet to max 3
			e.g.
			• Software may be designed to run on 1 core and not multiple cores
			// depends on the task(s)
			• …some tasks cannot be split across cores
			• Clock speed also affects speed
			// dual core may have a faster clock speed
			// quad-core may have slower clock speed
			• ….so one task may be run faster/slower
			• RAM size also affects speed
			// Quad-core may have less RAM
			// amount of VM being used
			• Cache size also affects speed
			// Quad-core may have less cache
				3
				AO1 1b (1)
				AO2 2b (2)
					Allow marks for other components that could affect the speed e.g. secondary storage access speed, onboard GPU.
					Award description of concurrent processing.

4	(d)	i	1 mark per bullet to max 3 • VM is used when RAM is full • ...part of the secondary storage used as (temporary) RAM/VM • Data from RAM is moved to the secondary storage/VM (to make space in RAM) • RAM can then be filled with new data • When data in VM is needed it is moved back to RAM	3 AO2 1a (1) AO2 1b (2)	Many candidates are giving disadvantages of VM, or that the computer can now run more programs, which are NAQ
4	(d)	ii	1 mark per bullet to max 2 • More RAM will improve the performance of the computer // More RAM will speed up the access to data • Excessive use can cause disk thrashing … • …which decreases performance • VM is slower to access than RAM direct (because it has to go back to RAM first) • Moving data between RAM and VM takes processor time	2 AO2 1b (2)	Do not award: VM is slower, without quantifying slower at what

Question			Answer	Mark	Guidance
1	a	i	1 mark for each completed word CPU stands for **Central Processing Unit**. It is the part of the computer that fetches and executes the **instructions** that are stored in **(main) memory**. The CPU contains the Arithmetic **Logic** Unit (ALU) and the **Control** Unit (CU).	5 AO1 1a (5)	Accept: • RAM/registers in place of “memory” • bod cache/MDR/CIR in place of memory • ‘and Logic’ in place of Logic • ignore 'data' if they put 'data and instructions' but no mark for data on its own • Do not award command for instructions • Bod central processor unit • Bod logical
1	a	ii	1 mark per bullet to max 2 • Dual core is 2 processors/cores // double the number of processors/cores • Parallel processing can take place • … which means each processor can execute a separate instruction **at the same time** // each processor can run a different part of the program **at the same time** // each core can process instructions **independently** of each other • ...which enables multitasking • Some processes/software **cannot** be split between two processors so it does not increase the performance	2 AO1 1b (1) AO2 1b (1)	• Needs the notion of the processors acting at the same time i.e. not just 'it can run twice as many instructions' without 'at the same time'. • Do not award more instructions per second - this could be achieved by having a faster clock speed. • Allow FDE for ‘executing instructions’. • Do not allow ‘cores can split the tasks’ – need to be how i.e. one task for each core to run at the same time. • BOD run more than one program at once

1	a	iii	1 mark per bullet to max 2 • Cache stores frequently/recently/next to be used instructions/data • …that can be **accessed** faster than **accessing** them from RAM • …which means more cache improves the performance of the CPU // less cache decreases the performance of the CPU • Too much cache can be detrimental … • …as it will take longer to find the instructions in cache	2 AO1 1b (2)	• No mark for just defining cache as being fast memory or close to the CPU. • No mark for cache is faster than RAM - faster at what? • Bod - More cache makes the processing faster • Bod - More cache makes the computer run faster

<table>
<tr>
<td>1</td><td>b</td><td>i</td>
<td>1 mark for each row
<table>
<tr><th></th><th>RAM</th><th>ROM</th></tr>
<tr><td>Stores data</td><td>✓</td><td>✓</td></tr>
<tr><td>The memory is volatile</td><td>✓</td><td></td></tr>
<tr><td>Data will not be lost when the computer is turned off</td><td></td><td>✓</td></tr>
<tr><td>Data is read-only, cannot be changed.</td><td></td><td>✓</td></tr>
<tr><td>Stores currently running data and instructions</td><td>✓</td><td></td></tr>
</table>
</td>
<td>5
AO1 1a (5)</td>
<td></td>
</tr>
<tr>
<td>1</td><td>b</td><td>ii</td>
<td>1 mark

• RAM is volatile // Flash memory is non-volatile
• RAM is faster to access/store data than Flash memory // Flash memory is slower to access/store data than RAM
• RAM stores currently running programs/instructions/data/OS // Flash memory stores files and software
• RAM can be directly accessed by CPU // Flash data has to go to RAM before CPU</td>
<td>1
AO2 1a (1)</td>
<td>• Accept description of volatile/non-volatile

• Bod - RAM is primary // Flash is secondary</td>
</tr>
<tr>
<td>1</td><td>c</td><td>i</td>
<td>1 mark for any suitable example
e.g.
Solid state drive // SSD // flash drive
USB memory stick // USB drive
Memory card // SD card</td>
<td>1
AO1 1b (1)</td>
<td>• USB on its own is incorrect.

• Accept USB stick // memory stick

• Do not accept Hard drive, bod solid state hard drive</td>
</tr>
</table>

1	c	ii	Secondary	1 AO1 1b (1)	• FT from (i) e.g. if RAM is given for 1ci then this answer must be primary. • FT USB (NE 1ci) as secondary. • If 1ci is NR or not an example of primary or secondary storage, then 0 for whatever is here.
1	c	iii	**Mark Band 3–High Level** **(6-8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate is able to weigh up both sides of the discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2-Mid Level** **(3-5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to discuss the impact on most areas, showing reasonable recognition of influencing factors.	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** <u>Portability</u> • Both are Small in size / portable and can easily be moved between Kerry's home and work • Solid state can be smaller • Solid state less likely to break <u>Robustness</u> • Optical are not robust i.e. easily scratched/damaged while being moved • Solid state has no moving parts so unlikely to break if dropped <u>Capacity</u> • CDs have small capacity • Depends on Kerry's files if they are small files e.g. text documents then a CD

			There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence. **Mark Band 1-Low Level** **(1-2 marks)** The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit		might be large enough bit if there are lots large files e.g. videos/software then solid state may be more appropriate <u>Cost</u> • Optical cost is small per GB • Solid state can be reused more times because it's more durable so may be cost effective in the long term
1	c	iv	1 mark for correct working e.g. 5*1024 // 5*1000 1 mark for 5120 MB // 5000 MB	2 AO2 1b (2)	

2	a		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: o defragment o view files o download o compression o preview o edit/read/write files • 'Organise files' without what into - is not enough.

2	b	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.
2	b	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
2	c	i	Smart watch	1 AO2 1a (1)	CAO

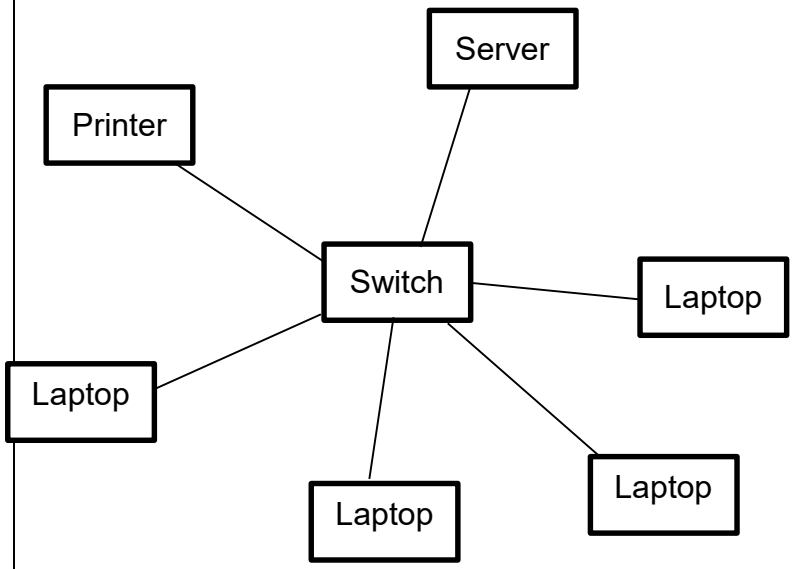
2	c	ii	1 mark per bullet for justification to max 2 • A smart watch is not a general-purpose computer • … which means the smart watch has one/limited/specific/dedicated function(s) • Smart watch has a microprocessor • … on a single circuit board • It is a computer system that is built within the watch • Runs firmware • Smart watch has built-in OS // difficult to change/manipulate the OS/function • Smart watch has few components all essential to its purpose • Smart watch has specific hardware required to function i.e. speaker/headphones	2 AO2 1b (2)	• Answers must be applied to scenario. Do not award generic definitions. • Allow opposite reasons for why a laptop is not an embedded system but do not allow repeated points.

3	a	i	1 mark per bullet to max 3 e.g. • Malware could be put on the computer • Data protection legislation states personal data must be protected / breaks Data protection legislation • … breach of privacy • …he could lose his job • Delete files // change data • … so the important work is lost/changed • Steal files/data/information // copy data/files/information // keylogger transmits data/files/information to third party • … use for illegal activities • … e.g. profit from the data // gain private information // leak information to the public • Data could be locked	3 AO2 1b (3)	
3	a	ii	1 mark for naming, 1 for description to max 2 per method e.g. • Password • No access without the password // **description** of strong password // limit attempts to guess // changing it regularly • Limited attempts to get into laptop • before laptop is locked • Firewall • Monitor incoming and outgoing transmissions // Stop unauthorised/unwanted incoming/outgoing transmissions/packets. • Biometrics • Need fingerprint/retina scan • Do not leave laptop logged on/unattended • So that other people cannot physical access it • Physical security // keep in locked room • So that people cannot physically access the laptop	4 AO1 1a (2) AO2 1a (2)	• Do not accept encryption/anti-malware, this will not prevent unauthorised access. • Do not accept penetration testing - it's a laptop, not a network. • Login is NE for password • Do not accept access rights - it's access to the laptop

			• Do not connect laptop to network // standalone computer • So that there are no network threats • Two-step verification // two-factor authentication • For example sending code to mobile phone		
3	b	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

3	b	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.

3	b	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.

4	a	i	1 mark per bullet • Four laptops/computers, a server and printer present and clearly identifiable (positions do not matter) • Switch as a device clearly identifiable… • …all devices directly connected to the switch and only the switch (FT from MP2) e.g.  	3 AO2 1a (3)	• Printer may be connected to the server or to the switch. • Accept PC for laptop • If the candidates has given server/switch or switch/server in the centre, mark the first one in their list. If they give server/switch, they do not get MP2, but allow access to MP3.
4	a	ii	1 mark per bullet to max • To connect the devices together • Receives data/packets/traffic • Direct/send data/packets/traffic **only** to its **destination** • Creates/generates a list of devices connected to it as it receives signals • Uses MAC addresses of devices connected to it	2 AO1 1a (1) AO2 1a (1)	• Do not award information, penalise once. • Do not award packet switching out of context. • Accept MP3 by example

4	b	i	1 mark per bullet to max 2 • Wireless transmission is slower **than cabled** • More devices/users could be connected e.g. mobile phones // increase in traffic • …reducing bandwidth available for each user // insufficient bandwidth for users/demand • Wireless can be limited by interference • …such as walls that disrupt the signal // from other wireless networks/users	2 AO1 1b (1) AO2 1b (1)	• Bod - wireless has less bandwidth
4	b	ii	1 mark per factor e.g. • Bandwidth available • Number of users (using the network at the same time) • (Number of) data collisions • Interference // by example e.g. walls • Distance data has to travel // signal strength • Amount of data being transferred • Applications being used • Server/CPU performance • Using a hub instead of a switch	2 AO1 1a (2)	• Do not accept wireless/wired connections • Bod answers such as cable length

4	c		1 mark per bullet to max 2 • Non-physical network • A **private** network that runs on a **public**/**existing** network • Combining 1+ physical networks into 1 logical network // 1+ logical networks on 1 physical network // partitioning part of physical network • It uses software to separate the Virtual Network from the wider network • Users in the Virtual Network can only access data in the Virtual Network • Employees can log in / join the private network from any location • Employees can access the server/documents from any location // only gives users of the Virtual Network access to the data • The connection is secured	2 AO2 1a (1) AO2 1b (1)	
5	a		1 mark per bullet to max 5 • The website is hosted on a webserver • The website/webserver has an IP address • (Browser) sends URL to DNS • URL has a linked IP • DNS finds IP • If DNS cannot find the IP it passes request to higher DNS • …if not found return error • IP address sent back to the browser/computer • (Browser) sends request to IP/webserver • Webserver processes request for the website/webpage • …webserver sends the webpage/file/data to the user	5 AO1 1b (3) AO2 1b (2)	• Do not award 'the IP goes to the webserver' • Allow domain name in place of URL • 'DNS finds the IP of the URL it is given' gets 2 marks, 1 for URL has linked IP and 1 for DNS finds the IP • MP 11 do not accept webserver *loads* the webpage on the user's computer
5	b	i	1 mark per bullet to max 2 • A layer can be removed/changed etc. • …without affecting any other layers • Each layer has its own purpose // separates the purposes // self-contained • ...so it does not need to consider what the other layers do • …so it can be programming individually • Individual protocols are each smaller/simpler to manage • Different layers can interface with different hardware	2 AO1 1a (1) AO1 1b (1)	• Do not award descriptions of what the layers do - the question asks why layers are used. • Do not award vague answers e.g. layers make it easier to work with

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>b</td><td>ii</td><td>1 mark for each protocol.

<table><tr><th>Task</th><th>Protocol</th></tr><tr><td>Sending an email from one mail server to another</td><td>SMTP // Simple Mail Transfer Protocol</td></tr><tr><td>Transmitting a file from a client to a server</td><td>FTP // File Transfer Protocol</td></tr><tr><td>Viewing a website using a web browser</td><td>HTTP // Hypertext Transfer Protocol
HTTPS // Hypertext Transfer Protocol Secure</td></tr><tr><td>Downloading an email to your computer</td><td>IMAP // Internet Message Access Protocol
POP(3) // Post Office Protocol</td></tr></table></td><td>4
AO2 1a (4)</td><td>• Mark first answer in each box</td></tr>
<tr><td>6</td><td>a</td><td></td><td>1 mark per bullet
Benefits of not providing physical copies e.g.
• Less/no plastic/paper/raw materials used in manufacture // no need for packaging // less waste
• Less electrical power needed to manufacture
• No petrol used to distribute/collect
• …smaller carbon footprint
• Fewer disks need to be manufactured
• Fewer factory emissions // less pollution
• Old versions will be thrown away

Drawbacks of still creating a physical copy (sold online) e.g.
• Plastic/paper are used in manufacture
• Increase in waste
• Old versions will be thrown away
• Uses petrol / creates emissions to distribute</td><td>2
AO2 1b (2)</td><td>• Could be read as still physically creating but not putting in shops.

• Do not accept more use of computers/electricity to download.</td></tr>
</table>

6	b		1 mark per bullet to max 2 for justification • She can sell it for a fee • Protects/copyrights her **source code** • …so it can't be copied/modified/redistributed	2 AO2 1b(2)	• Accept in reverse for why open source is not appropriate, but do not award same MP twice

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Original question 5

The full source mark scheme begins on page 29. Use the original paper code, tier and question number shown above.

Question			Answer	Mark	Guidance
1	a		1 mark for each completed space ROM stands for **read** only memory. This stores the **start-up** instructions for a computer and cannot be **changed**. RAM stands for **random** access memory. This stores the instructions and **data** that are currently being used. If the computer does not have enough RAM to run a process it can makes use of **virtual** memory. RAM and ROM are both examples of **primary** memory. Memory located close to the processor that allows faster access than from RAM is called **cache** memory.	8	**read** **start-up** **changed** **random** **data** **virtual** **primary** **cache**
1	b	(i)	• CPU performs the FDE cycle • Process **instructions**	1	
		(ii)	1 mark per bullet to max 2 • Single core means there is only **one processor** • 2.5Ghz means it can run 2.5 billion FDE cycles per second	2	MP1 BOD single processor Allow instructions for MP2
1	c		1 mark each • PC • MAR • MDR • Accumulator	2	Accept other correct registers (e.g. CIR, IR) Read first answer on each line

Question			Answer	Mark	Guidance
7	(a)	(i)	1 mark for • ROM is non-volatile, RAM is volatile // by description • Content of ROM cannot (usually) be changed, content of RAM can be changed	1	Read whole answer
7	(a)	(ii)	1 mark each to max 2 e.g. • Web browser/application that is **running** • (Parts of the) operating system currently **running** • Current video/film/tv program being watched • Data being downloaded/buffered • Button pressed by the user • Current volume • Current channel being watched • Source being watched (e.g. HDMI1)	2	Allow anything reasonable but must be clearly RAM e.g. not just stores the software/OS (this is secondary storage). Do not award brand names without exemplification.
7	(b)	(i)	1 mark for example e.g. the OS, web browser software, recorded show, user preferences 1 mark for • To store data once the computer is turned off / permanently // for non-volatile storage	2	Allow 2 marks by example, e.g. "To install software that will not be lost when the TV is turned off" gets 1 mark for software and 1 mark for not being lost when turned off. Do not award brand names without exemplification.

7	**(b)**	**(ii)**	1 mark for choice either magnetic or solid state 1 mark per bullet to max 3 for justification e.g. Magnetic: • Large storage capacity • … for storing software/videos/HD • Television unlikely to be moved • … therefore durability/portability not required • Cost to **purchase** is low • … so the TV will be cheaper to **manufacture**/**purchase** • Device will fit in a tv // device is small • Longevity // reliable Solid state: • Large storage capacity • … for storing software/videos/HD • Television may be moved • …therefore durable/robust/portable • Fast **data access** • … television will be more responsive • Cost to **purchase** is low • …so the TV is not too expensive to **manufacture**/**purchase** • Run quieter • Produce less heat • Use less energy • Compact // lightweight • …so tv can be made smaller / lighter	4	Do not award specific device, e.g. hard disk. Question asks for type. But then FT for justification to max 3. If device and type given award, e.g. solid state drive, SSD, magnetic hard disk drive. Mark first secondary storage type given. No secondary storage type, read justification for a type. Do not award this but mark justification (Max 3). Justification must match choice. If type is inappropriate e.g. optical, do not award.

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Original question 5

The full source mark scheme begins on page 45. Use the original paper code, tier and question number shown above.

Original question 7

The full source mark scheme begins on page 69. Use the original paper code, tier and question number shown above.

PMT

GCSE (9–1)

Computer Science

J276/01: Computer systems

General Certificate of Secondary Education

Mark Scheme for November 2020

Oxford Cambridge and RSA Examinations

PMT

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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J276/01 **Mark Scheme** **November 2020**

Annotations

Annotation	Meaning
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
^	Omission mark
BOD	Benefit of doubt
C	Subordinate clause/Consequential error
	Cross
E	Expansion of a point
FT	Follow through
NAQ	Not answered question
NBOD	Benefit of doubt not given
P	Point being made
REP	Repeat
	Slash
	Tick

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J276/01 **Mark Scheme** **November 2020**

Subject Specific Marking Instructions

LEVELS OF RESPONSE QUESTIONS:
For answers marked by **levels of response**:
• to determine the level – start at the highest level and work down until you reach the level that matches the answer
• to determine the mark within the level, consider the following

The indicative content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.

Using 'best-fit', decide first which set of BAND DESCRIPTORS best describes the overall quality of the answer. Once the band is located, adjust the mark concentrating on features of the answer which make it stronger or weaker following the guidelines for refinement*.

Highest mark: If clear evidence of all the qualities in the band descriptors is shown, the HIGHEST Mark should be awarded.

Lowest mark: If the answer shows the candidate to be borderline (i.e. they have achieved all the qualities of the bands below and show limited evidence of meeting the criteria of the band in question) the LOWEST mark should be awarded.

Middle mark: This mark should be used for candidates who are secure in the band. They are not 'borderline' but they have only achieved some of the qualities in the band descriptors.
Be prepared to use the full range of marks. Do not reserve (e.g.) high Band 3 marks 'in case' something turns up of a quality you have not yet seen. If an answer gives clear evidence of the qualities described in the band descriptors, reward appropriately.
*When only two marks are available (low mark band) only use Highest and Lowest mark guidance for 'best-fit'.

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	AO2.1a	AO2.1b
High (thorough) (6 – 8 marks)	Precision in the use of terminology. Knowledge shown is consistent and well-developed. Clear appreciation of the question from a range of different perspectives making extensive use of acquired knowledge and principles of computer science.	Understanding of concepts is consistently applied to context enabling a logical and sustained argument to develop. Examples used enhance rather than detract from response.
Middle (reasonable) (3 – 5 marks)	Awareness of the meaning of the terms in the question. Knowledge is sound and effectively demonstrated. Demands of question understood although at times opportunities to make use of acquired knowledge and concepts are not always taken	Understanding of concepts is shown and is applied to context. There is clear evidence that an argument builds and develops through the response but there are times when opportunities are missed to use an example or relate an aspect of understanding to the context provided.
Low (basic) (1 – 2 marks)	Confusion and inability to deconstruct terminology as used in the question. Knowledge partial and superficial. Focus on question narrow and often one-dimensional.	Inability to apply understanding of key concepts in any sustained way to context resulting in tenuous and unsupported statements being made. Examples if used are for the most part irrelevant and unsubstantiated.
0 marks	No response or no response worthy of credit.	No response or no response worthy of credit.

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<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>1 mark for a suitable prevention

<table><tr><th>Threat</th><th>Prevention</th></tr><tr><td>Unauthorised access</td><td>Firewall // (strong) password // physical security // access rights // security questions // two-step authentication</td></tr><tr><td>Virus</td><td>Anti-virus/malware // firewall // network restrictions e.g. no downloads // do not plug in unknown storage devices</td></tr><tr><td>Phishing</td><td>Firewall // do not click on unknown links // spam filter // education about what to do/not do // check sender/website to see if real/fake</td></tr><tr><td>Data interception</td><td>Encryption</td></tr></table></td><td>4</td><td>Mark first in box
Do not mark repeat</td></tr>
<tr><td>1</td><td>b</td><td></td><td>1 mark for each suitable threat, and 1 mark for suitable prevention
e.g.
Spyware (1) anti-spyware (1)
Pharming (1) Check web address is valid(1)
DOS/DDOS (1) Use of proxy server/firewall (1)
Ransomware (1) Use of antimalware (1)
SQL injection (1) Network forensics/suitable form validation (1)
Social engineering // people as a weak point (1) training (1)
Poor network policy (1) education/setting rules (1)
Hardware failure/loss (1) Backup (1)</td><td>4</td><td>Award different types of virus e.g. worm, trojan separately.

Do not award hacking, brute-force - both covered in unauthorised access.

BOD malware</td></tr>
</table>

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2	**a**		1 mark for LAN 1 mark per bullet for justification to max 2 • Small geographic area • They will own the hardware // dedicated hardware // do not need to use outside hardware // controlled by Hope	3	
2	**b**		Modem // router	1	Mark first given
2	**c**	**i**	1 mark per bullet to max 2 • Wifi signal/bandwidth will be weaker/less because // 5GHz is only short range • …bedroom further away from WAP than kitchen • ….to get to bedroom has to go through floor/walls etc.	2	
2	**c**	**ii**	1 mark per way e.g. • Change to 2.4Ghz • Install a signal booster // another WAP // mesh wifi • Move WAP closer to the bedroom • Remove obstructions // by example • Reduce number of devices connected • Change channel to one not being used in locality	2	Reduce interference is NE - they need to say how this can be achieved
2	**d**		1 mark per bullet to max 3 e.g. • **No** server (required for client-server) • Computers are **directly** connected to each other • Computers are independent / equal • Decentralised • Computers will have software installed/updated individually // no central installation/updates • Computers will need own security // no central security • Computers will have their own files // no central file storage • Less initial cost / maintenance • Specialist required to setup client-server • Easier to add new devices • Lesser need for file sharing • If any device fails/is removed the remainder can continue	3	Be careful MP1 is not just saying it does not need to connect to the server - the MP is that there is no server. Accept reasonable points in reverse.

J276/01			Mark Scheme		November 2020
2	e		1 mark per benefit to max 4, 1 mark per drawback to max 4 e.g. Benefit • Can access files from any device • … e.g. they can instantly access the data from laptop and mobile phone • Can access files from anywhere // Can access from anywhere with access to the Internet • Can pay for auto-backups // don't have to backup manually • Security **may be higher** than at home • May be free of cost • … you do not need to buy more hardware • **Easier/quicker** to share files with others • More available storage space on her device • Easier to increase storage capacity (not memory) • Can be used a backup in case of data loss Drawback • Cannot access files if no Internet access • Not in control of security (bod less secure) • …data may be hacked/stolen • May cost monthly fee • … which could be more long term than buying hardware • May not be a backup // if cloud storage fails you have lost your data • Data must be transferred to computer to read • …. may be intercepted • Connection may be slow • … therefore takes time to upload/download • May be issues as to who owns the data • If stop paying / leave subscription other storage for files needs to be found • If login details are forgotten/lost may not have access to files	6	Mark breadth and depth of knowledge. 1 mark for each valid point/expansion. Allow specific examples as expansions for each point. Mark benefits to max 4 first, then look for max 4 from drawbacks

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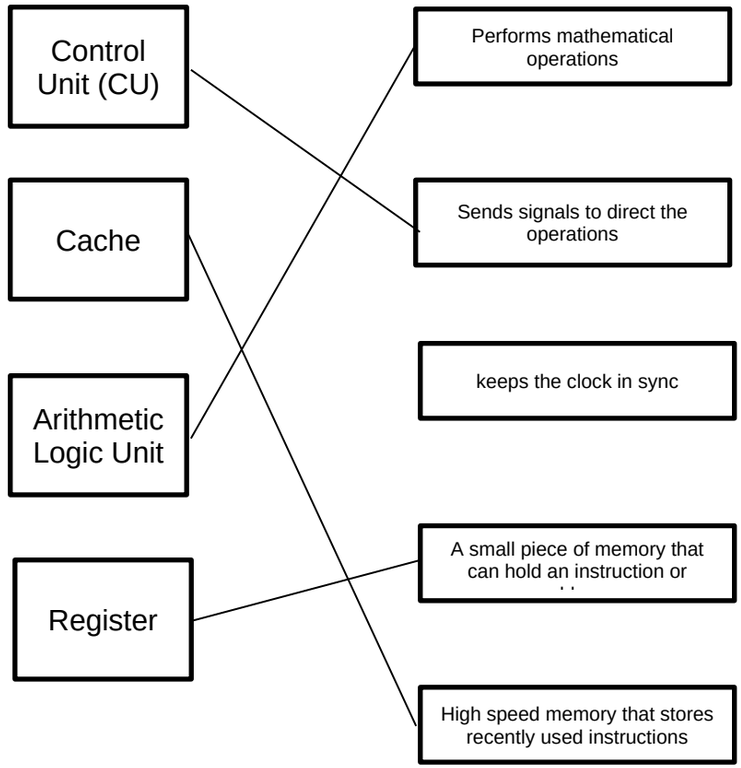
3			1 mark per correct line from component to definition  	4	Any 2 lines from 1 component = 0 mark

J276/01			Mark Scheme		November 2020
4			**Mark Band 3–High Level** **(6-8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate is able to weigh up both sides of the discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2-Mid Level** **(3-5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to discuss the impact on most areas, showing reasonable recognition of influencing factors. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.* **Mark Band 1-Low Level** **(1-2 marks)** The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** <u>Ethical</u> • Replacing people with machines • Loss of jobs • Community will suffer • Work will be completed faster • May find a cure faster • More reliable calculations • Save more lives <u>Legal</u> • More secure than people seeing personal data • May be at risk if not backed up • May be at risk of threats e.g. hackers • Who is responsible if there is an error <u>Cultural</u> • Removal of people from workforce • Change in demand for skills • Need people to manage the hardware/software instead of medical expertise • Skills may be lost

J276/01			Mark Scheme		November 2020
5	a		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
5	b	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.
5	b	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.

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5	**b**	**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.

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	c		1 mark for each letter in the correct place
			
			procedure storeData()
			  if RAM is **C/Full** then
			  move data from RAM to **A/Secondary Storage**
			  endif
			  store data in next free space in **H/RAM**
			F/endprocedure
			
			procedure accessData()
			  if **B/NOT**(data required is in RAM) then
			  if RAM is full then
			  move unneeded data from RAM to HDD
			  endif
			  move required data from HD to RAM
			  endif
			  read data from **H/RAM**
			endprocedure
				6	

5	**d**		1 mark per bullet to max 2 e.g. • Store BIOS • … the boot-up instructions • Stores data that should not be changed • Stores data that must be retained when the computer turns off • Store firmware/OS fundamentals	2	BOD non-volatile BOD cannot be changed

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5	**e**		1 mark per bullet to max 3 e.g. Incorrect: • Embedded system has one/few functions • …tablet has multiple functions // tablet is general purpose • Embedded system is single chip • …tablet has multiple chips combined • Embedded system is part of a larger system • … tablet is a self-contained system • You can update the software Correct: • Embedded system has one/few functions • ….the tablet may only be able to perform a small number of tasks • …tablet has a specific purpose • …tablet's hardware is fixed • …does not need/require/allow expansion • Embedded systems has firmware • ..you cannot update the OS in a tablet (usually) • Embedded system is part of a larger system • …tablet may have one microprocessor built into it	3	Max 2 if there is no application to the tablet
5	**f**		1 mark per bullet e.g. • 200000 / 1000 • 200 / 1000 • 1Gb = 5 videos // 80 * 5 // 80 / 0.2 • 400 videos Or • 80GB = 80000 MB • 80000MB = 80000000KB • 80000000 / 2000000 • 400 videos	4	Accept bullets 1 and 2 as division by 1000000 or 1048576 Bullets 1 and 2 may be combined Accept 1000 or 1024

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<table>
<tr><td>6</td><td>a</td><td></td><td>1 mark per bullet
• All devices connected to at least one other component
• All devices connected to all devices (individually or through another and not only through the printer)</td><td>2</td><td></td></tr>
<tr><td>6</td><td>b</td><td></td><td>1 mark for each row.<table><tr><th>Statement</th><th>True</th><th>False</th></tr><tr><td>Ethernet is a protocol</td><td>✓</td><td></td></tr><tr><td>Ethernet uses wireless data transmission</td><td></td><td>✓</td></tr><tr><td>Ethernet can transmit data up to 100Gbits per second</td><td>✓</td><td></td></tr><tr><td>Ethernet is within the TCP/IP stack</td><td>✓</td><td></td></tr></table></td><td>4</td><td>2 ticks in 1 row = 0 mark</td></tr>
<tr><td>6</td><td>c</td><td>i</td><td>1 mark per bullet to max 3
• URL sent to DNS // request sent to DNS for/with URL
• DNS looks up/finds to IP in its database
• DNS returns IP
• IF not found, DNS sends to higher level DNS</td><td>3</td><td>Request sent to DNS is NE without saying the URL is sent.

Only penalise missing or incorrect term for DNS once then FT</td></tr>
<tr><td>6</td><td>c</td><td>ii</td><td>1 mark per bullet to max 3
e.g.
• Destination IP/address
• Sender IP/address
• Packet Number
• Packet size
• Number of packets
• Error detection method/value</td><td>3</td><td>Do not award MAC address</td></tr>
</table>

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GCSE

Computer Science

J277/01: Computer systems

General Certificate of Secondary Education

Mark Scheme for June 2023

Oxford Cambridge and RSA Examinations

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING
SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the scoris messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

   Multiple Choice Question Responses

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When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
   - there is nothing written in the answer space or no valid attempt at an answer (e.g. "I don't know")

   Award Zero '0' if:

   - there is an attempt at an answer that is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The scoris **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the scoris messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response: Not applicable in F501
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

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11. **Annotations**

Annotation	Meaning
A	Omission mark
BOD	Benefit of doubt (must be accompanied with a tick)
	Cross
FT	Follow through (must be accompanied with a tick)
NAQ	Not answered question
NBOD	Benefit of doubt not given
REP	Repeat
	Tick
TV	Too vague
SEEN	Blank pages, pages with no annotation, no attempt to answer the question, page seen on QER
L1	QER Level 1 mark awarded
L2	QER Level 2 mark awarded
L3	QER Level 3 mark awarded

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12. Subject Specific Marking Instructions
Mark scheme conventions:

- Each mark point is worth 1 mark unless stated otherwise
- Each mark point can only be awarded once
- A word/phrase that is underlined needs to be exact in the answer to award the mark point
- A word/phrase that is **bold** needs that concept to be in the answer (but can be given in multiple ways) to award the mark point
- 3 dots at the end of one mark point and at the start of the next mark point mean that the second mark point cannot be awarded without the first being awarded, unless the mark scheme states otherwise (for example a reasonable attempt with some inaccuracies)
- 3 dots at the start of a mark point, without 3 dots at the end of the mark point above, means the sentence carries on and there is no dependency
- Any text in brackets is not required to gain the mark point
- Single / means alternative word
- Double // means an alternative statement that is acceptable for the same mark point
- Enlarged font is used for visibility reasons only

Annotating scripts:

- Blank pages at the start of the script need SEEN annotation
- Any questions answered elsewhere (e.g. on the first blank pages, separately on the page) need to be linked within RM Assessor and annotated with ticks/crosses/SEEN as appropriate
- 1 tick for every mark awarded, if a question is given 3 marks there must be 3 ticks (apart from QER question)
- A BOD or FT annotation needs to be accompanied by a tick
- QER question 6 – One annotation from: L1, L2 or L3, according to the level awarded, the page not annotated with the level needs a SEEN annotation. Do not include any ticks, crosses or other annotations on this question – other than SEEN and one from: L1, L2 or L3
- Any answers with no candidate response need a SEEN annotation and NR entered as the mark.
- Any questions where the candidate has not attempted the question e.g. answered 'don't know' need a SEEN annotation and NR entered as the mark.
- All questions must be annotated throughout the marking process.

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<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>1 mark for:
• Binary is used because computers are made of switches that can only be on or off (box 3)</td><td>1</td><td>Accept cross or other indication as long as clear which one they intend.
2+ ticks = 0 marks</td></tr>
<tr><td>1</td><td>b</td><td></td><td>1 mark for each completed box
<table><tr><th>Denary</th><th>8-bit binary</th><th>Hexadecimal</th></tr><tr><td>7</td><td>00000111</td><td>7</td></tr><tr><td>49</td><td>00110001</td><td>31</td></tr><tr><td>102</td><td>01100110</td><td>66</td></tr><tr><td>244</td><td>11110100</td><td>F4</td></tr></table></td><td>4</td><td>Must be 8-bits.

Ignore case in hex.

Ignore calculations in answer box.</td></tr>
<tr><td>1</td><td>c</td><td></td><td>1 mark for:
• 200MB (box 3)</td><td>1</td><td>Accept cross or other indication as long as clear which one they intend.
2+ ticks = 0 marks</td></tr>
<tr><td>1</td><td>d</td><td></td><td>1 mark for both boxes:
• 4 500 000 bytes (box 1)
4.5 MB (box 3)</td><td>1</td><td>Accept cross or other indication as long as clear which one they intend.
1/3+ ticks = 0 marks</td></tr>
<tr><td>1</td><td>e</td><td></td><td>1 mark each:
• Answer (1) 0 0 0 0 1 1 1 1
• Correct working e.g. carrying (might be above, below etc.)
0 1 1 1 0 0 0 1
1 0 0 1 1 1 1 0
0 0 0 0 1 1 1 1
carries: 1 1 1</td><td>2</td><td>Do not award marking for converting each number to denary and adding them together. If the carries are present, and converting to denary is present – award the carries (conversion can be used to check their answer).
Marks are not dependent.</td></tr>
</table>

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1	**f**		1 mark each: • Left shift • 3 places	2	

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<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>2</td><td>a</td><td>i</td><td>1 mark for each protocol
<table><tr><th>Task</th><th>Protocol</th></tr><tr><td>Requesting a webpage from a web server</td><td>HTTP // HTTPS</td></tr><tr><td>Entering a username and password to access their bank account</td><td>HTTPS</td></tr><tr><td>Downloading a text document from a web server</td><td>FTP // HTTP // HTTPS</td></tr><tr><td>Checking for new emails in their inbox</td><td>IMAP // POP</td></tr></table></td><td>4</td><td>Mark first answer in each box.

Allow full name to be written e.g. file transfer (protocol).

Accept POP3 or any other version</td></tr>
<tr><td>2</td><td>a</td><td>ii</td><td>1 mark each to max 2:
• Each layer is independent // layers are not reliant on other layers
• One layer can be changed without affecting the others // a layer can function without needing/changing/impacting any other layer // self-contained
• Separates tasks so they can be developed independently
• A developer can focus on only one layer // developer can specialise
• Allows for standards for individual tasks/layers to be developed // for compatibility
• Manufacturers can develop hardware to fit into one particular layer
• To group together similar protocols</td><td>2</td><td>Max 1 in each answer space</td></tr>
<tr><td>2</td><td>b</td><td>i</td><td>1 mark from:
• Uses dedicated/own/internal hardware
// no external/third party hardware/infrastructure
// computers use MAC addresses to communicate within the LAN</td><td>1</td><td></td></tr>
</table>

PMT

J277/01			Mark Scheme		June 2023
2	b	ii	1 mark each to max 4: e.g. • Allows **more** devices to connect … • …for example televisions, mobile phones • Easy to connect (devices) // Easier to setup (wireless connections) // By example e.g. easier for guests to connect their devices • Home is likely small area • … so short distance wireless is sufficient • Devices can move around // can use devices in different areas // can connect from anywhere in the house // can use where wires don't reach // can access from a larger area (than wired) • … by example e.g. student is using a laptop so does not need to be tied to one place // by example e.g. they don't have to disconnect before moving // e.g. they can stay connected whilst moving • Cheaper to **purchase**/**install**/**setup** for new devices // no cost for (new/replacement) wires/hardware • …because no **additional**/**fewer** wires are needed • Fewer trip hazards from trailing wires // reduce risk of damage to cables // fewer cables to damage • More compatible // some devices only have wireless connections	4	Easier/cheaper on their own is NE
2	b	iii	1 mark each to max 2: e.g. • Prone to interference // by example • Limited range of signal • Slower rate of transmission // less bandwidth // reduced network performance// increased latency // BOD slower connection // more users reduces rate of transmission / bandwidth /performance etc. • Increased risk of **security** concerns // by example e.g. A hacker could connect to the wireless connection • Less stable connection • Higher chance of collisions // Higher error rate	2	MP3 needs to say what is slower / decreased e.g. It's slower, is NE Mark first drawback in each answer space. Less reliable is TV on its own for MP 5

PMT

J277/01 **Mark Scheme** **June 2023**

Question			Answer	Mark	Guidance
3	a		1 mark for each completed space A character set stores **all** of the characters that the computer can represent. Each character is given a **unique/different** binary code. Lower-case and upper-case letters in a character set are given **unique/different/similar** binary codes. One example of a character set is ASCII. This character set uses **8** bits for each character. If the ASCII value for the character 'F' is 70 Then the ASCII value for the character "L" is **76**.	5	Award the same term used multiple times if used correctly
3	b	i	1 mark: • **Data** about the data/image/file	1	Question is for a definition, not an example. If the definition is not clear, for example details about the image, information about the image – this is NE, but read the example to see if it clarifies. For example: 'Information about the image, such as the number of pixels' give a BOD. Data could be properties/characteristics.
3	b	ii	1 mark each: • First row: red red purple • Remainder correct and in correct order red | red | purple blue | green | blue purple | purple | purple red | green | blue	2	Ignore case/spelling as long as legible. If a candidate has completed the table in the incorrect layout e.g. right to left, or bottom to top, then award MP2 as a FT if they have done it all correctly.
3	b	iii	16	1	Accept any calculation that equates to 16 i.e. 2^4

PMT

J277/01 **Mark Scheme** **June 2023**

3	**b**	**iv**	1 mark each to max 2: • The **quality** of the image can be improved • The **file** size will increase // takes up more **storage** space // image has/requires/takes up more data • The number of colours that can be represented/used will increase // BOD more colourful	2	Do not award higher resolution, image size increases, clearer image (NBOD) more detailed image (NBOD). Closer to original is NE on its own because there is not an original image in this context. Mark first answer in each answer space.

3	**c**	**i**	1 mark for lossless
			
			1 mark each to max 2 for justification:
			e.g.
			• Lossless will not remove any **data**
			// No **data** is lost with lossless
			// **File**/**data** can be fully reconstructed back to the original
			• Text files require all data to open/be used/work
			// text files will not work if any data is lost
			// lossy cannot (usually) be used on text files
			// none of the required characters / words / spaces / case / formatting / information would be lost
			// the text will remain accurate
			// the text will not have changed meaning
			// the text will still make sense
				3	Do not award an example of lossless for 1st mark (e.g. RLE), but FT for justification.
					
					Do not FT for lossy.
					
					Accept reverse for answers e.g. Lossy will remove data.
					
					If compression type is missing, read justification and if clearly stated which type is used then award justification.
					
					MP1 requires reference to the data (or equivalent) not information.
					MP2 requires reference to the text file context and information is allowed.
					
					If not valid compression – 0 marks.

PMT

J277/01			Mark Scheme		June 2023
3	**c**	**ii**	1 mark for lossy 1 mark each to max 2 for justification e.g.: • Will reduce the **file size more/significantly** (than lossless) • Image will only lose **quality** // changes may **not be noticed** by the user // remove **unnoticeable/unnecessary** detail/content	3	Do not award an example of lossy for 1st mark (e.g. reduce resolution), but FT justification. Do not award lossless but FT for justification for lossless: e.g. • Quality/detail of the image can be retained • No data will be lost (permanently) • File size may still be a substantial reduction If compression type is missing, read justification and if clearly stated which type is used then award justification. Do not award how the file can be compressed e.g. reduce number of colours – unless they also state that this change will not be noticed. MP1 it compresses the file more is NE – compression is in the question, the candidate needs to explain what this means. If not valid compression – 0 marks.

J277/01 **Mark Scheme** **June 2023**

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>4</td><td>a</td><td></td><td>1 mark for each row

<table>
<tr><th>Threat</th><th>Anti-malware</th><th>Penetration testing</th><th>Encryption</th><th>Firewall</th></tr>
<tr><td>Spyware</td><td>✓</td><td></td><td></td><td>(✓)</td></tr>
<tr><td>Brute-force attack</td><td></td><td>(✓)</td><td></td><td>✓</td></tr>
<tr><td>Data interception</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>SQL injection</td><td></td><td>✓</td><td></td><td>(✓)</td></tr>
</table></td><td>4</td><td>(✓) can be present, or not</td></tr>
<tr><td>4</td><td>b</td><td></td><td>1 mark for threat
1 mark each to max 2 for description
e.g.
• Threat: Social engineering
• Using deception to manipulate users
• …to gain personal data

• Threat: Shoulder surfing (threat or expansion)
• Watching a person entering a password
• …and using it to access an account

• Threat: Phishing
• Fake emails sent to person // click on link from fake email
• Person sends personal data // gives away personal data

• Threat: Pharming
• Software that redirects user to fake website // use of a fake website
• Person enters personal data // gives away personal data

• Threat: Denial of service // DOS // DDOS
• Multiple requests sent to a server (simultaneously) // server is flooded with requests
• More requests than the server can process // uses all of the bandwidth available
• Server cannot respond // server crashes/denies access // stops access to a network // slows access to a network

• Threat: Hacker
• Person gaining unauthorised access to a system/account</td><td>3</td><td>If threat is clearly wrong do not FT.

If no threat given, read description for name of threat. If no name, do not award.

If threat is vague award matching description.

Allow social engineering as the threat – naming and description of phishing/pharming/shoulder surfing in the description.

Ransomware – MP3 cannot be awarded for 'ransom' on its own without reference to it being paid.

For actions that the malware/virus etc. can carry out – award any feasible action.</td></tr>
</table>

			• To delete/damage/access data • Threat: Virus/malware • Software that replicates/spreads • Fills disk space • Deletes/corrupts data // allows unauthorised access • Threat: Trojan • Malware disguised as legitimate software • Once installed acts as a virus // by example of action e.g. deleting files / allows unauthorised access • Threat: Worm • Software that replicates across a network • Uses up all the bandwidth • Threat: Ransomware • Encrypts/corrupts/locks access to data • Cannot access data without **paying** a fee/money // **pay** fee/money to get them back/decrypted // Cannot access data without meeting demands • Threat: Physical threat // by example • Damage to hardware • Deletes/corrupts data		

5	**a**	**i**	1 mark each
			Primary
			• to store (active) **data/instructions/software/OS** that the **processor** needs to **access**
			// without primary the computer won't be able to start up/work
			// (ROM) so the start-up instructions are not deleted when the computer turns off
			// (RAM) to store the **currently** running **data/software/instructions**
			// (Cache) to store **frequently** used **data/instructions**
			
			Secondary
			• to store **data/files long-term/permanently**
			// without secondary the user's files will not be stored when the power is turned off
			// store **data** not currently being used
				2	Question is not what they store, but why they are needed.
					
					Secondary NBOD 'to backup data' without reference to the long-term/permanence

PMT

J277/01 **Mark Scheme** **June 2023**

5	**a**	**ii**	1 mark for device, 1 mark for data • Hard drive // SSD // USB (memory) stick // Flash memory card // CD // DVD etc. • E.g. Images created // documents // software // files // data moved from RAM to virtual memory	2	Allow any secondary device. BOD 'optical disc' Question asks for device not type of device e.g. magnetic/optical/solid state is NE. Award example even if incorrect secondary storage. USB on its own is NE

PMT

J277/01 **Mark Scheme** **June 2023**

<table>
<tr>
<td>5</td>
<td>a</td>
<td>iii</td>
<td>1 mark for each row.

<table>
<tr><th>Statement</th><th>True (✓)</th><th>False - correct the statement</th></tr>
<tr><td>A section of primary storage is partitioned to act as virtual memory</td><td></td><td>A section of secondary storage is partitioned to act as virtual memory</td></tr>
<tr><td>Data from ROM is transferred into VM</td><td></td><td>Data from RAM is transferred into VM</td></tr>
<tr><td>VM is needed when RAM is full, or nearly full</td><td>✓</td><td></td></tr>
<tr><td>Data from VM is transferred back to secondary storage when needed</td><td></td><td>Data from VM is transferred back to RAM when needed</td></tr>
</table>
</td>
<td>4</td>
<td>Allow a description of the error in column 2, e.g.
in row 1: 'primary should be secondary'

Accept HDD/SSD for secondary storage for the 1st row.

Do not accept primary for RAM (rows 2 and 4).</td>
</tr>
<tr>
<td>5</td>
<td>b</td>
<td></td>
<td>1 mark from:
• Performs housekeeping actions
• Monitor / manage / maintain a computer system
• Help the computer run smoothly/efficiently
• To diagnose/fix/identify problems with a computer system</td>
<td>1</td>
<td>Do not award example on its own</td>
</tr>
</table>

PMT

J277/01			Mark Scheme		June 2023
5	**c**	**i**	1 mark for identification: • Artist's computer // computer uploading the images // BOD The artist 1 mark each for justification to max 2: e.g. • Sends the files/data for storage/to the **host**/web **server** // the files are stored on the web **server** • Performs the user's actions … • .. and sends the results to the web **server** • Sends a **request** to the web **server**… • … to **store**/**upload** its files • It does not store data for others to access • Confirmation of upload/error is received (from server) for display	3	Incorrect computer, do not award justification. Be careful the justification is talking about the upload of images to the web server, not the download. Accept host for web server. If 'user's computer' is given for identification, this is NE – read on for justification. If 'user viewing the website' or similar is given this is incorrect.
5	**c**	**ii**	1 mark for identification: • Web server 1 mark each for justification to max 2: e.g. • The images/data are stored on / uploaded to / sent to / hosted on the web server • Web server receives a request (from the artist's computer to upload the images) • Web server executes/responds to the request // Web server is doing the processing/handling the (request to) upload • Web server returns confirmation/error of the processing/upload	3	If computer is incomplete or inaccurate e.g. server/website instead of web server. Do not award computer, but award justification. Allow FT in justification if the same inaccurate term is used, for example 'website' is given as computer (NE), but justification is: 'images are sent to the website' (FT for website instead of web server). Incorrect computer, do not award justification.

J277/01			Mark Scheme		June 2023
5	d	i	1 mark each: e.g. • Authors can earn money • …by selling for a fee // using licences to stop unauthorised use • No-one can see the code • …users cannot edit/change the software // by example inserting malware • …so it cannot be copied/resold/shared • More **control** over intellectual property // by example e.g. restrict users, restrict what can be done with the software without permission	4	Benefit is to artist and programmer – not user. Mark the answer as a whole. Do not award reference to ownership/copyright because both allow copyright of the code/program.
5	d	ii	1 mark for point, 1 for expansion: e.g. • Users can **view**/**edit** the (source) code // Users can **edit** the program/software • …to **tailor**/**improve**/**adapt** it to do what they need/want • …so errors can be fixed (by anyone) • …users can learn how the software works • Freely accessible • …do not have to pay • …can redistribute … • …with changes	2	Benefit to users not artist and programmer
6			**Mark Band 3–High Level** **(6-8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate is able to weigh up both sides of the discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2-Mid Level** **(3-5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; the material is generally accurate but at times underdeveloped.	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** Some points may cover more than one 'issue'. Legal issues: • DPA needs to be followed or company could be fined e.g. Customers informed the system is used Data held for specified

J277/01			Mark Scheme		June 2023
			The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to discuss the impact and most are showing reasonable recognition of influencing factors. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.* **Mark Band 1-Low Level** **(1-2 marks)** The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit		time/reasons Data kept secure • Centre is private property so customers can choose not to enter • Can be used to identify people committing crimes e.g. theft, used as evidence, make sure the correct people are caught. Ethical issues: • Users feel safer because they know any actions are being monitored and help/action will be taken if needed • If users have not done anything then there is no reason to be tracked/recorded so should not impact them • Users feels unsafe because they are being watched • Users may be unaware they are being recorded - need to be informed, give consent • Users do not know where the videos/data about them and their movements is stored/how it is used - DPA reference Privacy issues:

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J277/01			Mark Scheme		June 2023
					• Users may feel it is an invasion of privacy • Users are in a public place and can be legally recorded by anyone anyway • Users may feel like they are being watched all the time • Users have not given their permission to be tracked • Users may not know the system exists

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Question			Answer	Mark	Guidance
7			1 mark for example: e.g. • Auto lights • Auto window wipers • Sat nav // GPS • Airconditioning // climate control • Radio/entertainment/infotainment system/media system • Lane assist • Engine management system • Auto-park • Cruise control • Auto-brake • Follow-me • Dashcam 1 mark each to max 2 for explanation. • **Limited** functions // by example e.g. the system **only** checks the light and turns lights on/off • **Dedicated** microprocessor // by example e.g. there is a microprocessor that is only checking the lights • Hard to change function // by example e.g. the user cannot make the light system do any other role	3	Allow anything that could be reasonably within a car. If example is not clear if it's an embedded system, read explanation for justification e.g. hazard lights – could be embedded if they are activated automatically when the car crashes. Award the example in the explanation if this occurs. If justification is generic features of an embedded system max 1 for explanation. Do not award 'built into the car/larger machine' because this is in the question.

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GCSE

Computer Science

J277/01: Computer systems

General Certificate of Secondary Education

Mark Scheme for June 2024

Oxford Cambridge and RSA Examinations

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the

highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses
When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
   - there is nothing written in the answer space

- there is nothing of relevance to the question written in the answer space

Award Zero '0' if:

- anything is written in the answer space and is related to the question and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. *Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.*

10. For answers marked by levels of response: Not applicable in F501
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

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11. **Annotations**

Annotation	Meaning
A	Omission mark
BOD	Benefit of doubt (must be accompanied with a tick)
	Cross
FT	Follow through (must be accompanied with a tick)
NAQ	Not answered question
NBOD	Benefit of doubt not given
REP	Repeat
	Tick
TV	Too vague
SEEN	Blank pages, pages with no annotation, no attempt to answer the question, page seen on QER
L1	QER Level 1 mark awarded
L2	QER Level 2 mark awarded
L3	QER Level 3 mark awarded

12. Subject Specific Marking Instructions

Mark scheme conventions:

- Each mark point is worth 1 mark unless stated otherwise
- Each mark point can only be awarded once
- A word/phrase that is underlined needs to be exact in the answer to award the mark point
- A word/phrase that is **bold** needs that concept to be in the answer (but can be given in multiple ways) to award the mark point
- 3 dots at the end of one mark point and at the start of the next mark point mean that the second mark point cannot be awarded without the first being awarded, unless the mark scheme states otherwise (for example a reasonable attempt with some inaccuracies)
- 3 dots at the start of a mark point, without 3 dots at the end of the mark point above, means the sentence carries on and there is no dependency
- Any text in brackets is not required to gain the mark point
- Single / means alternative word
- Double // means an alternative statement that is acceptable for the same mark point
- Enlarged font is used for visibility reasons only

Annotating scripts:

- Blank pages at the start of the script need SEEN annotation
- Any questions answered elsewhere (e.g. on the first blank pages, separately on the page) need to be linked within RM Assessor and annotated with ticks/crosses/SEEN as appropriate
- 1 tick for every mark awarded, if a question is given 3 marks there must be 3 ticks (apart from QER question)
- A BOD or FT annotation needs to be accompanied by a tick
- QER question 4 – One annotation from: L1, L2 or L3, according to the level awarded, the page not annotated with the level needs a SEEN annotation. Do not include any ticks, crosses or other annotations on this question – other than SEEN and one from: L1, L2 or L3. A single cross can be used when there is nothing of credit and 0 marks (instead of NR) is being awarded.
- Any answers with no candidate response need a SEEN annotation and NR entered as the mark.
- Any questions where the candidate has not attempted the question e.g. answered 'don't know' need a SEEN annotation and NR entered as the mark.
- All questions must be annotated throughout the marking process.

PMT

J277/01 Mark Scheme June 2024

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>1 mark each
<table><tr><th>8-bit Binary</th><th>Denary</th></tr><tr><td>11110000</td><td>240</td></tr><tr><td>01101001</td><td>105</td></tr><tr><td>00011110</td><td>30</td></tr></table></td><td>3</td><td>Binary must be 8-bits</td></tr>
<tr><td>1</td><td>b</td><td></td><td>1 mark each
<table><tr><th>Statement</th><th>Answer</th></tr><tr><td>The smallest denary number that can be represented by a 4-bit binary number.</td><td>0</td></tr><tr><td>The largest denary number that can be represent by a 6-bit binary number.</td><td>63</td></tr><tr><td>The maximum number of different colours that can be represented with a colour depth of 7-bits</td><td>128</td></tr><tr><td>The minimum number of bits needed to represent 150 different characters in a character set.</td><td>8</td></tr></table></td><td>4</td><td>Accept calculations that equate to the same answer.

Accept any number of 0s for the first answer.</td></tr>
<tr><td>1</td><td>c</td><td></td><td>11110000</td><td>1</td><td>Ignore leading 0s</td></tr>
</table>

PMT

J277/01 Mark Scheme June 2024

1	**d**		1 mark for an example 2-digit hex number **correctly** converted into denary. 1 mark each to max 2 for describing/showing each stage. Either: Multiplying: • **Multiply** the **left/first** digit by **16** • **Add** value of **second** digit (without additional calculation) Or: Converting: • Convert each digit into **4-bit binary** • Combine and convert the **8-bit binary** to denary	3	No marks for converting denary to hex. If the example has an inaccurate result, for example they have converted A to 11. They can still get the method marks. No requirement to show how letters are used.
1	**e**		1 mark for correct working (4 carries) 1 mark for answer 01111010 Working showing carries e.g. 01101011 00001111 01111010 1 1 1 1	2	Do not award working mark for conversion to denary and back. Carries must be on the correct values, but could be above, below etc.

PMT

J277/01 Mark Scheme June 2024

Question			Answer	Mark	Guidance
2	a	i	1 mark for each valid IP v4: • 4 groups of denary numbers between 0 and 255 separated by full stops (example v4: 123.16.46.72) v6 • 8 groups of hex numbers between 0 and FFFF separated by colons. Double colon can appear **once** and replaces any number of groups of consecutive 0000 (example v6: 0252:5985:89ab:cdde:a57f:89ad:efcd:00fe) (example v6: F513:8C:2A::999:0000 expanded would be F513:8C:2A:0000:0000:0000:999:0000)	2	V6 Each hex number can be between 1 and 4 digits
2	a	ii	1 mark each to max 2 • (usually presented in) hexadecimal / denary / binary • 6 groups of numbers // 12 (hex) numbers • … each group has paired/2-digit (hex) numbers / 8 bit binary number • 48 bits long • Separated by colons/hyphens • (The first half/part) contains the **manufacturer ID** // (first half/part) identifies the manufacturer • (The second half/part) contains the **serial number** // (second half/part) identifies the device	2	MP1 'numbers' is NE Allow both marks for a valid example. NB '6 pairs of numbers' gets MP2 and MP3. '4 pairs of numbers' gets MP3

J277/01			Mark Scheme		June 2024
2	**b**	**i**	1 mark each for benefit 1 for application to max 4 e.g. • Fast connection/speed // high bandwidth // consistent bandwidth • … e.g. reduce delays at check in // by example for airport • Secure // unlikely to have unauthorised access/hacked // data transmissions are likely to be safe • …e.g. so that data about passengers/staff/aeroplanes is not intercepted // by example for airport • Little interference // little chance of data loss // reliable • … e.g. flight status is received without delay // by example for airport • Long range transmission • … e.g. airport has a large floor area/terminals // by example for airport	4	Mark in pairs. Mark each benefit space to the candidates' benefit. An expansion/application for a benefit can be awarded in the other answer space. 1 benefit and 1 expansion for each answer space. Max 2 marks per answer space. **Max 3** marks if expansions have no direct application to the **airport** and its **computers** connecting using **wired** connections. If the second expansion is not applied, annotate with **^** NOT cost. The question is not a comparison to wireless, but accept answers worded in this way. Fast on its own is NE. 'faster to connect' is NE because this could

					be to set up the connection as opposed to the bandwidth.
2	**b**	**ii**	1 mark each to max 3 e.g. • Staff do not need to be in one-place // movement of staff // can work whilst moving to another part of the airport // can be accessed from any location (in range) • Staff can be more responsive to customers/requests • Allows a larger number of connections/devices // more scalable … • … without the disruption/cost of installing more cables • Some devices do not allow physical/wired connection // allow wider range of type of device (or by example such as vehicles/mobile devices/aeroplanes) • Easier to add/connect more devices • Do not need to find/use a physical connection/wire // can allow you to connect in a place where there isn't a cable/connection • For use as a backup if the wired connection fails	3	Do not award cost on its own. Do not award range on its own. Allow explanation of how a wireless network will benefit the passenger as well as the airport and staff. Allow in reverse if clear, for example wired restricts staff to one location.
2	**c**	**i**	1 mark each for drawing showing: • 5 computers, 2 printers and 1 switch **all clearly labelled** • All devices directly connected to the **switch** // all computers connected to **switch** and each printer to a switch/computer(s) • Only 8 devices **and** no additional connections other than to the switch (or central device, or printers to only one computer each)	3	Allow any type of computer e.g. PC, laptop. Do not accept client for computer. MP1 there must be at least 5 computers, at least 2 printers, at least 1 switch

PMT

2	**c**	**ii**	1 mark for benefit e.g. • Easier to add new nodes // easier to setup BOD • Central device can monitor/control **transmissions** • Faster data transmission • Fewer data collisions • One connection/computer breaks the network still works • Less cost of **cables** 1 mark for drawback e.g. • Switch fails the network fails // reliant on a central device (working) // single point of failure • Extra cost of **central device/switch**	2	Speed, cheaper etc. on its own is NE Server is irrelevant. Read whole benefit and award a valid benefit. Read whole drawback and award a valid drawback. Do not award contradictory statements.
2	**c**	**iii**	1 mark each to max 3 e.g. • Connects the devices together in the network // allows devices to communicate in the network • **Receives** data from (all) devices in the star topology • Record/register/store the address of devices connected to it … • …in a table • Uses MAC address of devices • Direct data **to destination** • …if address not recorded transmit to all devices	3	

J277/01 Mark Scheme June 2024

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>3</td><td>a</td><td></td><td>1 mark for function and 1 name for task

<table>
<tr><th>Function</th><th>Task</th></tr>
<tr><td>Memory management // managing memory</td><td>Moves data from secondary storage to RAM</td></tr>
<tr><td>Peripheral management</td><td>• Receiving data from input devices
• Transmitting data to output devices
• Installing/downloading device drivers
• Allows communication from input device / to output device</td></tr>
<tr><td>File management // managing files</td><td>Allows the user to create, name and delete folders</td></tr>
<tr><td>User interface</td><td>• Outputting data to the user
• Receiving input from the user
• Allows user to communicate/interact with/control the computer
• Creating/displaying/allowing interaction with a GUI/command prompt interface</td></tr>
</table></td><td>4</td><td>BOD storage for memory in the first function.

Peripheral: allow input and output devices by example.

File management, do not award folder management.

The task for peripheral management needs to extend 'manage' i.e. 'manage output devices' is NE.</td></tr>
<tr><td>3</td><td>b</td><td></td><td>1 mark for each term

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

defragmentation 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 consecutive in storage and the free space is moved together. This does not provide more storage space on the disk, instead it makes the access of the data faster because the read head does not have to move as far to access the next part of the file.</td><td>6</td><td>Encryption
Key
Understood
Defragmentation
Consecutive
Access

Mark first answer in each space.</td></tr>
</table>

J277/01 Mark Scheme June 2024

Question			Answer	Mark	Guidance
4			**Mark Band 3–High Level** **(6-8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate is able to weigh up both sides of the discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* The answer covers all required elements (legal/ethical, benefits, drawbacks) given in the question about open source **and** proprietary and includes a recommendation with justification. The top of the band makes a clear and structured recommendation to the programmer. **Mark Band 2-Mid Level** **(3-5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to discuss the impact on most areas, showing reasonable recognition of influencing factors. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.* The answer includes one or more from legal/ethical, benefits, drawbacks for open source **and** proprietary. Alternatively, the answer could have a justified recommendation without clearly referencing the bullet points in the question. **Mark Band 1-Low Level** **(1-2 marks)** The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** Licence features Open source – (usually free), can access/change source code, redistribute Proprietary – purchase at a cost, cannot access/change code Legal and ethical issues: • Both provide copyright • Open source – allows more people to take code and possibly change to resell, or adapt in their own programs to resell or claim as their own (reverse for proprietary) • Open source – allows more people access to the game because there is likely no cost (reverse for proprietary) Benefits and drawbacks: • Open source – wider customer base, more exposure, users can alter to make it better/fix

			candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* The answer is limited to the facts about open source **and/or** proprietary. **0 marks** No attempt to answer the question or response is not worthy of credit		bugs, limited documentation, little financial gain • Proprietary – allows programmer to earn money, gives more control over what happens with the program, usually well tested, more restrictions for copyright, cannot be adapted to meet user needs, Decision: Either would be appropriate, justification needs to be clearly for the scenario

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5	**a**	**i**	1 mark for The amplitude of the wave is measured at set intervals	1	2+ ticks = 0 marks
5	**a**	**ii**	1 mark each to max 2 • The number of bits per sample will change // by example e.g. there will be more/less bits per sample • The file size will change // by example e.g. the file size will increase/decrease • There will be a change in the accuracy of each sample/amplitude/sound // by example e.g. more precise amplitudes // by example e.g. a wider/smaller range of amplitudes can be recorded • The quality will change // there will a different amount of distortion // by example e.g. the quality will improve/decline	2	MP3 needs to be clearly a wider range of amplitudes can be recorded i.e. more different values. **Not** that there are more **amplitudes/samples per second.** MP3 – 'more amplitudes can be measured' is BOD, but 'more amplitudes measured per second' is incorrect. BOD 'sound' for 'amplitude' e.g. for MP3 "a larger range of sounds can be recorded."

J277/01			Mark Scheme		June 2024
5	**b**	**i**	No mark for type. Accept the type by example e.g. HDD for magnetic. 1 mark each for each point matching to type given to max 4 Magnetic e.g. • (Usually) cheaper cost to purchase per unit of data • Sufficient/good durability for what is needed • … computer unlikely to move (regularly) // by example • Sufficient/fast speed of access • …no significant delays in storing/reading data • (Long-term) reliable // longevity • …unlikely to need to purchase another //unlikely to break from over-use • High capacity • … e.g. file size of sound files can be large // allows the musician to store files with higher bit depth Solid state e.g. • Cost often equates to magnetic per quantity // not expensive per unit of data • Durable // robust // no moving parts • …so computer can be moved without risk of losing data • Fast **speed of access** of data • … no significant delays in storing/reading data // musician does not have to wait for files to load/store • High capacity // (nearly the) same/higher capacity than magnetic • …file size of sound can be large • Small in physical size • … device is portable // can fit in a smaller type of computer • Produces less sound when running • … so the musician distracted • Requires little/less power (compared to others) • … so running costs are reduced • Drives do not get fragmented files • … drives do not need to be defragged // constant access time	4	MP1 needs to be cost per unit e.g. it costs less per GB than other storage types. Not just 'it is cheap to buy'. Allow reverse argument for each e.g. for magnetic, why they have not chosen solid state. For example: 'magnetic is not as robust but the computer will not be moved' gets 1 mark for the not moving, and 1 mark for solid state's robustness is not required. If there is no type give on line 1. Read the answer to look for a type and then award justification. If there is not type identified anywhere in the answer, 0 marks.
5	**b**	**ii**	1 mark for Optical	1	BOD optic. Do not award an example of optical storage
5	**b**	**iii**	1 mark for 200 000 KB	1	2+ ticks = 0 marks

PMT

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5	**b**	**iv**	1 mark for the answer 3 GB 1 for working e.g. • 3 * 1000 / 1000 • 3 * 1000 • 3000 / 1000 • 3 / 1000 • 0.003 * 1000	2	Allow 2.9296875 (or approximated) for division by 1024. Allow addition of metadata e.g. 10% added. This can be awarded for both working and answer. Not all of the working needs to be correct to get the working mark. Ignore mention of MB/GB in the working.
6	**a**		1 mark each • **Data/instructions** are fetched from **memory/RAM/primary storage** • **Data/instructions** are stored using the registers // **correct example** of a register storing address/data • **Data/instructions** are decoded // **Data/instructions** are split into opcode and operand • **Data/instructions** are **executed/processed** • **ALU** performs the logical/arithmetic calculations	2	MP4 BOD carried out etc. for executed. Ignore inaccurate references to registers and components (other than MP2 correct example of a register).

6	**b**		1 mark for naming register, 1 for matching purpose • Program counter // PC • **Stores** the **address** of the **current/next** instruction to be fetched // **stores** the **address** of the instruction for the **current/next** FE **cycle** • Memory address register // MAR • **Stores** the **address** of the **current/next** instruction/data to be fetched // **stores** the **address** where data/instruction is to be stored • Memory data register // MDR • **Stores** the **data/instruction** fetched from memory // **stores data/instruction** to be stored in memory // stores the **data/instruction** located in the **memory** location in the **MAR** • Accumulator // ACC • **Stores** the **result** of calculations // **stores data currently** being processed / by example // **stores** the result from the ALU	4	Careful that the purpose is not an action such as fetches, takes, retrieves. Read full purpose and award a correct point Accept • Current instruction register//CIR//Instruction register//IR • Stores the instruction currently being executed BOD memory buffer register for MDR. If there is no register but the register is given in the purpose column, award the purpose if accurate. If the answer in the register column is incorrect, do not mark purpose. For PC and MAR, accept 'pointer' for storing address Accept memory address, memory data
6	**c**		1 mark each to max 3 • Clock speed • Cache size • Number of cores	3	'clock' 'cache' 'speed' 'cores' on its own is NE.

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7	**a**		1 mark each to max 3 • Has a specific purpose // it only performs one/limited task // dedicated to the Follow Me system • Built within a larger device/car • **Dedicated**/specific/its own hardware / sensors • Has a microprocessor • Built-in operating system/software // software is all in firmware/ROM • …it's instructions/operation does not/is hard to change/update • It is a control system // it is automated	3	MP2 BOD reference to it being 'built into' 'something' reasonable
7	**b**	**i**	1 mark each to max 2 • Start-up instructions // BIOS // bootstrap // where to find the OS • Firmware // Program/instruction to run the Follow Me system // Instructions for operation • Example of data being stored e.g. the maximum speed, the min distance • Operating System // OS	2	MP2 'programs' on its own is NE MP3, Allow two marks for examples of instructions or data. For example both marks can be given for: 1 – The maximum speed 'Follow Me' can operate 2 – The minimum distance the car in front can be
7	**b**	**ii**	1 mark each to max 3 e.g. • Current distance from car in front • Set distance from car in front • Current speed of vehicle • Current speed of vehicle in front • Reading from sensor • Driver actions (e.g. moving wheel/braking) • Direction the car (in front) is travelling (e.g. turning)	3	'speed' or 'distance' on its own is NE BOD reference to a camera taking images of what is in front
7	**b**	**iii**	1 mark each to max 2 • Only stores a small amount of data in **RAM** // only stores specific/few items in **RAM** • …unlikely to run out of **RAM** // there is enough space in **RAM** • No secondary storage to use/needed as VM • Few/one program/instructions running at a time // no memory intensive tasks • Dedicated hardware will be optimised for system // **RAM** is designed to meet the system's requirements	2	

PMT

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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 .....

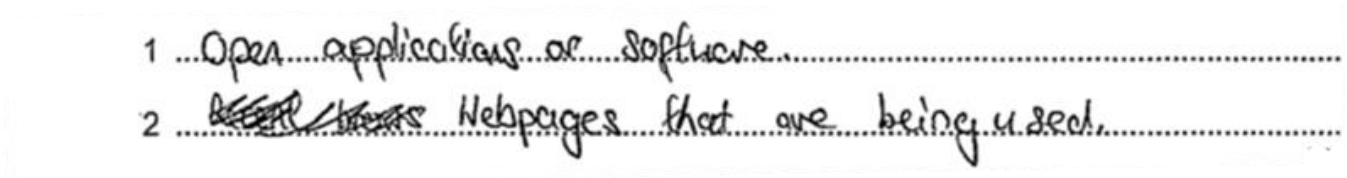
[2]

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



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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Question 5 (a) (i)

5 An artist has a computer that they use to create images.

Their computer has both hardware and software.

(a) The hardware includes primary and secondary storage.

(i) Explain why a computer needs both primary **and** secondary storage.

.....

.....

.....

..... **[2]**

Some candidates found this question challenging and often gave examples of each type of storage instead of answering why both are required. Some candidates were able to accurately describe the purpose of primary storage as storing currently running data and software.

Misconception

A common misconception was that secondary storage is used when primary storage is full, or that it is only used as a backup.

Question 5 (a) (ii)

(ii) Give **one** example of a secondary storage device that the artist's computer will have **and** an example of the data that will be stored on it.

Secondary storage device .....

Example data .....

.....

[2]

Candidates were required to identify a secondary storage device. Some responses identified a type of storage media (for example magnetic) instead of identifying a device (for example hard drive). Some responses gave RAM or ROM as a secondary storage device. These responses were incorrect.

The example data varied but many responses were able to identify the storage of files, the images or software.

Question 5 (a) (iii)

(iii) The computer has Virtual Memory (VM).

The table has four statements about VM. Not all of the statements are correct.

Tick (✓) the **True** column for the statements that are correct.

Re-write any statement that is incorrect in the **False** column by changing the statement to make it true.

Statement	True (✓)	False – rewrite the statement to make it true
A section of primary storage is partitioned to act as virtual memory		
Data from ROM is transferred into VM		
VM is needed when RAM is full, or nearly full		
Data from VM is transferred back to secondary storage when needed		

[4]

In this question candidates needed to consider each statement, identify whether it was true or false and if it was false re-write the statement about virtual memory to make it true.

Candidates commonly identified the third statement as being true.

The first statement was often correctly altered to identify that secondary storage was used. The second statement was sometimes changed correctly to RAM, but at other times was changed to secondary storage.

The final statement was often changed to primary storage, which was not enough because primary storage would include ROM and cache, therefore not being precise enough to describe how VM works.

Question 5 (b)

(b) The computer has an operating system and utility software.

State the need for utility software in a computer.

.....

..... **[1]**

Some candidates gave an example of utility software and described the purpose of that software instead of utility software in general. For example, a candidate gave defragmentation, or file management as the need.

Question 5 (c) (i)

(c) The artist uploads images to be displayed on a website. This is a client-server relationship.

(i) Identify the computer that is acting as the client in this scenario **and** justify your choice.

Client computer .....

Justification .....

.....

.....

.....

[3]

Many responses identified the artist's computer as being the one that is acting as a client.

Fewer responses were able to justify this, for example they described a different scenario, such as downloading the images to view the website, instead of the given scenario of the client uploading the files.

Exemplar 2

Client computer ..... Artist's Computer .....

Justification ..... The Artist's Computer is .....
..... requesting a response for .....
..... uploading images by the website .....
.....

[3]

In this response the candidate has identified the correct computer. The justification states that it is requesting a response, but not where this response is from, and then that the images are uploaded to the website when in this scenario they should be referring to the server in the client-server relationship.

Question 5 (c) (ii)

(ii) Identify the computer that is acting as the server in this scenario **and** justify your choice.

Server computer .....

Justification .....

.....

.....

.....

[3]

Fewer candidates were able to accurately identify the server in this scenario.

Many candidates identified the website as a server when a website is not a computer.

Some candidates who identified the webserver were also able to justify their choice by identifying the actions it was performing in the scenario.

Exemplar 3

Server computer website server

Justification the website server receives and processes data and does not send it back

The response in Exemplar 3 has correctly identified the webserver as the computer. They have also identified that this server (the computer) receives the data and processes the data.

Question 5 (d) (i)

(d) The artist is working with a programmer on the development of a new piece of software.

The software will allow users to edit images on devices such as mobile telephones.

They are considering releasing the software as open source instead of proprietary.

(i) Describe **two** benefits to the artist and programmer of releasing the software as proprietary.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

This question required candidates to consider the benefits to the developer of releasing the software as proprietary.

A common error was describing the benefits to the users, for example they know the software has not been tampered with and that there is lots of support.

The most common responses included the ability to earn money from selling the software and retaining control due to no-one else being able to access the source code.

Question 5 (d) (ii)

(ii) Describe **one** benefit to the users of releasing the software as open source.

.....

.....

.....

..... **[2]**

This question required candidates to consider the benefits to the users of the software being released as open source.

Many candidates were able to accurately identify that the source code comes with the software, and this allows the user to edit it to meet their needs.

Question 6*

6* A shopping centre has a security system that includes CCTV cameras to record activities in the centre. The security system is being upgraded to include the use of facial recognition to identify, track the movements of and record individuals throughout the shopping centre.

Discuss the positive and negative impacts of this upgrade including:

- ethical issues
- privacy issues
- legal issues

.....

.....

.....

.....

.....

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

The quality of written communication required a balanced discussion of the positive and negative impacts of including facial recognition with CCTV cameras in a shopping centre.

Some responses gave strongly negative arguments with little, if any, consideration for the positive impacts. Some candidates also chose to focus on the introduction of CCTV cameras, where the question states there are already CCTV cameras and the discussion is about the upgrade to facial recognition.

The more successful responses considered the ethical, privacy and legal issues one at a time and identified the positive and negative impacts (where applicable) for each of these three sections. These responses were usually well structured and had a balanced discussion before leading to justified conclusions.

Some successful responses included bullet points and table structures to help the candidates structure their response. These were often thorough and included detailed discussions.

Some of the less successful responses focused on people not wanting to be watched by CCTV cameras, or that people would misuse the CCTV cameras. The CCTV cameras were already in existence and therefore this was irrelevant to the context of the question.

More successful responses considered the storage of the tracked videos and how this could lead to data privacy issues. These responses also discussed how shops could use the stored data to analyse where people go in shops to identify areas where they could put more adverts.

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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