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GCSE COMPUTER SCIENCE

4.1

Edexcel 1CP2 | Specification point 4.1.8

Characteristics of network topologies (bus, star, mesh)

Untiered

Answers and examiner comments

7	2019-2025	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.

Question Number	Answer	Additional Guidance	Mark
2(a)	A linked description such as: A record for each guest (1) that uses attributes for guest characteristics (1)	Responses may refer to table, records, fields, relationships, keys	**2**

Question Number	Answer	Additional Guidance	Mark
2(b)	WAN / Wide Area Network		**1**

Question Number	Answer	Additional Guidance	Mark
2(c)	Indicative content: • Cost - can be cheaper than hardware / can cost a lot for large amounts of data • Space - likely to get more than on physical drives • Scalability • Trust / Control • Physical security • Access (read/write) speeds and impact on uses/applications • Shared storage vs dedicated • Often belongs to a third party • Bandwidth limitation • Data vulnerability due to unknown provider • Access from any Internet devices		**6**

Level	Mark	Descriptor
	0	No rewardable content
Level 1	1-2	Basic, independent points are made showing elements of knowledge and understanding of key concepts/principles of computer science. The discussion will contain basic information with little linkage between points made.
Level 2	3-4	Demonstrates adequate knowledge and understanding of key concepts/principles of computer science. The discussion shows some linkages and lines of reasoning with some structure.
Level 3	5-6	Demonstrates comprehensive knowledge and understanding by selecting relevant knowledge and understanding of key concepts/principles of computer science to support discussion being presented. The discussion shows a well-developed, sustained line of reasoning which is clear, coherent and logically structured.

Question Number	Answer	Additional Guidance	Mark
2(d)	B – TCP/IP **The only correct answer is B** **A** is not correct because HTML is not a protocol **C** is not correct because an ISP is not a protocol **D** is not correct because a URL is not a protocol		**1**

Question Number	Answer	Additional Guidance	Mark
2(e)	A description to include two from: ● each node/device is connected to multiple other nodes/devices ● it is decentralised ● ensures data can still be routed to the destination address if one node fails ● self-configuring		**2**

3(a)	An explanation such as: Access to the network/Internet will be removed/unstable (1) because IP addresses have to be unique (1) *Award one mark for a response such as:* *So that data is routed to the correct recipient*	Example response: 'Devices must have a unique IP address (1) because otherwise, a switch would not know which of the two was the correct device to send packets to (1)	**2**

Question Number	Answer	Additional Guidance	Mark
3(b)	D – Star		**1**

Question Number	Answer	Additional Guidance	Mark
3(c)	((3 X 1000 X 1000 X 1000) ÷ 8) x 10 1 mark for 3 x 1000^3 1 mark for ÷ 8 1 mark for x 10		**3**

Question Number	Answer	Additional Guidance	Mark
3(d)	B – 4		**1**

Question Number	Answer	Additional Guidance	Mark
3(e)	B – Utility		**1**

Question Number	Answer	Additional Guidance	Mark
3(f)	C – SMTP		**1**

Question Number	Answer	Additional Guidance	Mark
3(g)	To provide access to the Internet		**1**

Question Number	Answer	Additional Guidance	Mark
3(h)	C - Structured		**1**

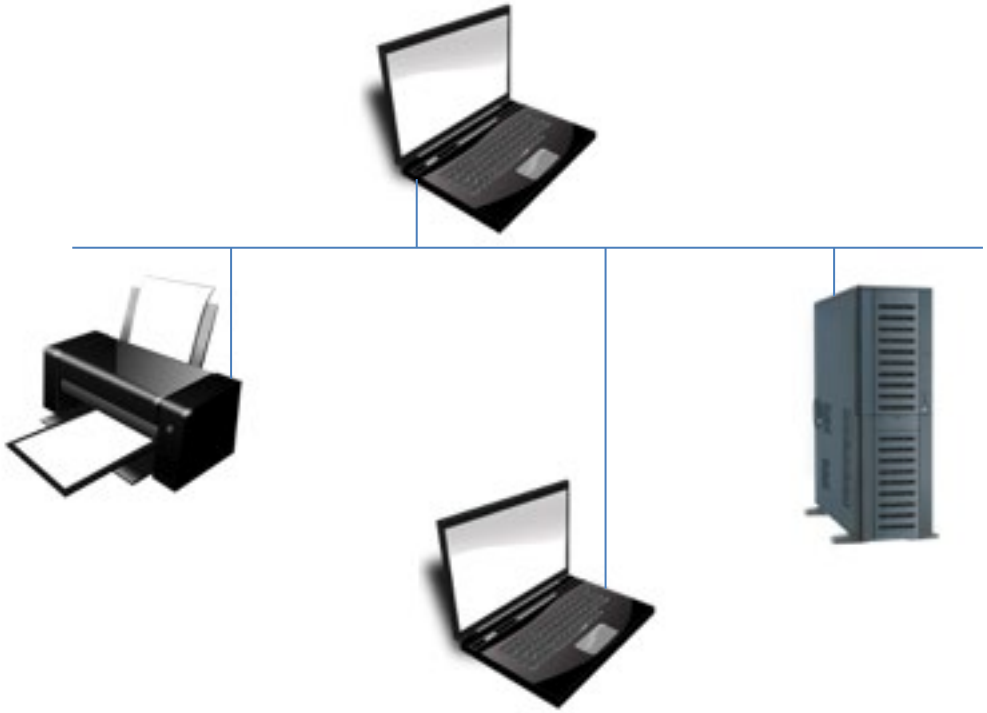
Question Number	Answer	Additional Guidance	Mark

Question Number	Answer	Additional Guidance	Mark
7(a)	C		**1**

Question Number	Answer	Additional Guidance	Mark
7(b)	An explanation to include **two** from: • IMAP retains the data on a server (1) which can be read by any computer (1) • POP3 downloads the data to the client (1) so it would not be available from a different computer (1)		**2**

Question Number	Answer	Additional Guidance	Mark
7(c)	A linked description to include **four** from: Splits the data into packets (1) and numbers them (1) using a checksum (1) to see if packets have been delivered correctly (1) to avoid error/data corruption detection (1) before reordering them at their destination (1) Award other linked points such as: resends packets if found to be corrupt/missing on arrival (1) handles handshaking and transmission details (1) establishes a dedicated channel between source and destination devices (1) communicates with the application layer above and the network layer below (1)		**4**

Question Number	Answer	Additional Guidance	Mark
7(d)	Responds to incoming client requests (1) by supplying a service/resource (1) Examples: File/web/mail/database server (1) stores resources (data/files) and delivers (data/files) / manages requests (for data/files) (1) Print server (1) manages requests for print jobs (1)		**2**

Question Number	Answer	Additional Guidance	Mark
7(e)	Single line not directly connected to any device (bus) (1) single lines connecting each device to bus (1) 		**2**

Question Number	Indicative content
8	• Validation and authentication techniques (access control, physical security and firewalls) • Security issues associated with the 'cloud' and other contemporary storage • Different forms of cyberattack (based on technical weaknesses and behaviour) including social engineering (phishing, shoulder surfing), unpatched software, USB devices, digital devices and eavesdropping • Methods of identifying vulnerabilities including penetration testing, ethical hacking, commercial analysis tools and review of network and user policies • How to protect software systems from cyber-attacks, including considerations at the design stage, audit trails, securing operating systems, code reviews to remove code vulnerabilities in programming languages and bad programming practices, modular testing and effective network security provision

Level	Mark	Descriptor
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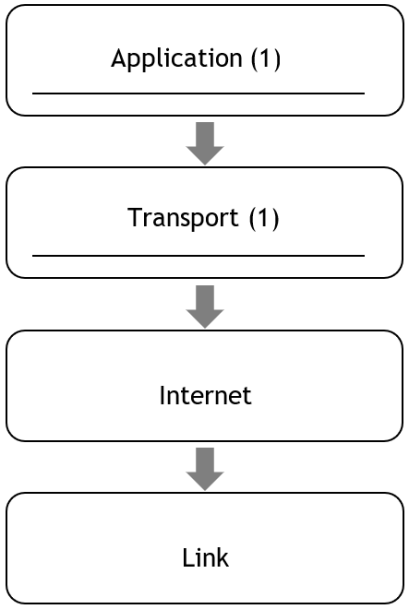
Level 2	3-4	Demonstrates adequate knowledge and understanding of key concepts/principles of computer science. The discussion shows some linkages and lines of reasoning with some structure.
Level 3	5-6	Demonstrates comprehensive knowledge and understanding by selecting relevant knowledge and understanding of key concepts/principles of computer science to support the discussion being presented. The discussion shows a well-developed, sustained line of reasoning which is clear, coherent and logically structured.

Original question 1

The full source mark scheme begins on page 26. Use the original paper code, tier and question number shown above.

Question Number	Answer	Additional Guidance	Mark
2(a)	Award one mark for each of:  	Award one mark if both layers are named correctly, but in the wrong order Allow alternatives, such as Process and Host-to-host	(2)

Question Number	Answer	Additional Guidance	Mark
2(b)	Award one mark for: • Bus (topology) (1)		(1)

Question Number	Answer	Additional Guidance	Mark
2(c)	The only correct answer is D *A is not correct because files can be encrypted without the computers holding them being connected in a network* *B is not correct because unconnected computers are at less risk than connected computers* *C is not correct because latency is a network metric, not a reason to connect devices*		(1)

Question Number	Answer	Additional Guidance	Mark
2(d)	Award one mark for any of the following: • HTTP (1) • HTTPS (1) • Hypertext Transfer Protocol (1) • Hypertext Transfer Protocol Secure (1)		(1)

Question Number	Answer	Additional Guidance	Mark
2(e)	Award up to two marks for a linked explanation such as: • Emails can be accessed from multiple devices (1) because IMAP does not remove/delete emails (from the server) (1) • Emails can be accessed through a browser (1) because IMAP doesn't need a client application to download messages (1)	For both marks, the expansion must associate with the statement.	(2)

Question Number	Answer	Additional Guidance	Mark
2(f)	Award up to two marks for a linked explanation such as: • (Digital/biometric) locks / magnetic card scanners / security personnel could be put on the office door (1) to prevent unauthorised access (1) • Movement sensors (1), to activate an alarm/ a light (1) • Security lights / alarms (1), so that intruders would be scared off / identified (1) • Alarms / alerts could trigger (1) because there is unauthorised access (1) • The servers/assets could have security tags (1), so that the owner can be tracked if stolen (1) • ID cards could be issued to all staff (1) to prevent impersonation/to allow unknown people to be challenged (1) • Warning posters could be positioned at entrances (1) to make people aware of shouldering/tailgating/two people entering together (1)	CCTV given in the question For both marks, the expansion must associate with the statement.	(2)

Question Number	Answer	Additional Guidance	Mark
2(g)	Award one mark for any of the following: • The **maximum** volume/amount of data that can be transmitted (in one second/unit of time) (1) • The **full capacity** of data that can be transmitted (in one second) (1)	Response must be about capacity of transmission, i.e. the maximum that can be transmitted, not how much/how fast data is currently being transmitted.	(1)

Question Number	Answer	Additional Guidance	Mark
2(h)	Award one mark for any of the following up to a maximum of two marks: • Read the destination/recipient's IP address (in each packet) (1) • Uses a routing table (1) • Sends the data packet **to the next router** (1) • Uses the fastest/least congested route/pathway (1) • Keeps track / informs other routers of traffic conditions (1)		(2)

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	Award one mark for any of the following: • LAN (1) • Local area network (1)	Allow: Wireless LAN (WLAN) Personal Area Network (PAN)	(1)

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	Award one mark for any of the following: • Range (1)	Do not allow length / distance	(1)

Question Number	Answer	Additional Guidance	Mark
3(a)(iii)	Award one mark for any of the following up to a maximum of two marks: • The whole network stops working if the backbone/cable is broken (1) • The number of collisions increases/the network will slow down as the number of devices/users increases (1) • A greater security risk (because all the nodes on the network see all the data packets) (1) • The network stops working if the terminators are missing/not working (1) • Only one device can transmit data at a time (1)	Do not award responses associated with installation, either cost, extra wires, or invasiveness	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)	Award up to two marks for a linked description, such as: • It is an authorised attack (black box/white box) on a network/system (1) to identify security vulnerabilities (1) • It is a network/system attack carried out with the knowledge of an organisation (1) to recommend measures that should be taken to improve security (1)	For both marks, the expansion must follow/associate with the statement.	(2)

Question Number	Answer	Additional Guidance	Mark
3(c)(i)	Award one mark for: • Wi-Fi (1) • Bluetooth (1)	Ignore capitalisation and hyphenation Allow ZigBee	(1)

Question Number	Answer	Additional Guidance	Mark
3(c)(ii)	Award one mark for any of the following: • File Transfer Protocol (1) • FTP (1)	Ignore capitalisation	(1)

Question Number	Answer	Additional Guidance	Mark
3(d)	Award up to two marks for a linked description, such as: • It converts the data into a suitable signal/electrical/radio (1) for transmission on the media Ethernet cable/Wi-Fi (1) • It uses/adds a physical/MAC address (1) for a source/destination (1) • Receives data from the network layer (1) to send via physical hardware (1)	For both marks, the expansion must follow/associate with the statement.	(2)

Question Number	Answer	Additional Guidance	Mark
3(e)	Award one mark for: • 13 x 60 or 780 (seconds) (1) • 1.4 x 8 x 1024^3 (1) • 1000^2 (1) • Fully correct response (1) Example: $\frac{1.4 \times 8 \times 1024^3}{13 \times 60 \times 1000^2}$	Award equivalent expressions	(4)

Question Number	Answer	Additional Guidance	Mark
4(a)	Award **one** mark for: • WAN/Wide Area Network (1)	Allow internet, VPN	**(1)**

Question Number	Answer	Additional Guidance	Mark
4(b)	Award **one** mark for each correct cell: <table><tr><th>Description</th><th>Network protocol</th></tr><tr><td>Allows two computers to establish a connection across a network</td><td>TCP / Transmission Control Protocol (1) Ethernet (1)</td></tr><tr><td>Allows connection to a network using radio waves</td><td>Wi-Fi / Wireless (1) Bluetooth (1) Zigbee (1)</td></tr><tr><td>Allows upload and download of files across a network</td><td>FTP / File Transfer Protocol (1) HTTP / HTTPS (1)</td></tr></table>	Accept SSH for allows upload and download of files across a network.	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(c)	Award up to **three** marks for a linked description, such as: • Employed/authorised by a company/owner of the network (1) to question/test employees about security (1) in order to report vulnerabilities/make recommendations (1) • May use penetration testing (1) to attack a network (1) in order to gain access (1) • Given a list of the organisation's websites (1) to see if they can identify vulnerabilities/open ports/SQL injection (1) to highlight security issues (1) • Given access to internal network (1) attempt to access unauthorised resources (1) to send data out of the organisation through the network (1) • Perform penetration testing (1) that can be black box without having any credentials (1) or white box with system details/credentials (1)	Accept three relevant points Do not accept 'hacking a network' in isolation. There must be a clear indication that 'hacking' is attacking/trying to gain access to a system in the context of this question.	**(3)**

Question Number	Answer	Additional Guidance	Mark
4(d)	Indicative content: **Media** Ethernet/wired connection • Reliable because the cables are shielded from interference • Secure as it is difficult to intercept data/packets on physical wire • Consistent transmission speed • Low latency • Employees cannot move around while connected Wireless • Flexible/allows users to connect from anywhere in the office • Health and safety/no wires • Additional users can be added simply by giving them an access password • Subject to interference • Slows down if lots of devices added • Easy to intercept wireless transmissions • Blind spots/areas where there is no accessibility Hybrid • Combination of both, but need to clarify which type of connectivity is being described	Responses do not have to compare different media or topologies Do not allow server as equivalent to switch/central device Level 3 responses must cover both media and topology.	**(6)**

	Topology Bus topology • Easy to install, as long as no major building work is required • Easy to install extra devices, as every device only needs a connector and a cable to join the bus • Doesn't require much cable, as each device is attached directly to the main cable • It could be used as a backbone for the attached Wi-Fi access points • If the cable breaks, the whole network goes down • The number of devices affects throughput, i.e. the more devices, the lower the throughput Star topology • Each node is separately connected to the central switch so failures don't affect other nodes • Fast as packets can be sent directly to destination if it is connected to the same switch as the source • Limited to the number of available connections on the central switch • Uses a switch, which is the central device • If switch goes down, then entire network goes down • Data is only sent from the switch to the destination device Mesh topology • No central point of failure, as the devices are connected directly • Data can be sent by many routes when one device is faulty • Nodes have multiple connections, as each device may be connected directly to each other • Can transmit and receive at the same time		

	• Easy to add devices if the mesh is implemented in software • Hard to add devices when physical cables and network interface cards are required		

Level	Mark	Descriptor
	0	No rewardable content.
Level 1	1–2	Basic, independent points are made, showing elements of understanding of key concepts/principles of computer science. (AO1) The discussion will contain basic information with little linkage between points made or application to the context. (AO2)
Level 2	3–4	Demonstrates adequate understanding of key concepts/principles of computer science. (AO1) The discussion shows some linkages and lines of reasoning with some structure and application to the context. (AO2)
Level 3	5–6	Demonstrates comprehensive understanding of key concepts/principles of computer science to support the discussion being presented. (AO1) The discussion is well developed, with sustained lines of reasoning that are coherent and logically structured, and which clearly apply to the context. (AO2)

PMT



Mark Scheme (Results)

June 2022

Pearson Edexcel GCSE In Computer Science (1CP2/01) Paper 1: Principles of Computer Science

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	Any **two** from: • Can share files/data • Can share applications/software • Can collaborate • Can share peripherals (printers, speakers) • Can share connectivity (Internet connection, hotspot) • Can access files **from any computer / hot desk** • Central control/management (security, software updates, backup, remote support, users, remote monitoring) • Allows communication (email, social media, video conferencing, online meeting, collaborative games)		**2**

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	A description such as: • A LAN covers a small (geographic) area / a WAN covers a large (geographic) area (2) • A LAN uses infrastructure owned by one company / a WAN uses third-party infrastructure (2) • A LAN connects individual devices / uses switches (1), whereas a WAN connects LANs / uses gateways (1)	Do not accept 'smaller/larger' in reference to the physical size of the network.	**2**

Question Number	Answer	Additional Guidance	Mark
1(a)(iii)	B 17 080 000 *A 17 080 is not correct because it is 17.08 multiplied by 1000* *C 17 080 000 000 is not correct because it is 17.08 multiplied by 1000^3* *D 17 080 000 000 000 is not correct because it is 17.08 multiplied by 1000^4*	17 080 000 is 17.08 multiplied by 1000^2	**1**

Question Number	Answer	Additional Guidance	Mark
1(a)(iv)	The delay/amount of time between data/signal being sent and it being received	Do not accept reference to delay/lag on its own.	**1**

Question Number	Answer	Additional Guidance	Mark
1(b)i **Clerical**	Any **one** from: • IP (address) • MAC (address)		**1**

Question Number	Answer	Additional Guidance	Mark
1(b)ii	A Data being sent *B is not correct because it is located in the header* *C is not correct because it is located in the header* *D is not correct because it is not located in a packet*		**1**

PMT

Question Number	Answer	Additional Guidance	Mark
1(c)	A description to include two from: • Monitors/checks traffic (1) using a set of rules / list of authorised/unauthorised computers/addresses/protocols (1) to decide if data is allowed into or out of the network (1)		**2**

Question Number	Answer	Additional Guidance	Mark
1(d) **Clerical**	Any **one** from: • POP3 • IMAP • SMTP	Accept POP	**1**

Question Number	Answer	Additional Guidance	Mark
1(e)	A linked explanation such as: • All communication could fail (1) because/if the central device fails (1) • It can be difficult/expensive to set up (1) because each device needs a cable to connect to the central device (1) • The number of devices that can be connected is limited (1) because the central device supports a fixed number of connections (1)	For 'central device': • Accept 'router' or 'hub' (as a term to refer to a device that contains a switch). • Accept 'switch' (as this is the correct term to refer to the central device) • Do not accept 'server'	**2**

Question Number	Answer	Additional Guidance	Mark
2(a)i	Any **one** from: • To represent an instruction/command • To make an instruction/command easy to read/write/learn/remember/understand • An instruction in a set of instructions	Accept generic definitions of mnemonic such as: 'To shorten a piece of information so it is easy to remember.'	**1**

Question Number	Answer	Additional Guidance	Mark
2(a)ii **Clerical**	Assembly language		**1**

Question Number	Answer	Additional Guidance	Mark
2(a)iii	A linked description such as: • They are microprocessor/CPU/machine specific (1) so they can manipulate the hardware directly (1) • They can be highly optimised (1) to make efficient use of the hardware/execute more quickly/use minimal memory (1) • Each line of code (1) is one instruction only (1) Award responses that refer to machine code as a low level language, such as: • **Machine code** is written in binary (1) so instructions can be processed **directly** by the CPU / do not need to be translated (1) Award **one** mark for: • Machine code does not need to be translated (1)	Accept: (Assembly language) instructions are assembled (1) to machine code (1)	**2**

Question Number	Answer	Additional Guidance	Mark
2(a)iv **Clerical**	Interpreter		**1**

Question Number	Answer	Additional Guidance	Mark
2(b)	• Data • Instructions		**2**

Question Number	Answer	Additional Guidance	Mark
2(c)i	A description to include **two** from: A laser heats/burns (areas of a disk) (1), which creates lands/pits (1) representing binary / 1s and 0s (1)		**2**

Question Number	Answer	Additional Guidance	Mark
2(c)ii **Clerical**	Solid state / flash *Accept 'SSD' for solid state*		**1**

Question Number	Answer	Additional Guidance	Mark
2(d)	Any **two** from: • Limited processing resources • Low power consumption • Simple/robust operating system • Low cost per unit • Smaller in size • Less storage • Limited user interface	Do not accept: 'Carries out a specific task': This is the opposite of 'general purpose', which is given in the question.	**2**

Question Number	Answer	Additional Guidance	Mark
2(e) **Clerical**	A Reduces data transfer times C Reduces required storage space *B is not correct because parts of a compressed file can still be written to several different places on a disk* *D is not correct as compression does not make data more secure like encryption does* *E is not correct because error detection/correction mechanism are still needed in network packets*		**2**

Question Number	Answer	Additional Guidance	Mark
2(f)	Any **two** from: • Programming language specific vulnerabilities (directly manipulating memory) • Security (vulnerability) • Weak design • Insufficient testing • Bad programming practices (not following standards, using unvalidated 3rd party libraries) • Inadequate validation (that fails to prevent incorrect/inappropriate data input) • Inadequate authentication (that enables hackers to gain unauthorised access) • Sensitive data not encrypted		**2**

Question Number	Answer	Additional Guidance	Mark
2(g)	A linked explanation such as: • Users can be added/deleted (1) so multiple people can use the same computer (1) • Edit user permissions (1) so only specific users can securely access their storage space (1) • Control the amount of resources/storage each user can access (1) so the limited storage on the machine can be shared (1) • Enforce user permissions (1) so only certain users are allowed to install programs / access certain files (1)		**2**

Question Number	Answer	Additional Guidance	Mark
3(a)(i) **Clerical**	1 mark for each nibble: 0011(1) 1001(1)		**2**

Question Number	Answer	Additional Guidance	Mark
3(a)(ii) **Clerical**	1 mark for each digit in the correct location: 2D		**2**

Question Number	Answer	Additional Guidance	Mark
3(a)(iii)	A linked description such as: • Flip all the bits (1) and add one (1) • Copy/keep all the 0s from the right/LSB, up to and including the first 1 (1), then flip the remaining bits (1) • Flip all the bits from the left/MSB (1) up to, but not including, the 1 nearest the right/LSB (1)		**2**

Question Number	Answer	Additional Guidance	Mark
3(a)(iv)	A linked explanation such as: • There are not enough bits (1) to store the result (1) • An overflow occurs (1) because 1 + 1 = 0 with a 1 carry / because the result is more than 255 (1)		**2**

Question Number	Answer	Additional Guidance	Mark
3(b) **Clerical**	Lossy		**1**

Question Number	Answer	Additional Guidance	Mark
3(c)	A description to include **two** from: • A standard • For representing text/characters • Allows data to be interchangeable between computers (from different manufacturers) • Each character is mapped to a unique number/binary equivalent • ASCII (encoding) uses 7/8 bits • There are 128 unique characters (allow 256 for 128)	Award a mark for an example of an ASCII character equivalence e.g. A = 65 as this can be awarded from mark point 4. (A = 01000001 could similarly be awarded.)	**2**

Question Number	Answer	Additional Guidance	Mark
3(d)(i)	Any **one** from: • The number of pixels **per** (square) **inch** is higher • The density of pixels is higher		**1**

Question Number	Answer	Additional Guidance	Mark
3(d)(ii)	Award **one** mark for each number in the correct location for a maximum of 4: • 15 in numerator (1) • 1028 x 640 in numerator (1) • 1024×1024 in denominator (1) • 8 in denominator (1) Example of expression that gains full marks: $\frac{1028 \times 640 \times 15}{1024 \times 1024 \times 8}$	Award equivalent representations of 1024 (2^{10})	**4**

Question Number	Answer	Additional Guidance	Mark
4(a)	A linked explanation such as: • It helps prevent loss of data (1) because malware could deliberately delete data / because data can be deleted/corrupted accidentally (1) • It helps minimise disruption following a system failure (1) because data can be restored (1) • Data can be restored (1) because physical hazards (fire/flood) (can damage storage devices) (1)		**2**

Question Number	Answer	Additional Guidance	Mark
4(b)	Any **two** from: • That they are giving consent • That they can say no / refuse • That they are not denied service, if they say no • What the data is being collected for • What processing will be done on their data/purpose of the processing/how data will be processed • That they can withdraw consent at any time • That the data will be shared (with third parties) • How long it will be stored • That the data will be stored securely		**2**

Question Number	Indicative content	Additional Guidance	Mark
4(c)	Discuss how algorithmic bias can affect the decisions police forces make. **Causes of algorithmic bias** • Machine learning having been trained using insufficient/inappropriate data • Human bias leading to discrimination and a lack of fairness • Poor design of the algorithm **Impacts on individuals and communities of algorithmic bias** • Deploying officers to the wrong areas • Individuals may feel as though they are being monitored/targeted/subjected to unfair treatment as a result of the output of a biased algorithm deploying too many officers / too few officers • Discrimination/equality (e.g. resourcing police more heavily in particular communities) • Feedback loops (if a model predicting crime rates based on historical arrest data is used to prioritise police resources, then arrests in high risk areas could increase further, reinforcing the imbalance) source **Methods available to reduce the risk of algorithmic bias** • Human oversight and 'sense checking' and confidence/error ratings of predictions • Governance (anticipating and managing risks and make sure legal requirements are adhered to) • Auditing to enable identification and mitigation of systematic bias • Open to scrutiny / transparent • Involvement of communities during development • Improve the training data		**6**

Level	Mark	Descriptor
	0	No rewardable content.
Level 1	1–2	Basic, independent points are made, showing elements of understanding of key concepts/principles of computer science. (AO1) The discussion will contain basic information with little linkage between points made or application to the context. (AO2)
Level 2	3–4	Demonstrates adequate understanding of key concepts/principles of computer science. (AO1) The discussion shows some linkages and lines of reasoning with some structure and application to the context. (AO2)
Level 3	5–6	Demonstrates comprehensive understanding of key concepts/principles of computer science to support the discussion being presented. (AO1) The discussion is well developed, with sustained lines of reasoning that are coherent and logically structured, and which clearly apply to the context. (AO2)

Question Number	Answer	Additional Guidance	Mark
5(a)(i) **Clerical**	Any **one** from: • Array • List		**1**

Question Number	Answer	Additional Guidance	Mark
5(a)(ii) **Clerical**	Yellow		**1**

Question Number	Answer	Additional Guidance	Mark
5(a)(iii) **Clerical**	Abstraction		**1**

Question Number	Answer	Additional Guidance	Mark
5(a)(iv) **Clerical**	Decomposition		**1**

Question Number	Answer	Additional Guidance	Mark
5(b)	A linked description such as: • If the value of the item at the current index position in the array is more than the value of the target (1), no more passes of the loop are required / the loop will exit (1) • If the pass through the loop goes past the expected location of the target value (1), the third condition for the loop to execute will not be met (1) • If the value (of 'theTarget') is exceeded without reaching the end of the array (1) the algorithm will end (1)	Do not accept 'index' in place of 'the value at the index'.	**2**

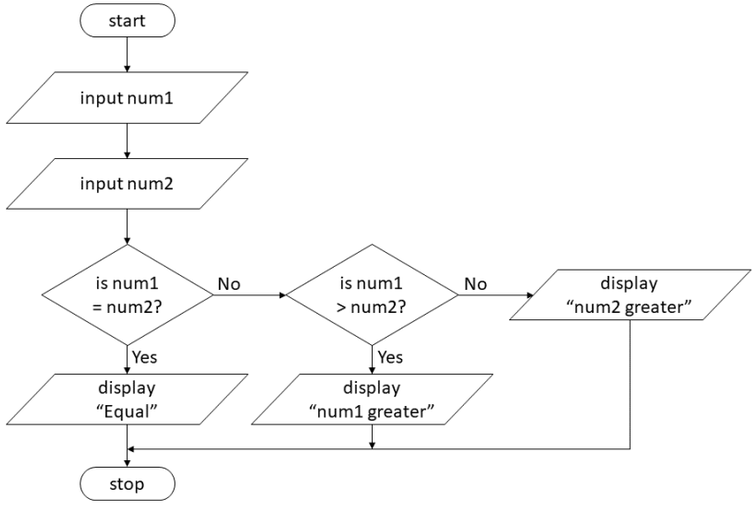
<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(c)</td><td>One mark for each correct row showing relationship of variable changes.
<table>
<tr><th>count</th><th>accept</th><th>reject</th><th>weight</th><th>Display</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>1</td><td>1</td><td></td><td>404</td><td></td></tr>
<tr><td>2</td><td></td><td>1</td><td>393</td><td></td></tr>
<tr><td>3</td><td>2</td><td></td><td>395</td><td></td></tr>
<tr><td>4</td><td>3</td><td></td><td>405</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>3 1</td></tr>
</table></td><td>Different versions of trace tables are acceptable.

Blanks can be replaced with contents of previous row.

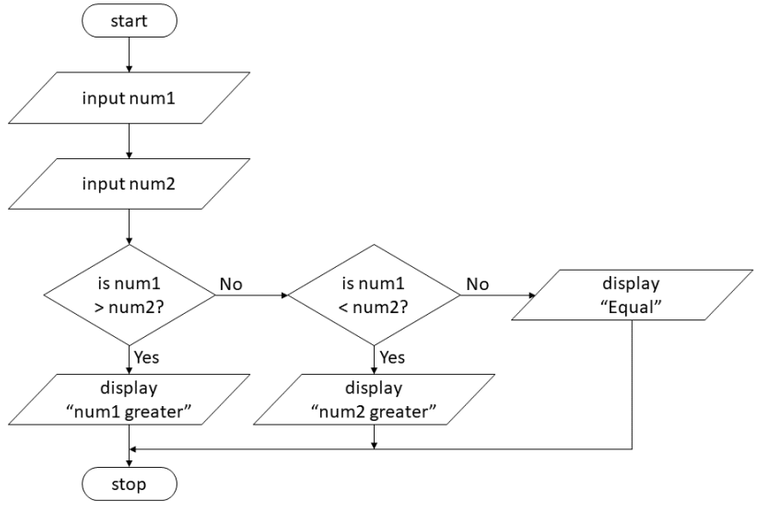
Final ‘3 1’ can be included on row above.

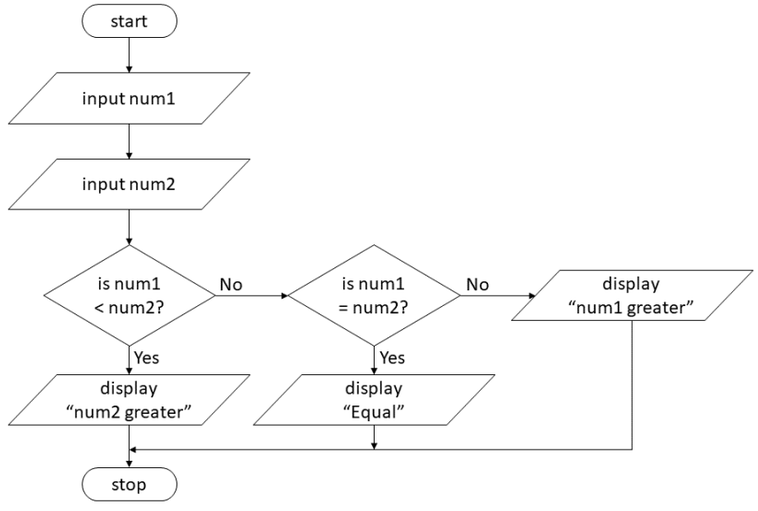
Ignore formatting of 3 1 in Display column (e.g. accept ‘3,1’)

Allow ‘Enter weight of box:’ in Display column until 3 1 should be displayed.</td><td>6</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
5(d)	• Both start and stop terminators present **and** algorithm terminates correctly at the stop terminator (1) • Two separate inputs for two integers (1) [can be in the same input symbol] • Test for equivalence, greater than or less than in one decision box (1) • Different test (for equivalence, greater than, or less than) in separate decision box (1) • Two outputs, labelled Yes and No, for each decision box (1) • Logic of flowchart links to **three** logically valid outputs (1) 	• Award 'End', 'Stop', 'Start' and 'Begin' as text for terminator symbols. • Award '==' and '=' used for equivalence inside decision symbol. • Accept 'Print' or 'Output' as an alternative to 'Display' in the output symbols. No quotes required around output string. • Accept True/False for Yes/No labels	**6**

PMT





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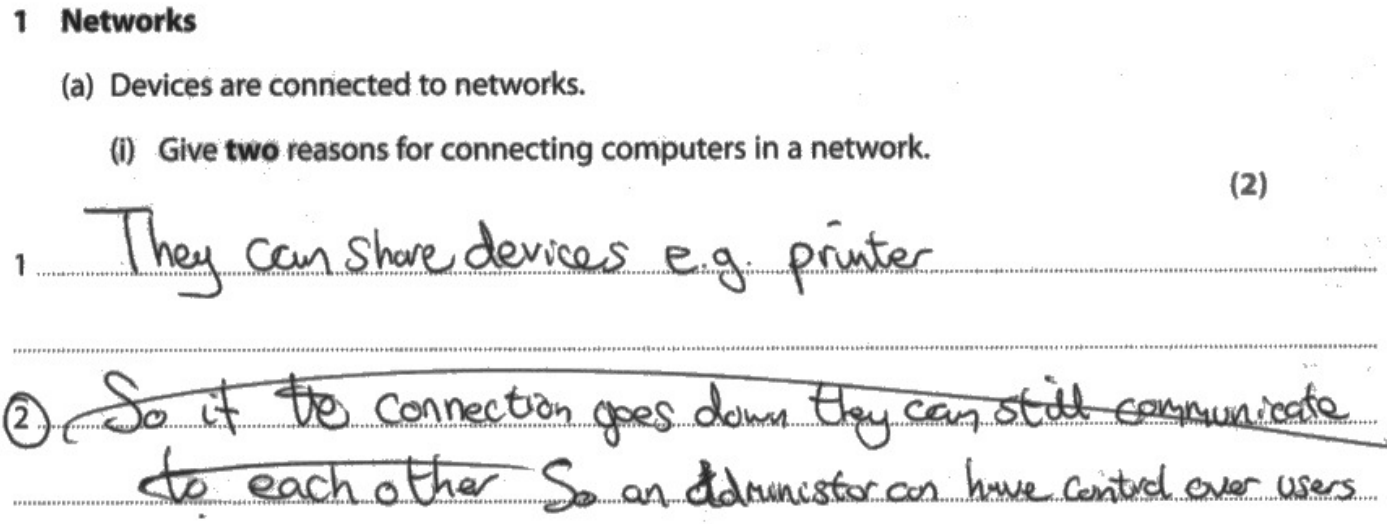
1CP2-01

PMT

Question 1 (a)(i)

'Share data', 'communication' and 'share peripherals' were very frequent responses amongst candidates, who answered this question well.



1 Networks

(a) Devices are connected to networks.

(i) Give **two** reasons for connecting computers in a network.

(2)

1 They can share devices e.g. printer

2 So if the connection goes down they can still communicate to each other So an administrator can have control over users

ResultsPlus
Examiner Comments

'Share devices' gained the first mark.

The second mark was given for stating that an administrator can have control over users, as it implies 'central control'.

Total: 2 Marks

1 Networks

(a) Devices are connected to networks.

(i) Give **two** reasons for connecting computers in a network.

(2)

1 faster connection

2 Data is faster shared and saved easily.

ResultsPlus
Examiner Comments

This response implies that data can be shared.

Total: 1 Mark

Question 1 (a)(ii)

Candidates showed an understanding that LANs cover a smaller area than WANs.

It was good to see candidates using network hardware terminology correctly, to differentiate in this question.

(ii) Describe **one** way a local area network (LAN) is different from a wide area network (WAN).

(2)

LAN is only connected to one switch / hub while WAN is a group of LAN connected

ResultsPlus
Examiner Comments

This candidate receives both marks.

Total: 2 Marks

Question 1 (a)(iv)

There was some understanding of the delay between sending and receiving data.

Some responses referred to it linking to a device or network and how dependable that was instead. Quite a few candidates described bandwidth, rather than latency.

(iv) Define the term 'latency'.

(1)

time of Delay.

ResultsPlus
Examiner Comments

There is not enough information here, to justify the mark.

Total: 0 Marks

(iv) Define the term 'latency'.

(1)

The time taken for a network to communicate with a device.

ResultsPlus
Examiner Comments

This response implies that latency is the time taken for data to be sent (communication) between two devices (a single device called 'a device' and an abstraction of many devices called 'a network').

Total: 1 Mark

Question 1 (b)(i)

The majority of candidates gained the mark for this question.

Question 1 (c)

Candidates understood that a firewall monitors traffic, but there was a lack of expansion from this.

Candidates who said it followed a set of protocols/rules often expanded with 'that defines whether the data is allowed into the network or not'.

A few candidates only referred to hacking.

(c) Describe how a firewall protects a local area network (LAN).

(2)

The firewall protects viruses from a LAN. It also protects the LAN from hackers

ResultsPlus
Examiner Comments

Some candidates gave general and inaccurate responses.

Total: 0 Marks

(c) Describe how a firewall protects a local area network (LAN).

(2)

Firewalls work as barriers against untrusted networks by monitoring ingoing and outgoing traffic. It also has reference to a set of security guidelines so it can detect and block hostile traffic.

ResultsPlus
Examiner Comments

There was a number of responses where good levels of understanding were evident.

Total: 2 Marks

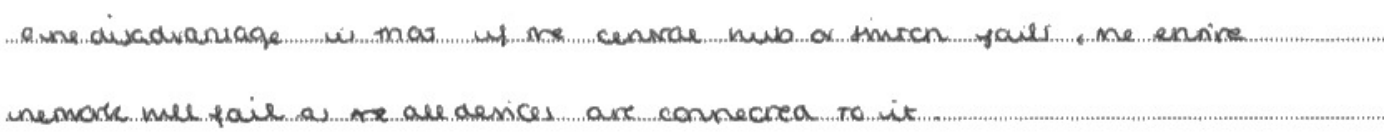
Question 1 (e)

A few candidates referred to the star network as having a server. Apart from this, the question was answered well.

The majority of candidates mentioned that if the central device/switch/hub failed, then those connected to it would too.

(e) Explain **one** disadvantage of using a star network topology.

(2)



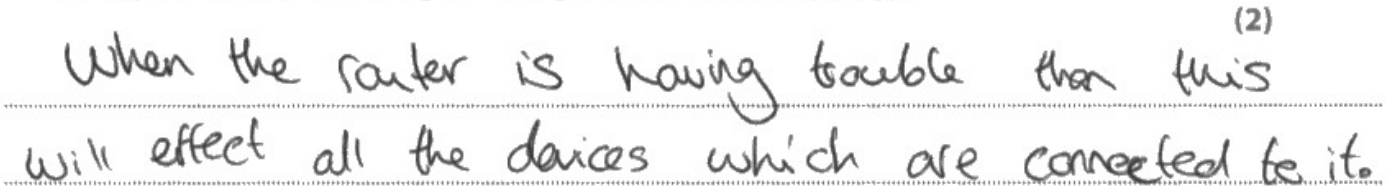
ResultsPlus Examiner Comments

A good response that gains both marks.

Total: 2 Marks

(e) Explain **one** disadvantage of using a star network topology.

(2)



ResultsPlus Examiner Comments

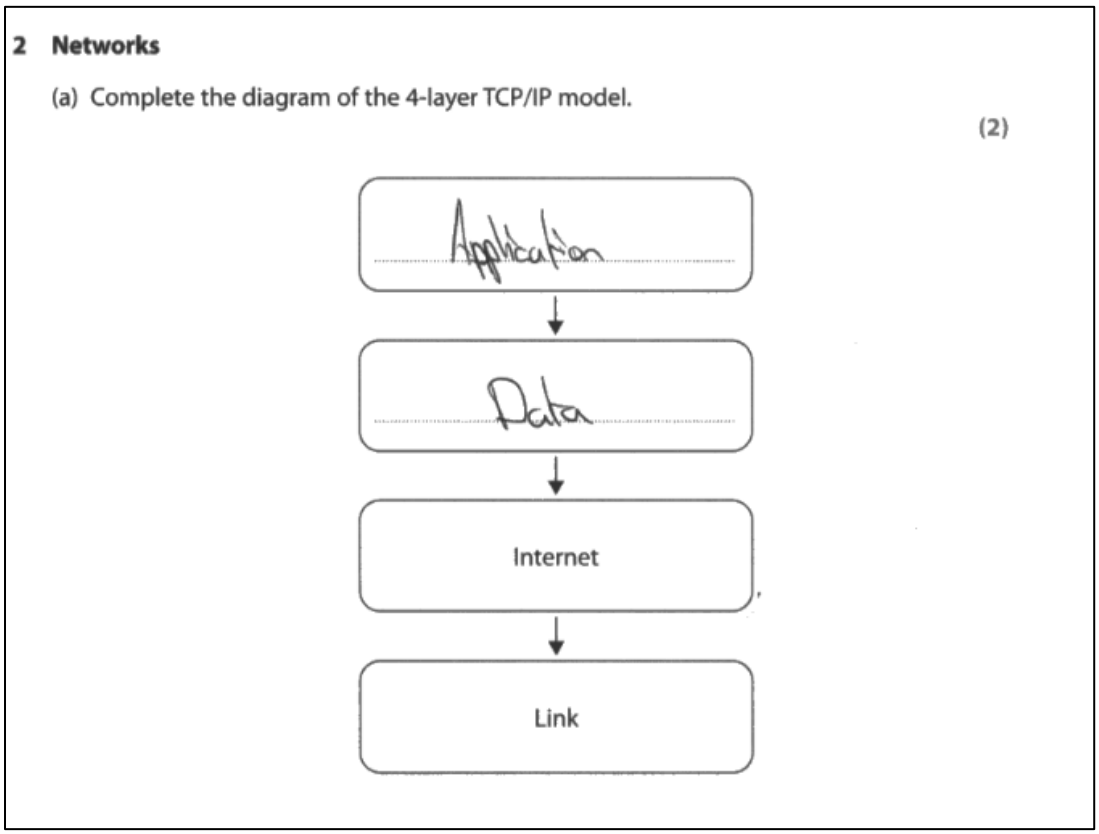
See additional guidance in the Mark Scheme.

The response implies that if the central device fails, all other devices will be affected (infer: negatively).

Total: 2 Marks

Question 2a

Students could either complete the first two layers correctly or not identify either of the layers. There were a wide range of unrelated responses that showed a lack of understanding of the layers.

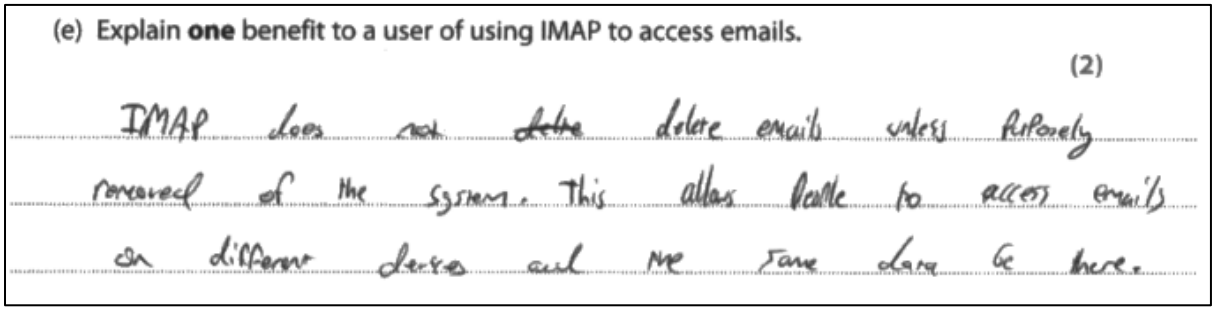

2 **Networks**

(a) Complete the diagram of the 4-layer TCP/IP model.

(2)

This response scored 1 mark for 'Application'.

Many responses stated that IMAP allows emails to be accessed from multiple locations instead of multiple devices, thereby confusing IMAP with networking. A number of responses made reference to speed of access and security, which were not relevant to the question.


(e) Explain **one** benefit to a user of using IMAP to access emails.

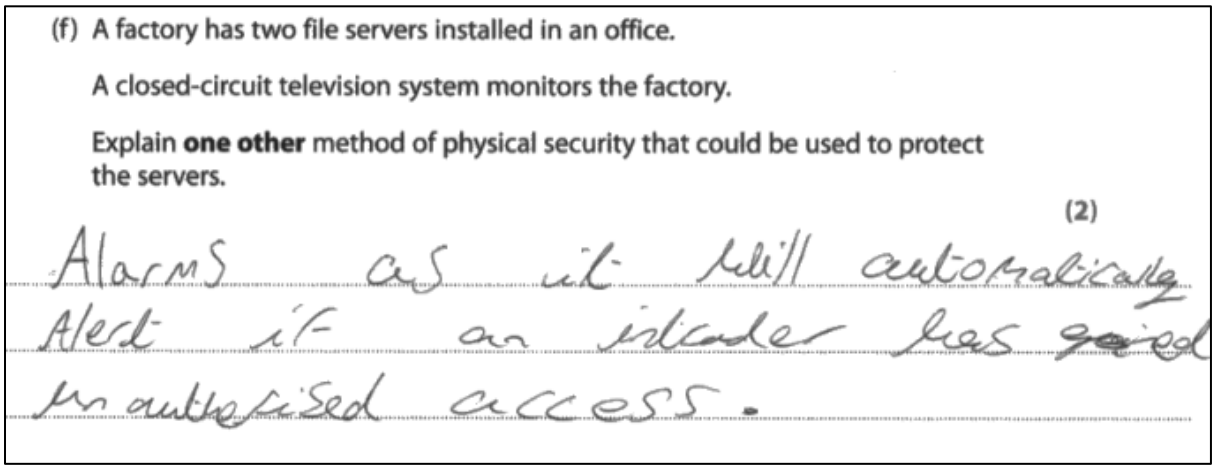
(2)

IMAP does not delete emails unless purposely removed of the system. This allows people to access emails on different devices and the same data be there.

This response scored 2 marks. 1 mark for 'unless purposely removed' and another mark for 'allows people to access emails on different devices'.

Question 2f

Many students highlighted the use of locked doors as a suitable method of physical security. Some referenced CCTV, despite it being in the question. Those who only gained one mark did not make it clear that unauthorised users would be prevented. A few responses mistakenly identified protection such as firewalls, which did not directly address the question's focus on physical security. While their responses demonstrated some knowledge, they needed to be aligned with the specific requirements of the question.


(f) A factory has two file servers installed in an office.

A closed-circuit television system monitors the factory.

Explain **one other** method of physical security that could be used to protect the servers.

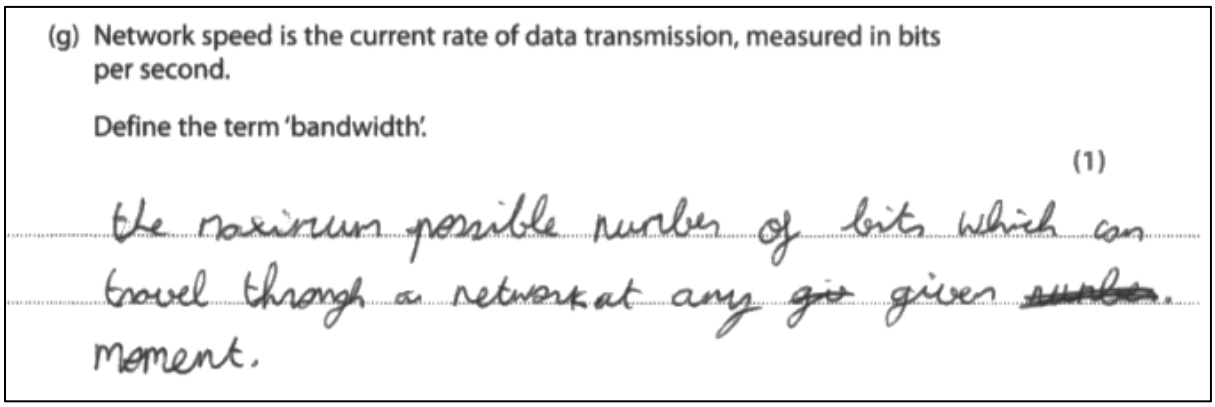
(2)

Alarms as it will automatically Alert if an intruder has gained unauthorised access.

This response scored 2 marks.

Question 2g

Most responses suggested some knowledge of bandwidth, but students did not identify that it is the maximum amount of data that could be transmitted at a given point in time. Most students who did not gain full marks did not refer to maximum data capacity. Some responses referred to 'bandwidth' in terms of distance/range.

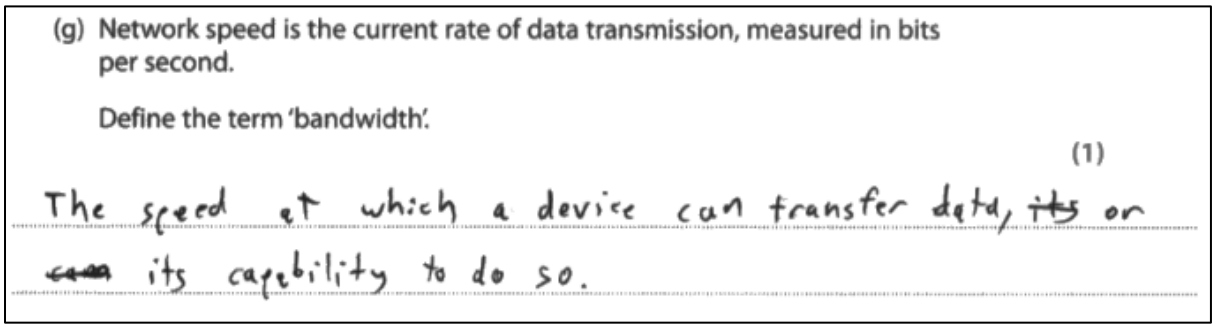

(g) Network speed is the current rate of data transmission, measured in bits per second.

Define the term 'bandwidth'.

(1)

the maximum possible number of bits which can travel through a network at any ~~gi~~ given ~~number~~. moment.

This response scored 1 mark for 'The maximum possible number of bits'.


(g) Network speed is the current rate of data transmission, measured in bits per second.

Define the term 'bandwidth'.

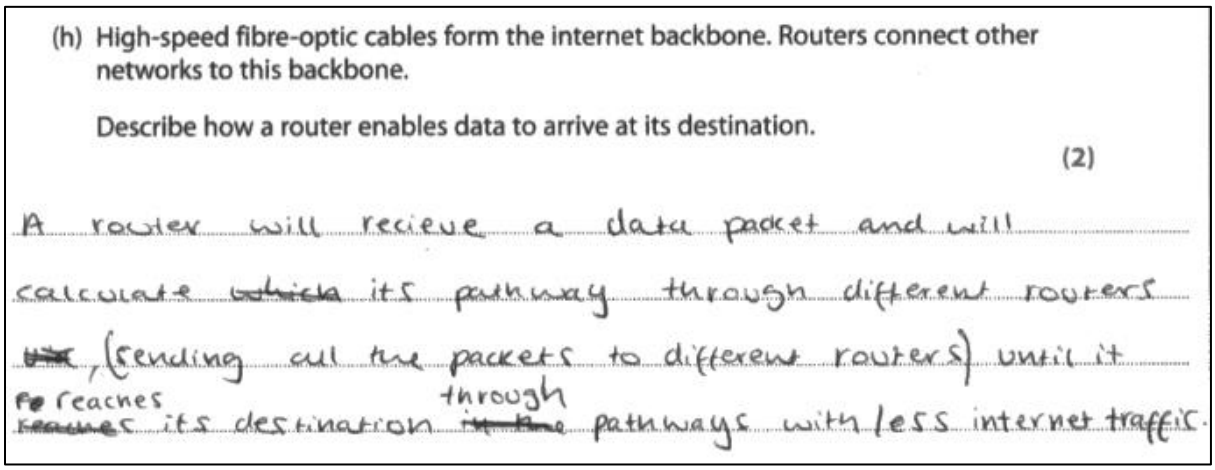
(1)

The speed at which a device can transfer data, ~~its~~ or ~~can~~ its capability to do so.

This response scored 0 marks.

Question 2h

Students often described the process of what happens when data travels through the network but not how (i.e. packet switching). Many were able to identify that the data travelled through the router and concentrated on what it does rather than how it gets there. Many key words were used, including IP address, but MAC was also used in descriptions of the process. At other levels, students had described the packet switching process in detail including checksum processes, clearly showing their level of knowledge and understanding.
There was some evidence that students were recalling a model answer from a similar question on a previous paper.


(h) High-speed fibre-optic cables form the internet backbone. Routers connect other networks to this backbone.

Describe how a router enables data to arrive at its destination.

(2)

A router will recieve a data packet and will calculate ~~which~~ its pathway through different routers ~~the~~ (sending all the packets to different routers) until it ~~re~~ reaches ~~reaches~~ its destination ~~through~~ through ~~the~~ pathways with less internet traffic.

This response scored 2 marks. 1 mark for 'calculate its (the data packet's) pathway' and the other mark for 'will receive a data packet ... sending all the packets to different routers'. This was enough to imply packets received and then sent **to the next router** (mark point 3). The implication that data is sent to another router was required for this mark point.

Question 3 (a)(i)

The vast majority of candidates were able to correctly identify a Local Area Network (LAN).

Question 3 (a)(ii)

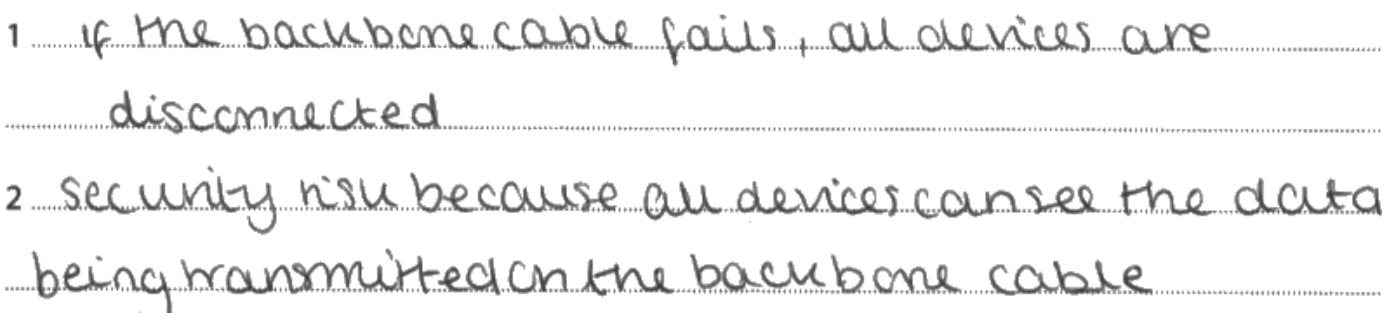
Many candidates struggled to identify that the range that a wireless network covered could be measured in meters. Some candidates confused range with bandwidth.

Question 3 (a)(iii)

The most popular answer was reliance on a common backbone where failure would mean that the whole network would stop working. Some candidates phrased this inaccurately by saying 'if the bus failed' which was not accurate enough, or erroneously thought that if one computer/workstation failed then the whole network would fail. Candidates found it harder to give a second disadvantage.

(iii) Give **two disadvantages** of a bus network topology.

(2)



ResultsPlus
Examiner Comments

This response scores 2 marks for identifying a bus is reliant on the backbone functioning and that there is a greater security risk with a shared cable.

Question 3 (b)

Many candidates had some knowledge of penetration testing but answers were frequently quite vague or limited to 'hacking' without further expansion. Common mistakes included confusion with testing in general, omitting the point that it is an attack that is authorised by the organisation, or did not expand to give the purpose being to find vulnerabilities to fix to improve security.

(b) Describe penetration testing.

(2)

Penetration testing involves purposefully attacking a network to test for vulnerabilities that could be exploited by a hacker / virus or other threat to the security of the network.

ResultsPlus
Examiner Comments

This response scores 2 marks for correctly identifying that penetration testing is used to attack a network to find vulnerabilities.

Question 3 (c)(i)

This question was generally well answered but a number of of candidates gave an example of an application protocol rather than a protocol that is used for transmission.

(c) Network protocols control the rules of communication.

(i) Name a network protocol that transmissions from other electrical devices can interfere with and that can be blocked by walls.

(1)

Wi-Fi

ResultsPlus
Examiner Comments

This response scores 1 mark for naming WiFi.

Question 3 (c)(ii)

Many candidates gave examples of protocols, but few could correctly identify File Transfer Protocol (FTP) as the protocol that would be used to download a file. The question was clear in terms of specifying a protocol that is used for file transfers such as downloading. Some candidates erroneously gave a music file format such as .mp3 rather than a network protocol.

Question 3 (d)

Candidates found this to be a challenging question, and the link layer appeared to be poorly understood. Some candidates appreciated that WiFi and Ethernet are protocols that are used at the link layer and some could go on to expand as to the types of signal that would be sent. Few candidates discussed MAC addresses and how they are used at the link layer. Many candidates confused the link layer with the network layer and IP addressing.

(d) Describe how the link layer of the TCP/IP protocol stack works.



(2)

The link layer uses either Ethernet or Wi-Fi to ~~get~~ send data from one device to ~~at~~ another, using its IP address and data packets

ResultsPlus Examiner Comments

This response scores 1 mark for identifying that the Wi-Fi or Ethernet protocol can be used by the link layer.

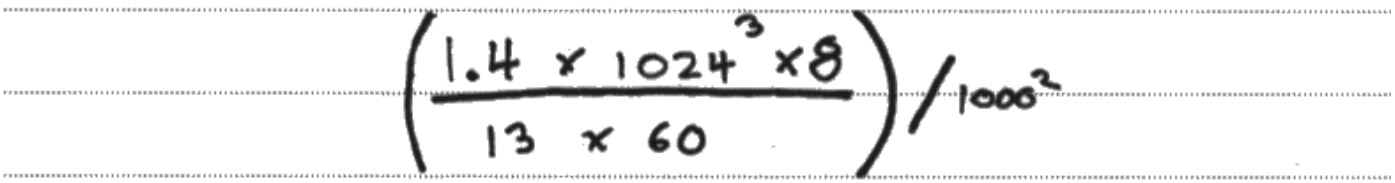
Question 3 (e)

Many candidates gained at least 1 or 2 marks, with the most frequent mark being for identifying an expression for the total number of seconds. Some candidates confused SI units (decimal prefixes) with IEC units (binary prefixes). Candidates also struggled to remember that file storage size is in bytes and that transmission speeds are measured in bits, so a conversion factor of 8 is also required.

(e) Construct an expression to calculate the transmission rate, in megabits per second, required to transmit a 1.4 gibibyte file in 13 minutes.

You do not need to do the calculation.

(4)



(Total for Question 3 = 14 marks)

ResultsPlus Examiner Comments

This response scores full marks. It identifies 13x60 for the number of seconds, $1.4x8x1024^3$ for the total number of bits to transfer and 1000^2 for the number of bits in a megabit. Each component is then combined to construct a fully correct expression.

Question 4(a)

Nearly all candidates correctly identified WAN as the correct response.

Question 4(b)

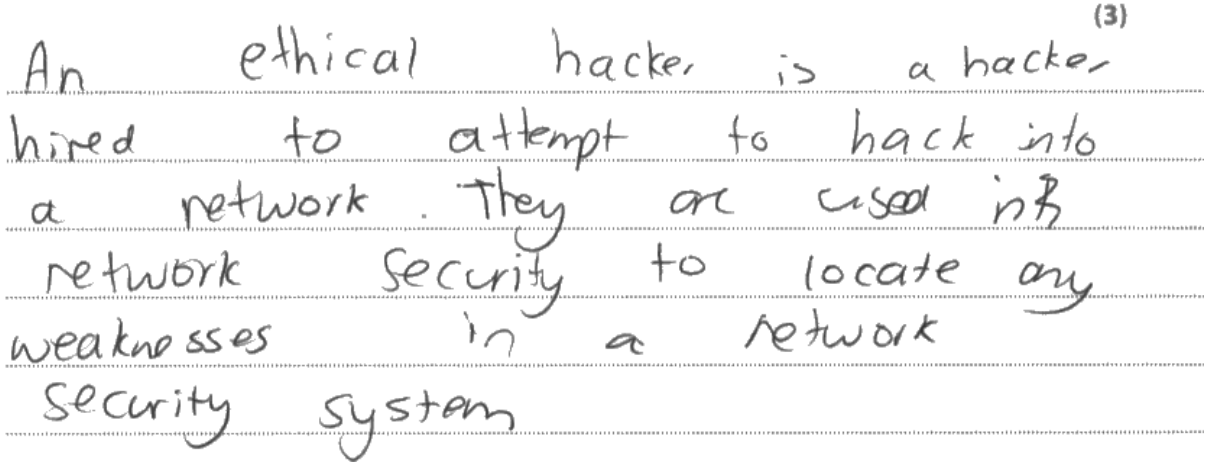
Whilst most candidates achieved at least one mark, relatively few achieved all three marks. Many candidates wrote IP instead of TCP/IP. IP on its own does not establish an end-to-end connection between two computers on a network.

Question 4(c)

Most candidates were able to identify at least one role or aspect of an ethical hacker's involvement in network security. Some responses were vague and limited being of the form that ethical hackers 'hack networks' without specifying what this actually meant. Clearer responses indicated that penetration testing was performed to try to gain access to systems. Whilst there were a wide range of potential points that could be made, fewer candidates were able to give three separate points. A common misconception was that ethical hackers retaliate against malicious actions 'hacking them back' instead of testing for vulnerabilities.

(c) Describe the role of an ethical hacker in network security.

(3)



ResultsPlus
Examiner Comments

This response scored 2 marks for identifying that ethical hackers can be hired by a company and that they try to find weaknesses in systems. 'Hacking into a network' was often seen and was regarded as too vague, because it did not state that this means trying to gain access to systems/networks. This response could have achieved a third mark if it had gone on to say that weaknesses are reported on so that they can be patched/fixed.

Question 4(d)

Most candidates attempted the essay question and could either comment on transmission media or topology. Transmission media was more commonly omitted from responses than topology. For topology, some candidates erroneously diverged into talking about LANs and WANs. Fewer candidates were able to discuss both transmission media and topology, and this was required to access Level 3 marks. Some candidates continued to discuss ring topologies, but it should be noted that this is not a topic covered in the specification.



This response is an example of a Level 3 answer that covered both the transmission media and the network topology in depth. It drew out the benefits and drawbacks of different media and topologies and made recommendations.

The response was very detailed and scored 6 marks.