



GCSE (9-1)

Computer science

Unit **J276/01**: Computer science

General Certificate of Secondary Education

Mark Scheme for June 2018

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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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J276/01

Mark Scheme

June 2018

Annotations

Annotation	Meaning
	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
	Benefit of doubt
	Cross
	Follow through
	Not answered question
	Benefit of doubt not given
	Repeat
	Slash
	Tick
	Too vague
	Zero
	Noted but credit not given

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'.

J276/01

Mark Scheme

June 2018

	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.

J276/01

Mark Scheme

June 2018

Question			Answer	Mark	Guidance
1	(a)	i	<p>1 mark per bullet to max 2</p> <ul style="list-style-type: none"> For long term/permanent/non-volatile storage // storing when the device is turned off To store the videos / data / files For transferring the videos (to another device) 	<p>2</p> <p>AO2 1a (1)</p> <p>AO2 1b (1)</p>	<p>Do not award capacity.</p> <p>Bullet 3 – portable is not enough, needs application.</p> <p>Bullet 2 – must identify the data is stored. For videos accept data or any other term that signifies the data is being stored/transferred e.g. photos/images.</p> <p>Accept any alternative for transfer e.g. sending/exporting.</p>
1	(a)	ii	<p>1 mark per bullet to max 4</p> <p>Max 3 if only stating features</p> <p>e.g.</p> <ul style="list-style-type: none"> Portable Lightweight ...e.g. device needs to be carried Small physical size ...e.g. can fit in a small camera Durable No moving parts ...e.g. device is moved so may be dropped // won't be damaged when moving around Reliable ...e.g. needs to work when out in the 'field' Sufficient/large capacity ...Videos are large file size // store more videos Fast access/read/write speed ...e.g. the device will retrieve the videos without delay Efficient power consumption ...e.g. run on battery // longer battery life 	<p>4</p> <p>AO1 1b (1)</p> <p>AO2 1a (1)</p> <p>AO2 1b (2)</p>	<p>Award marks for why solid state is most appropriate, not why others aren't.</p> <p>Award descriptions of portable/durable etc., not looking for key words.</p> <p>Do not just allow can transfer data elsewhere.</p> <p>Fastest without quantifying read/write speed is not enough.</p> <p>Allow: quietest and expansion.</p> <p>Do not award cost.</p> <p>Small on its own is insufficient as it could mean physical or memory size.</p>

J276/01

Mark Scheme

June 2018

Question			Answer	Mark	Guidance
1	(b)	i	1 mark for working, 1 mark for answer <ul style="list-style-type: none"> • $1024(1000) / 100$ // $10 * 100 = 1000$ • = 10 (videos) 	2 AO2 1a (1) AO2 1b (1)	Final answer must be 10, not 10.24
1	(b)	ii	1 mark per bullet to max 6 <ul style="list-style-type: none"> • Output asking for file size (in megabytes) • Taking number of MB as input • Multiplying by 1024 or 1000 • Multiplying by 1024 or 1000 (may be same line as bullet 3, this must be the final value with no further changes) • Outputting the final bytes value... • ...in an appropriate message <pre> output "Please enter the file size in megabytes" input numberMB numberKB = numberMB * 1024 (or 1000) numberBytes = numberKB * 1024 (or 1000) output "There are " & numberBytes & " bytes in " & numberMB & "MB" </pre>	6 AO3 2b (6)	<p>Award bullet 5 even if bullets 3 and 4 are wrong. Do not award if outputting the original input value.</p> <p>Bullet 4 must be the final calculation to get the mark. If there are any further calculations, or changes to the final bytes value then bullet 4 cannot be awarded.</p> <p>Input = value is incorrect, variable must be on left.</p> <p>Bullet 6 is dependent on bullet 5.</p> <p>Input must be stored e.g. <code>user input</code> – no mark</p> <p>Outputs must have "" around strings, variable identifiers must not have "".</p> <p>If bullet 5 is not given because the variable is in "", still award bullet 6 if correct.</p> <p>Bullet 3 and 4, could be multiplying by 1,000,000 or 1,048,576 (award both bullets).</p> <p><code>numberMB = input("Enter the file size")</code> would get both bullets 1 and 2.</p> <p>Concatenation is not required for the final bullet.</p> <p><code>input("Filesize")</code> will get 1 mark for outputting File size, it will not get the input as there is no variable.</p>

J276/01

Mark Scheme

June 2018

Question			Answer	Mark	Guidance
1	(c)	i	<p>1 mark per bullet to max 3 e.g. Incremental:</p> <ul style="list-style-type: none"> • Only the changes need to be backed up • The software/OS/settings are unlikely to have changed between backups • Small number of files likely to be used/edited between backups • Take less time to backup • Each backup will take less memory space to store <p>Full:</p> <ul style="list-style-type: none"> • Backup all the data/files and software • It might not take a significant time to back up entire system • He might only have a small number of files to be backed up each time • Safer as have more past versions to revert to • User may have changed settings on computer • Faster to restore the backup • Needs to do a full before he can do an incremental 	<p>3 AO2 1a (1) AO2 1b (2)</p>	<p>Discussion must match the backup given.</p> <p>Either method is acceptable, marks are awarded for the justification.</p> <p>Allow marks for why the other is not appropriate.</p> <p>If there is no method given, or both, then read the answer and mark their justifications. It must be clearly given which method each point refers to.</p>

J276/01

Mark Scheme

June 2018

Question			Answer	Mark	Guidance
1	(c)	ii	<p>1 mark for naming program, 2 for description of use e.g.</p> <ul style="list-style-type: none"> • Encryption software • Scramble/encode/mix up data • ...so it cannot be read/understood if intercepted/stolen <ul style="list-style-type: none"> • Defragmentation • Move free space together • Move files together • E.g. Faster access to files <ul style="list-style-type: none"> • (Data) compression • Reduce the file size of files // makes files smaller • To use less storage space • Faster transmission • To store more files <ul style="list-style-type: none"> • Anti-virus / anti-malware • To help protect computer/data against viruses/malware • To scan the computer to look for/quarantine/remove viruses/malware <ul style="list-style-type: none"> • Disk analysis and repair • Scan disk and look for faults • Prevent loss of data due to faulty disk <ul style="list-style-type: none"> • Auto-update • Checks Internet for new versions of software/OS • Downloads and installs without user interaction <ul style="list-style-type: none"> • Firewall • Examine ingoing and outgoing traffic • To help restrict/prevent unauthorised access • ...over a network/external source 	<p>3</p> <p>AO1 1a (1)</p> <p>AO1 1b (1)</p> <p>AO2 1b (1)</p>	<p>Must be appropriate to scenario.</p> <p>For encryption, no mark for 'it encrypts data'</p> <p>Do not award: any form of backup or device driver.</p> <p>Do not award: encryption stops data being stolen.</p> <p>Do not award: brand names. But read description.</p> <p>Mark program first. If incorrect 0 marks. If wording is not clear, or terminology not exact but it can be understood, marks can be awarded for description of use.</p> <p>Defragmentation – do not award marks for describing a fragmented disk this is a NAQ.</p>

J276/01

Mark Scheme

June 2018

Question		Answer	Mark	Guidance
1	(d)	<p>1 mark per bullet to max</p> <ul style="list-style-type: none"> • Allows free distribution // other people can use/edit his work • Other people can redistribute his work • Can choose to restrict other people to be able to use/edit/share the videos • Work is still copyrighted // others cannot claim it as their own • No-derivative • ...William can set that if others edit it they cannot redistribute it with the edits • attribution • ...Can insist e.g. on having his name on it if re-used // referencing // must be credited • Can insist on non-commercial use // others cannot sell/profit from his work // personal use only 	<p>3</p> <p>AO1 1b (1)</p> <p>AO2 1a (1)</p> <p>AO2 1b (1)</p>	<p>“People need to ask to use it” is not enough.</p>

J276/01

Mark Scheme

June 2018

Question		Answer	Mark	Guidance																		
2	(a)	1 mark for LAN 1 mark per bullet for justification to max 2 <ul style="list-style-type: none"> • Small distance/geographical area by example e.g. same building/house • Connected by own hardware/infrastructure // not connecting through Internet // no hired/third-party infrastructure // dedicated connection 	3 AO2 1a (2) AO2 1b (1)	Do not allow – in a local area, local needs to be quantified in some way. No marks for WAN.																		
2	(b)	1 mark per row <table border="1" data-bbox="421 587 1211 959"> <thead> <tr> <th>Description</th> <th>Ethernet</th> <th>Wifi</th> </tr> </thead> <tbody> <tr> <td>A wired connection</td> <td>✓</td> <td></td> </tr> <tr> <td>More likely to be affected by interference</td> <td></td> <td>✓</td> </tr> <tr> <td>Data can be transmitted at a faster speed</td> <td>✓</td> <td></td> </tr> <tr> <td>Wireless transmission</td> <td></td> <td>✓</td> </tr> <tr> <td>Shorter transmission range before data is lost</td> <td></td> <td>✓</td> </tr> </tbody> </table>	Description	Ethernet	Wifi	A wired connection	✓		More likely to be affected by interference		✓	Data can be transmitted at a faster speed	✓		Wireless transmission		✓	Shorter transmission range before data is lost		✓	5 AO1 1a (5)	0 mark for row with >1 tick
Description	Ethernet	Wifi																				
A wired connection	✓																					
More likely to be affected by interference		✓																				
Data can be transmitted at a faster speed	✓																					
Wireless transmission		✓																				
Shorter transmission range before data is lost		✓																				
2	(c)	i <ul style="list-style-type: none"> • 1 mark per bullet to max 2 • Directs packets/data to destination // directs packets/data in a network • Receives packets/data from the network/Internet • Forwards packets/data to other computers on the network/Internet • Connects (different) networks together // e.g. joins home network to Internet • Has (public) IP address for LAN • Designates (private) IP addresses to network nodes 	2 AO1 1a (1) AO1 1b (1)	Controls flow of data as BOD for bullet 1. Bullet 1 needs to refer to the router directing the destination e.g. it is making a decision/choice on where to send it. Bullet 4 - it has to be referring to the connection between the Internet and home network, or forwarding of data between them. Just referring to accessing Internet is not enough. Do not allow information for data/packets																		

J276/01

Mark Scheme

June 2018

Question			Answer	Mark	Guidance
2	(c)	ii	1 mark per item to max 2 e.g. <ul style="list-style-type: none"> • Network Interface card / NIC • Wireless access point / WAP • Wireless network interface card / WNIC / wi-fi card • Bridge • Switch • Hub • Repeater // wireless extender/booster • Server 	2 AO1 1a (2)	Accept modem, power line adapter, Ethernet jack Must be an item of network hardware
2	(d)	i	Domain Name Server // DNS.	1 AO1 1a (1)	Allow Server/service/system
2	(d)	ii	1 mark for each letter in the correct place 1 The request is put into packets 2 E 3 The packets are sent across the network 4 D 5 A 6 If they have not arrived: 7 A timeout is sent to request the packets are resent 8 If they have arrived: 9 B 10 C	5 AO1 1b (5)	

J276/01

Mark Scheme

June 2018

Question	Answer	Mark	Guidance
2 (e)	<p>1 mark for naming threat, 1 for description, 1 for prevention. Max 3 per threat</p> <p>e.g.</p> <ul style="list-style-type: none"> • Virus / trojan / worm / malware • Piece of software/code/a program that replicates itself // causes damage e.g. editing/deleting files • Running anti-virus/anti-malware software // don't download from unknown sources // don't click on unknown links • Spyware / malware / keylogger • Piece of software/code/a program that records actions/key presses and sends this data to a third party for analysis • Running anti-spyware/anti-malware software/firewall • Data interception / passive • Data is sent to another device and is intercepted by a third party • Encryption • Phishing • An e-mail has a link that when clicked directs the user to a fake website that collects personal data • Network policy // firewall • Pharming • A piece of code installed that redirects user to fake website that collects personal data • Anti-malware // firewall • Hacker • Person attempting to gain unauthorised access to the network/computers/ data/files // unauthorised access and then deleting/editing data/files 	<p>9</p> <p>AO1 1b (3)</p> <p>AO2 1a (3)</p> <p>AO2 1b (3)</p>	<p>Must be relevant to home use i.e. not denial of service, SQL injection.</p> <p>Do not allow adware, spam.</p> <p>Do not allow backup as a prevention – it does not prevent the threat occurring. Do not allow encryption for stopping a hacker.</p> <p>Description must do more than repeat the threat.</p> <p>Read whole response to threat, identify threat first (may not be at the start and may be within description), then look for description.</p> <p>If no threat identified, then no mark for prevention.</p> <p>Allow any example of hacking for hacker e.g. cracking (password), active. But only once.</p> <p>Only award malware once, for virus or spyware e.g. virus identified, then malware identified both can be awarded. Virus, then malware, then spyware, would get a repeat for final spyware.</p> <p>Allow:</p> <ul style="list-style-type: none"> • Ransomware • Prevents access to your files unless a ransom is paid • Anti-virus/firewall

J276/01

Mark Scheme

June 2018

Question	Answer	Mark	Guidance
	<ul style="list-style-type: none"> • Firewall // strong password // biometrics // penetration testing • Brute force attack • Person/software using every combination of passwords to gain access • Firewall//strong passwords • Social engineering • Person being the weak point of the system // by example e.g. any example of deception • e.g. Strong passwords // check validity of sources 		

Question	Answer	Mark	Guidance
3*	<p>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. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>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. <i>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</i></p> <p>Mark Band 1-Low Level (1-2 marks) The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material</p>	8 AO2 1a (4) AO2 1b (4)	<p>The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: Indicative Content:</p> <p><u>Inhabitants</u></p> <ul style="list-style-type: none"> • Connection with the rest of the world • Access to more information • Up-to-date with news • E-commerce • Communication with people • Can be used in schools/for education • Cost (Devices and connection) <p><u>Businesses</u></p> <ul style="list-style-type: none"> • Sell products to wider audience//more customers • Purchase items from wider range/more places • Competitive prices • Tourism can be advertised • Online bookings for hotels <p><u>Ethical issues</u></p> <ul style="list-style-type: none"> • Access to inappropriate/illegal content • Lead to social pressure to be online and get technology • Cost • Introduces digital and social divide • Threats <p><u>Privacy issues</u></p> <ul style="list-style-type: none"> • Tracking of IPs/devices • Social media

J276/01

Mark Scheme

June 2018

Question	Answer	Mark	Guidance
	<p>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.</p> <p><i>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.</i></p> <p>0 marks No attempt to answer the question or response is not worthy of credit</p>		<ul style="list-style-type: none"> • Unwanted images and videos of people may be put online • Risk of threats e.g. phishing/pharming/virus

J276/01

Mark Scheme

June 2018

Question		Answer	Mark	Guidance
4	(a)	<p>1 mark per bullet to max 2 per register</p> <ul style="list-style-type: none"> • 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)	<p>MAR stores address is not enough for description MDR stores the data is not enough for description</p> <p>Allow:</p> <ul style="list-style-type: none"> • Current instruction register // IR • Stores the instruction currently being processed <p>Accept MBR // Memory buffer register for MDR</p>
4	(b)	<p>1 mark per bullet to max 2</p> <ul style="list-style-type: none"> • 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)	<p>Do not award: how fast the computer is // speed of CPU</p> <p>3.8 = 3,800,000,000</p>

J276/01

Mark Scheme

June 2018

Question			Answer	Mark	Guidance
4	(c)		<p>1 mark per bullet to max 3 e.g.</p> <ul style="list-style-type: none"> • 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 	<p>3 AO1 1b (1) AO2 2b (2)</p>	<p>Allow marks for other components that could affect the speed e.g. secondary storage access speed, onboard GPU. Award description of concurrent processing.</p>
4	(d)	i	<p>1 mark per bullet to max 3</p> <ul style="list-style-type: none"> • 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 	<p>3 AO2 1a (1) AO2 1b (2)</p>	<p>Many candidates are giving disadvantages of VM, or that the computer can now run more programs, which are NAQ</p>
4	(d)	ii	<p>1 mark per bullet to max 2</p> <ul style="list-style-type: none"> • 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 	<p>2 AO2 1b (2)</p>	<p>Do not award: VM is slower, without quantifying slower at what</p>

J276/01

Mark Scheme

June 2018

Question			Answer	Mark	Guidance
5	(a)		<ul style="list-style-type: none"> • An agreement / set of rules / standard • ...for how computers should communicate // how data is sent/received/transmitted on a network • Example of what could be agreed in the protocol (e.g. speed / error checking / etc.) 	2 AO2 1b (2)	Do not award set of instructions for bullet 1
5	(b)	(i)	1 mark for protocol, 1 mark for description <ul style="list-style-type: none"> • FTP / file transfer protocol • Uses a client-server model // sends from client to server // sends from server to client 	2 AO2 1b (2)	If protocol wrong, no mark for description
5	(b)	(ii)	1 mark for protocol, 1 mark for description e.g. <ul style="list-style-type: none"> • HTTPS / hyper text transfer protocol secure • Encrypts the connection/data // Uses SSL/secure socket layer 	2 AO2 1b (2)	If protocol wrong, no mark for description
5	(c)		1 mark for IMAP, 1 mark for SMTP. IMAP <ul style="list-style-type: none"> • Retrieves/accesses/downloads (a copy of an) e-mail • Allows synchronisation/management of account SMTP: <ul style="list-style-type: none"> • Sends/forwards/transmits e-mail 	2 AO1 1b (2)	Marks are for IMAP retrieving, SMTP sending. At this stage do not worry about where they are going. Question does not refer to email, so response must in some way refer to email/message. Sends/receives data is not enough.

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