9.2 Networking Mark Scheme

Q1.

All marks AO1 (understanding)

Level	Description	Mark Range
4	A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response. The response covers all three areas indicated in the guidance below and in at least two of these areas there is sufficient detail to show that the student has a good level of understanding. To reach the top of this mark range, a good level of understanding must be shown of all three areas.	10-12
3	A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response which shows a good level of understanding of at least two areas indicated in the guidance below.	7-9
2	A limited attempt has been made to follow a line of reasoning and the response has a mostly logical structure. At least four points have been made. Either a good level of understanding of one area from the guidance has been shown or a limited understanding of two areas.	4-6
1	A few relevant points have been made but there is no evidence that a line of reasoning has been followed. The points may only relate to one or two of the areas from the guidance or may be made in a superficial way with little substantiation.	1-3

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Guidance – Indicative Response

For each guidance point, if the student expands on the point to explain in what way the measure will improve performance then this can be considered to be a second point. For example:

- "Using a processor with more cores" is one point.
- "Using a processor with more cores which will be able to execute multiple instructions simultaneously" is two points.

Note that just "faster" is not enough to count as an expansion point without an explanation of why.

1. Server Hardware

Replace the processor with one which has more cores

Replace the processor with one which has more cache memory // increase the

amount of cache memory

Replace the processor with one which runs at a faster clock speed **NE.** faster processor

Use a parallel processor architecture // use more processors which can work in parallel

Use a processor with a bigger word size

Use a processor that makes (better) use of pipelining

Install more RAM // main memory // primary memory

Use RAM // main memory // primary memory with a faster access time

Replace HDDs with SSDs // Replace HDDS with HDDs that can read data at a faster rate

Defragment the HDD

Replace the motherboard with one which has buses which run at a faster clock speed

Replace the motherboard with one which has more lines in the data bus

Use the Harvard architecture

Distribute the processing across multiple servers

2. Network

Replace the network cable with cable that has a higher bandwidth // replace copper cable with fibre-optic cable **A.** Ethernet cable for fibre-optic NE. higher bandwidth network

Replace any wireless / WiFi connections with wired ones

Replace the network cards with ones that can transmit data at a higher bitrate

Consider the overall network design eg how the network is divided into subnets **A.** split the network into subnets

Use a star topology (instead of a bus)

Consider using a more efficient protocol for the data across the network

Add additional wireless access points

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3. Database and Software

Use a more efficient technique for controlling concurrent access to the database // replace record/table locks with serialisation/timestamp ordering/commitment ordering

Replace the database software with software that uses more efficient algorithms for tasks **A.** examples eg replace linear search with binary search

Use the index feature of the database to speed up searching on fields that are commonly used for this purpose

Rewrite the database software in a language that is suitable for concurrent execution // use a functional programming language for the database software

Ensure the software is compiled rather than executed by an interpreter // rewrite the software in assembly language/machine code

Review the conceptual model of the database to see if it contains any inefficiencies such as data redundancy that could be eliminated **A**. normalise the database design

Consider if it would be appropriate to sacrifice normalisation of the conceptual model to improve performance

Use a non-relational database system **A.** examples eg NoSQL

Distribute the data across multiple servers

Try to reduce the amount of other (unrelated) software that might be running on the database server at the same time

Try to reduce the number of database accesses that need to be made simultaneously // run some tasks at quiet times / overnight

Purge / archive data that is no longer necessary / in use

[12]

Q2.

All Marks AO1 (Understanding)

Award one mark for each pair of measure and how this is effective.
Do not award marks for both rows 1 and 2.

	Measure	How Makes Effective
1	Use WPA (WiFi Protected Access)/WPA2 (**A.** WEP) (which is strong) **NE.** use of password	To encrypt transmission // so that if intercepted transmissions cannot be understood/read by someone who does not have the key / by an unauthorised person
2	Encrypt transmissions	So that if intercepted cannot be understood/read by someone who does not have the key / by an unauthorised person
3	Disable broadcast of SSID (Service Set Identifier)	So that the network is harder to discover // so that you must know the SSID to connect
4	Use a MAC address white list **A.** "Hardware" for "MAC" **NE.** whitelist without reference to MAC addresses	So that only devices with a known address // address on the list can connect

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Max 2

[2]

Q3.

2 marks for AO1 (knowledge) and 4 marks for AO1 (understanding)

Level	Description	Mark Range
3	A detailed, coherent, description that includes the use of RTS / CTS and that conveys good understanding of how the access method works. Whilst there may be some omissions from the description it contains no misunderstandings.	5-6
2	An adequate description, including at least three points from the list below. The description is	3-4

	logically organised so that it makes sense when read as a whole and therefore demonstrates a reasonable understanding of how the system works. The description may or may not include the use of RTS / CTS.	
1	A small number of relevant points have been recalled (in this case award one mark per point, up to a maximum of two from lists below). However, the structure of the response, or lack of it, demonstrated only a very limited understanding, if any, of the access method used.	1-2

Indicative Content

- computer with data to send monitors/listens for (data signal)
- if (data) signal present/another transmission in progress then continue to wait
- when no (data) signal present computer sends a Request to Send / RTS **A**. if no valid points made about RTS / CTS in response then accept that when no data signal is present computer starts to transmit data, but with no marks awarded for RTS / CTS then response is limited to max Level 2
- two computers could start transmitting simultaneously if they both detect there is no data signal
- receiver/WAP responds (to RTS) with a Clear to Send / CTS signal **A.** router
- RTS / CTS signal blocks any other transmissions from nodes in range
- if / when CTS received then start to transmit **A.** by implication as **BOD** if the student states that the computer will begin to transmit after the receiver sends the CTS
- if CTS not received continue to wait (until transmission ends)
- receiver sends acknowledgement / ack after (all) data received
- after transmitting (the transmitter) waits to receive acknowledgement packet (to confirm data received and not corrupted)
- if no acknowledgement / ack received (within reasonable time period) then:
  - wait a time period
  - then listen again / retransmit
- the acknowledgement / ack also notifies other computers that they can transmit again
- waiting periods are (often) random **A.** an example waiting period that is random
- collisions cannot be detected by transmitter

[6]

EXAM PAPERS PRACTICE

Q4.

Marks is for AO2 (understanding)

Level	Description	Mark Range
4	A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response. The response covers all four areas indicated in the guidance below and in at least three of these areas there is sufficient detail to show that the student has an excellent	10-12

	level of understanding of the issues and technologies involved. To reach the top of this mark range, an excellent level of understanding must be shown of all four areas.	
3	A line of reasoning has been followed to produce a coherent, relevant, substantiated and logically structured response but the response may only cover two or three of the areas indicated in the guidance below. A good understanding is shown of each of these areas and if only two areas are covered, the coverage of these is excellent.	7-9
2	A limited attempt has been made to follow a line of reasoning by covering at least two of the topic areas in the guidance below. Overall, at least four valid points must have been made which can relate to any of the topic areas in the guidance.	4-6
1	A few relevant points have been made but there is no evidence that a line of reasoning has been followed. The points may only relate to one or two of the four areas from the guidance or may be made in a superficial way with little substantiation.	1-3

Guidance – Indicative Response

1. How it was possible for data to be collected

WiFi signals can travel outside of property // over wide area // limited control over range

Any WiFi receiver in range can read the data packets **NE**. The receiver in the car can read the packets

No need to physically "tap" into a WiFi connection, unlike a cabled connection

A protocol that does not encrypt the transmissions may have been used // unencrypted data sent. **NE**. Network not secure

2. Steps to prevent

Use a protocol that encrypts data transmissions

A. Encrypt the transmission

R. Password protection

Example of secure protocol eg WPA, WPA2

Disable broadcast of SSID to make network harder to identify (Note: Accept this point even though the SSID would be in other data packets)

Limit power of transmitter so data does not travel outside premises (although in practice this might be hard to achieve)

Use cabled network instead of WiFi.

R. MAC address filtering (as cars were not connecting to networks just intercepting transmissions)

3. Legal and ethical issues

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If the data is being transmitted through the air, who does it belong to, if anyone? // Should data transmitted by WiFi be treated like a broadcast (eg TV) or a private communication (eg telephone call)?

Is it wrong to intercept data if people freely choose to transmit it wirelessly? **A**. Is it ethical to collect data from people without their permission?

Is it legal to intercept data if people freely choose to transmit it wirelessly? What laws apply in this scenario? Is this really hacking?

Are the ethics or laws different for intercepting data transmitted wirelessly than by cable?

Is there a difference between collecting statistical data eg channel number, signal strength, SSID and collecting the payload data?

Was the data just collected or was there an intention to process it as well?

What should the company have done when it realised that the data had been collected? // Should the data have been immediately deleted, or kept so that the company could contact and apologise to people it had collected data from? // What should be done with the data now?

What should the company have done if it inadvertently discovered evidence of illegal activity in the collected data?

Legality/ethicality may depend on the nature of the data gathered // (In the UK) would some of the collected data count as “personal data” (under the Data Protection Act) // could some of the data have been sensitive (accept example eg bank account details, details of minors) **NE**. Data may be private

To what extent is the company financially liable for collecting the data? Or any consequences of its use?

Could the legal situation be different in different countries where the company operated?

Was the collection of data intentional or just an accidental side-effect of a reasonable process?

What was done to ensure (existing) policies are followed?

Should there have been more oversight of code development?

Could intellectual property have been inadvertently stolen?

Is it ethical to collect/store information secretly from people // without them knowing?

Is it ethical to collect data if there is no (legitimate) purpose for doing so?

Were the developers in breach of their contracts with the company / company guidelines?

Relevant Legislation

Students may name specific pieces of legislation that could have been breached as part of their response. Determining whether or not a breach has actually occurred would probably require more information than is provided in the question and detailed knowledge of the legislation, which is not required by the specification. Therefore, up to **two points** can be given for students naming relevant pieces of legislation that could have been breached, regardless of whether or not this can be ascertained with certainty. Relevant pieces of legislation include:

- The Data Protection Act
- The Computer Misuse Act
- The Regulation of Investigatory Powers Act
- The Communications Act

Points should be given for assertions that legislation has definitely been breached, even if this is only a possibility in the context rather than a certainty.

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Responses that reference other legislation should be referred to Team Leaders.

A. As an alternative to naming the Data Protection Act, a response could instead question whether privacy laws have been breached, or if a breach of privacy has occurred.

4. Lessons

Improved training for developers in what is legal / ethical (accept company needs to improve understanding of legal/ethical issues)

Need to review guidelines that developers are expected to follow

Need for scrutiny of code / supervision by people outside of development team

Developers could be required to check each other's code

Developers could be required to log changes made to code and reason

Should only collect data that is absolutely necessary // that has a clear purpose // need to review collected data to see why it is being collected and stored // need to fully consider the purpose of any data collection before doing it

Could/should remove equipment for Wi-Fi data capture used in cars to collect mapping data.

NE. Further testing should be carried out unless there is a clear explanation of the mechanism by which testing will check that the software has no additional functionality is described eg inspection of collected data files to verify purpose of contents

[12]

Q5.

All marks AO1 (understanding)

Physical: The (physical) layout/arrangement/architecture of the cabling/wiring/connections (between the devices/computers on the network);
A. The (physical) layout/arrangement/architecture of the devices/computers/network
NE. How the devices/computers are connected to each other
NE. "Setup" for layout
NE. List of topologies eg bus, star

Logical: How the data/packets flows around a network // architecture of the communication mechanism in a network;
A. The type of protocol used
NE. How a network operates/behaves

[2]

Q6.

All marks AO1 (understanding)

Client-server (MAX 2):

Resources stored on the server;
R. Responses which suggest that everything must be done on the server
Clients access resources from server // server provides these resources in response to client requests;
A. Server provides services to client
Centralised / improved security management // centralised login system // centralised administration // administration will be easier;

EXAM PAPERS PRACTICE

Configuration/setup more complex // configuration/setup requires greater expertise;

Peer-to-peer (MAX 2):
Resources stored on each individual computer/device/peer;
Any computer/device/peer can access resources from any other // any computer/device/peer can share resources with any other // files can be distributed across the computers on the network;
Each computer/device/peer has equal status // a computer can act as both client and server;
Management of security / administration could be more difficult;
Computers communicate directly with each other // there is no dependence on a server;
NE. Computers connected directly to each other, no server

In both sections, reject points about how computers are connected to each other.

Accept responses that use examples of resources eg files, web pages

Max 4

[4]

Q7.

(a) System will be storing confidential/personal data (that must be kept securely/safely);
Centralised/improved security management // centralised login system // centralised administration // administration will be easier;
Centralised backup;
Harder for users to change security/sharing settings;
Running database from a server will avoid concurrency issues // will avoid problems if two users/computers update (a record in the) database simultaneously; **A**. Will allow simultaneous updates/access **R**. Answers that imply that on a peer-to-peer system there would be a separate copy of the database on each workstation
Running database from server will ensure that it is always available (as server is unlikely to be turned off) // Files would always be available (as server is unlikely to be turned off);
Server (operating system) may allow more simultaneous connections than a workstation // (operating system software on) workstations may not allow enough simultaneous connections for ten users;
NE. The database could be stored on the server

Max 2

(b) **How works (MAX 3):**
All/most processing done by (central) server; **A**. All software run on server
Keystrokes/mouse clicks/user input transmitted from workstation/terminal to server over network; **A**. Workstations are just interfaces
Image/data needed to produce image transmitted from server to terminal over network;
Applications not installed on (thin client) workstations // all applications on server;
Operating system loaded by clients from server at boot;

Selection of hardware (MAX 3):
Higher bandwidth network connection required;
Network must use switch not hub;
Slower processor /reduced RAM/ no HDD required in workstations;

EXAM PAPERS PRACTICE

A. Other examples of limited hardware requirements **A**. 'Dumb terminal' Server must have multiple processors/a lot of RAM;
NE. More powerful / less powerful, higher performance / lower performance, cheaper / more expensive
Accept the opposite of points eg for "Slower processor" accept "a thick client system would need a faster processor".

6

(c) College network uses a different protocol from the Internet/their ISP // College network does not use TCP/IP;
A. Examples of different protocols/hardware types being used

1

[9]

Q8.

SUBJECT MARKING POINTS:

How systems work:

Rich client:

- Applications run (locally) on computer // all processing done on (local) computer // applications installed locally **A.** On client

Thin client:

- All/most processing done by (central) server // applications not installed on (thin client) workstations // all applications on server; **A.** All software run on server
- Keystrokes/mouse clicks/user input transmitted from workstation/terminal to server over network, **A.** Workstations are just interfaces
- Image/data needed to produce image transmitted from server to terminal over network
- Operating system loaded by clients from server at boot

EXAM PAPERS PRACTICE

How hardware differs for thin client:

- Higher bandwidth network connection required
- Network must use switch not hub
- Slower processor /reduced RAM/ no HDD required in workstations, **A.** Other examples of limited hardware requirements, **A.** 'Dumb terminal'
- Server must have multiple processors/a lot of RAM

N.E. more powerful / less powerful, higher performance / lower performance, cheaper / more expensive

Accept the opposite of points e.g. for "a thin client system could use a slower processor" accept "a thick client system would need a faster processor" but don't award marks for a point and its opposite point.

Why SaaS is a type of thin client:

Software is run on a remote computer (not locally, so an example of thin client)

A. Server, web server for "remote computer"
N.E. Accessed via internet

What distinguishes SaaS from other types of thin client:

- SaaS is accessible anywhere that there is an internet connection // is used via the internet
- Customers usually purchase access to SaaS instead of buying software outright
- SaaS is usually managed by an application service provider / another company / a contractor // company using SaaS does not need to manage software
- SaaS usually works in (web) browser

HOW TO AWARD MARKS:

Mark Bands and Description	
7-8	*To achieve a mark in this band, candidates must meet the subject criterion (SUB) and all 5 of the quality of written communication criteria (QWCx).* *SUB* Candidate has written a detailed explanation of how thin client systems work in comparison to rich client systems, and has also made a good comparison of the hardware required for both types of system. Some points have been made about how SaaS is distinguished from other types of thin client system. The candidate has made at least seven subject-related points. *QWC1* Text is legible. *QWC2* There are few, if any, errors of spelling, punctuation and grammar. Meaning is clear. *QWC3* The candidate has selected and used a form and style of writing appropriate to the purpose and has expressed ideas clearly and fluently. *QWC4* Sentences (and paragraphs) follow on from one another clearly and coherently. *QWC5* Appropriate specialist vocabulary has been used.
5-6	*To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality of written communication criteria (QWCx).* *SUB* Candidate has made some points in both of the areas of how thin client systems work in comparison to rich client systems, and how the hardware requirements of each type of system vary. The candidate has made at least five subject-related points. *QWC1* Text is legible. *QWC2* There may be occasional errors of spelling, punctuation and grammar. Meaning is clear. *QWC3* The candidate has, in the main, used a form and style of writing appropriate to the purpose, with occasional lapses. The candidate has expressed ideas clearly and reasonably fluently.

EXAM PAPERS PRACTICE

	QWC4 The candidate has used well-linked sentences (and paragraphs). *QWC5* Appropriate specialist vocabulary has been used.
1-4	*To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality of written communication criteria (QWCx).* *SUB* Candidate has made some relevant points, but these are superficial or narrow in scope. *QWC1* Most of the text is legible. *QWC2* There may be some errors of spelling, punctuation and grammar but it should still be possible to understand most of the response. *QWC3* The candidate has used a form and style of writing which has many deficiencies. Ideas are not always clearly expressed. *QWC4* Sentences (and paragraphs) may not always be well-connected. *QWC5* Specialist vocabulary has been used inappropriately or not at all.
0	Candidate has made no relevant points.

Note: Even if English is perfect, candidates can only get marks for the points made at the top of the mark scheme for this question.

If a candidate meets the subject criterion in a band but does not meet the quality of written communication criteria then drop mark by one band, providing that at least 4 of the quality of language criteria are met in the lower band. If 4 criteria are not met then drop by two bands.

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[8]

Q9.

(a) **Marks are for AO1 (understanding)**

Label	Description
1	channel idle / not busy / / no node transmitting;
2	no acknowledgement received; **NE** collision occurs
3	acknowledgement received; **NE** no collision detected
4	(wait for) random period of (time);

1 mark: each correct description

4

(b) **1 mark for AO1 (knowledge) and 2 marks for AO1 (understanding)**

AO1 (knowledge):

1 mark: SSID is a (locally unique) identifier for a wireless network;

AO1 (understanding):

1 mark: A wireless client must have the same SSID as the one put in the access point to join;
1 mark: Broadcasting SSID announces publicly your wireless network and can be seen as a security weakness;

3

(c) **Marks are for AO1 (understanding)**

In coffee shop speed could be limited for each device that is connected / / throttling;
In coffee shop more clients connecting to one access point;
In coffee shop connection to Internet might have less bandwidth;
In coffee shop there may be more collisions;
NOTE accept answers made in terms of home
Max 2 marks

MAX 2

[9]

Q10.

(a) **All marks AO1 (understanding)**

1 mark: The 'Router 2' port labelled **A** 192.168.2.x where x is not 0 or 255;

1 mark: The computer network interface card labelled **B** 192.168.2.y where y is not 0 or 255 or x from the previous response;

2

EXAM PAPERS PRACTICE

(b) **All marks AO1 (understanding)**

1 mark for advantage and 1 mark for reason. Must give the advantage to get the reason mark.

1 mark: (any 1 from) Improved security; as data only travels down one link / / is not sent throughout network / / is not sent to all nodes;
Improved reliability; as if one link fails the other links / nodes are not affected;
1 mark: (any 1 from) Speed of link remains constant / / speed not affected by number of connections / collisions / / faster connection; as no collisions / links not shared;
A cable for link
R responses about terminal / computer failure

2

(c) **2 marks for AO1 (knowledge) and 4 marks for AO1 (understanding)**

Level	Description	Mark Range

3	A detailed, coherent, description of the basic mechanism that shows a good level of understanding. To score six marks, either the description of the basic mechanism must be comprehensive, or, there may be one or two minor errors or omissions in the description of the basic mechanism but these are compensated for by also describing some aspects of CTS/RTS or the back-off mechanism.	5 – 6
2	An adequate description, including at least three points from the lists below. Some aspects of the basic mechanism may be missed out. The description is logically organised so that it makes sense when read as a whole and therefore demonstrates a reasonable understanding of how the system works.	3 – 4
1	A small number of relevant points have been recalled (in this case award one mark per point, up to a maximum of two from lists below). However, the structure of the response, or lack of it, fails to demonstrate an understanding of the mechanism used.	1 – 2

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Basic mechanism:

- computer monitors / listens for (data signal)
- if (data) signal present / another transmission in progress then continue to wait
- when no (data) signal present start to transmit
- wait to receive acknowledgement packet (to confirm data received and not corrupted)
- if no acknowledgement received (within reasonable time period) then:
  - wait a random time period
  - then retransmit.

CTS / RTS (if implemented):

- before starting to transmit, computer sends a Request to Send (RTS) to access point
- access point will respond with a Clear to Send (CTS) signal to only one computer at a time
- only the computer that receives the CTS signal will transmit.

Back-off mechanism:

- waiting period is random to reduce likelihood of two computers transmitting at the same time again / / to reduce likelihood of another collision
- if a collision occurs again then wait a longer random time before attempting to transmit again
- use of exponential back-off algorithm to determine wait time.

6

(d) **1 mark for AO1 (knowledge) and 2 marks for AO1 (understanding)**

AO1 (knowledge): 1 mark: Checksum (is a number / value which) is calculated from / / is a hash of the data in the packet (before it is transmitted);
AO1 (understanding): 1 mark: Checksum recalculated when packet is received;
AO1 (understanding): 1 mark: If checksum received in packet matches recalculated checksum then data received correctly / / If checksum received in packet differs from recalculated checksum then data has been corrupted;

3

[13]

Q11.

(a) 192.168.0.x (where x is not 0, 2 or 255);

1

(b) Star (topology);
A Star network
I additional writing that does not talk out the response

1

(c) Devices are not directly connected to the Internet;
NE all computers on a private network

So that LAN devices cannot be connected to (directly) by computers outside of the LAN / on the Internet // for increased security;
A relevant examples of increased security

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Don't need to be allocated by a central authority // would be difficult to organise for each device to have a unique (routable) IP address // easier to allocate if do not need to be unique // (as devices not directly connected to Internet) IP addresses don't need to be globally unique;
NE routable IP addresses globally unique and non-routable only locally unique

Would / May not be enough unique IP addresses for each device to have a routable address // globally more IP addresses would be required if all devices had routable IP addresses // more bits would be required to store an IP address if all devices had routable IP addresses;

MAX 2

2

(d) AND operation performed using IP address(es) and subnet mask (to produce network IDs / subnet IDs of both desktop computer and FTP server) // Network IDs / subnet IDs / first three octets / bytes / values (in IP addresses) computed using IP address(es) and subnet mask;

To award either of the next two marks, the candidate must have indicated that the subnet mask is used to produce the results that will be

compared - even if the method by which the subnet mask is used is incorrect so the first mark has not been awarded.

Network / subnet IDs of both computers / machines compared;
A Results of previous operation compared
A First three octets / bytes / values (in IP addresses) compared
A Award this mark by implication if it is stated what will happen if these two are the same or different

As network / subnet IDs (**A** first thee octets / bytes / values / results) differ, desktop computer determines that FTP server is not on same network (so must be communicated with via combined device);

3

(e) Block / allow (traffic on) specific ports // block specified protocols;
Block / allow (traffic from) specific IP addresses / domain names;
Search packets for specific contents / text (and block / allow based on this);
Act as a proxy server // all traffic to Internet must go via firewall // stops computers on the Internet directly accessing devices on the LAN;
Stateful inspection // firewall maintains information about current connections and only allows packets relevant to these connections through;
Identifies unusual behaviour from a host // example of unusual behaviour eg sending an unusually large amount of data;
NE Packet filtering
NE "Data" instead of "packets"
NE Block specific programs connecting to Internet
A Firewall checks packets using rules / criteria for 1 mark if not other marks awarded
MAX 3

3

(f) *Baseband*
Whole bandwidth of medium dedicated to one transmission (at a time) // one channel (at a time) // only one computer can send data (at a time) // sends signals with frequencies from 0Hz to a maximum highest frequency;
Broadband
Bandwidth of medium shared // multiple channels can be carried (simultaneously) // many computers can send data (simultaneously) // frequency bands assigned to different communications; **TO** multiple wires
MAX 1

1

(g) More reliable // less susceptible to interference // more stable connection;
Faster transmission speed // higher bit rate // lower latency;
R More secure (not relevant in this instance)
NE Just the word "faster" on its own.
MAX 1

1

[12]

Q12.

(a) (i) 192.168.0.x where x is not 0 or 255;

1

(ii) 192.168.2.x where x is not 0 or 255;

1

EXAM PAPERS PRACTICE

(iii) 192.168.2.y where y is not 0 or 255 and is not the same as x in (ii);

1

(b) **Reason:** To reduce (network) congestion / / improve throughput / / *to cut the number of collisions**; **A** faster operation / transmission;
Explanation: *by cutting the number of collisions** / / by reducing the number of stations / computers connected to each section of cabling / / because two computers in one segment can communicate at the same time as two computers in another segment;
Note: * = Do not award **2 marks** for cutting the number of collisions – only award one for either reason or explanation.

Reason: To improve security;
Explanation: by localising packet transmission to one segment;

Reason: To improve reliability;
Explanation: By limiting effect of cable failure to one segment;
R answers referencing the computers not working at all

Award marks for either:
- **one reason + explanation**
- **two reasons**
- **two explanations**

2

(c) (i) No need for maintenance / / no need to upgrade / / no need to install patches for software / / could employ fewer technical staff;
Lower hardware requirements for computers (as processing done on web server); **A** examples of lower hardware requirements but **R** just cheaper hardware
No (high) one-off purchase cost; Platform independence / / can access the software on many devices; **A** examples eg PC and tablet.
Software can be used from anywhere that there is an Internet connection / / from outside of office; **Note**: To award this point must be clear that can be accessed from outside of office, just "can be accessed from any computer" is not enough.
Can still access software and data if a specific computer is not working;
A reduced management cost / effort when a reason is given, such as no need to install software on each computer, but just "does not need to be installed on each computer" is not enough on its own.
MAX 2

2

(ii) Reliance on Internet / / unreliable internet connection may mean software inaccessible;
Reliance on the company that develops the software to keep providing the service;
Slow connection speed may make software difficult / annoying to use;
Concern over security of saved documents / / security of transmission;
May be an ongoing cost to pay for using the software;
Lack of control over which version to use / when upgrades happen;
Software may slow when used by many users simultaneously;
Higher cost (to company) of fast internet connection to connect <u>many</u> computers to SaaS;
MAX 1

1

(d) LAN usually baseband whilst WAN broadband* / / only one communication

EXAM PAPERS PRACTICE

can take place at a time on a LAN whereas multiple communications can take place simultaneously on a WAN;
LAN communication links have higher speeds than WAN;
LAN has lower latency than WAN;
Lower error rates on LAN than WAN;
Communications medium in LAN likely to be privately owned, whereas likely to be leased / publicly owned in a WAN;
Use different protocols (at link layer / hardware level);
Different hardware required to connect (**A** examples);
WAN may have greater security risks (as data transmitted over larger area, on public system, through more servers or devices);
A WAN may use satellites / microwave whilst LAN may use cables / radio / WiFi* - this point cannot be awarded for just saying WAN uses cables on LAN radio or vice-versa as both LAN and WAN can use either of these
MAX 2

Only one side of the difference needs to be provided (as the other is implicit) except for the points marked with an * for which both sides are needed.

2

[10]

Q13.

(a) (i) 192.168.0.x where x is not 0 or 255;
Must be a specific IP address
R addresses that include port numbers

1

(ii) 192.168.1.x where x is not 0 or 255;
Must be a specific IP address
R addresses that include port numbers

1

(iii) 192.168.1.y where y is not 0 or 255 and is not the same as x in (ii);
Must be a specific IP address
R addresses that include port numbers

1

EXAM PAPERS PRACTICE

(b) Bus (topology / network);
A Line

1

(c) 255.255.255.0 / FFFFFF00 /
11111111 11111111 11111111 00000000;

1

(d) (An operating system that is optimised to) provide (one or more specialised) services to (network) clients;
A description of examples of services e.g. logging on, sharing printers,
but just the example of accessing files is not enough as this is in the question. There needs to be additional explanation if files is used as an example, e.g. managing quotas, security of files.
R answers that imply that server does all processing i.e. confusion with thin client

1

(e) (i) Use of Wired Equivalent Privacy / WEP / WPA / WPA2 / WiFi Protected

Access;
(Strong) encryption of transmitted data // use of Advanced Encryption Standard / AES; **R**encoding Use of Extensible Authentication Protocol / EAP; User / computer must enter / send a passphrase / certificate at start of communication before laptop allowed to connect;**A** key for passphrase **A** only allow password if used in correct context ie for accessing network, not for logging on to a server or just having a password
Access point checks MAC / hardware address of laptop and only allows computers with a MAC / hardware address in a list of approvedaddresses to connect; **R** IP address
Disable broadcast of SSID / identity;
Reduce / limit power of transmitter;
Use of two / multi-factor authentication;

1

(ii) Longer range // faster transmission speeds // higher bandwidth // more simultaneous connections;
A reverse of points e.g. "Bluetooth only has a short range"
R Bluetooth can only connect two devices at once

1

(f) **SUBJECT MARKING POINT S:**

Internal:
- Student's computer uses subnet mask (and destination / web server's IP address) to determine if destination computer / web server is on same subnet // identify not on same subnet
- Up to two marks from description (in separate section below) of how subnet mask is used
- Packet is sent (from student's computer) to Router (1)
- Router 1 identifies that destination is outside the LAN so forwards packet to Gateway

External:
- Hierarchical organisation of routers
- Example of hierarchical organisation of routers e.g. passed up to a national router, transferred internationally and then passed back down a hierarchy
- Path to take selected by each router (not determined at start) **NE** passed from router to router
- Route may change as a result of e.g. congestion, technical problems

Either:
- (Possible) repackaging of packet to use different protocol (e.g. Gateway may change protocol)
- Route determined using the (Network ID part of the destination) IP address (Note: can infer "IP address" if just "address" is stated, if previously candidate has written about an IP address)
- Use of router tables / criteria to determine next hop / (step of) path
- Router decrementing "time to live" of packet
- Source and destination MAC addresses changed at each router // MAC addresses used for each "hop"

How subnet mask used (Max 2 points):
- AND operation of subnet mask with student's computer's IP address
- AND operation of subnet mask with web server's IP address
- Result (of AND operation) is the network ID;

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- Network IDs compared
- If they are the same, then the computers are on the same subnet
  A interchangeable use of subnet ID and network ID

HOW TO AWARD MARKS:

Mark Bands and Description

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and all 5 of the quality of language criteria (QLx).

SUB Candidate has covered both internal and external routing in detail and has made at least seven subject-related points.
QWC1 Text is legible.
QWC2 There are few, if any, errors of spelling, punctuation and grammar. Meaning is clear.
QWC3 The candidate has selected and used a form and style of writing appropriate to the purpose and has expressed ideas clearly and fluently.
QWC4 Sentences (and paragraphs) follow on from one another clearly and coherently.
QWC5 Appropriate specialist vocabulary has been used.

7-8

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality oflanguage criteria (QLx).

SUB Candidate has covered both internal and external routing, although one may be in more detail than the other and has made at least five subject-related points.
QWC1 Text is legible.
QWC2 There may be occasional errors of spelling, punctuation and grammar. Meaning is clear.
QWC3 The candidate has, in the main, used a form and style of writing appropriate to the purpose, with occasional lapses. The candidate has expressed ideas clearly and reasonably fluently.
QWC4 The candidate has used well-linked sentences (and paragraphs).
QWC5 Appropriate specialist vocabulary has been used.

EXAM PAPERS PRACTICE

5-6

To achieve a mark in this band, candidates must meet the subjectcriterion (SUB) and 4 of the 5 quality of language criteria (QLx).

SUB Candidate may not have covered both internal and external routing, but has covered at least one of them. Up to four relevant points have been made.
QWC1 Most of the text is legible.
QWC2 There may be some errors of spelling, punctuation and grammar but it should still be possible to understand most of the response.
QWC3 The candidate has used a form and style of writing which has many deficiencies. Ideas are not always clearly expressed.
QWC4 Sentences (and paragraphs) may not always be well-connected.
QWC5 Specialist vocabulary has been used inappropriately or not at all.

1-4

Candidate has made no relevant points.

0

Note: Even if English is perfect, candidates can only get marks for the points made at the top of the mark scheme for this question. If a candidate meets the subject criterion in a band but does not meet the quality of language criteria then drop mark by one band, providing that at least 4 of the quality of language criteria are met in the lower band. If 4 criteria are not met then drop by two bands.

8

(g) Any two points from the list below. Candidate only needs to make one side of point, the other can be implied. Do not award marks for two sides of same point.

Routable	**Non-Routable**
(Globally) unique	Many computers / devices may have same address
Allocated by a central / regional issuing authority (**A** example)	Not allocated centrally // allocated by a home user / company / ISP
Can be connected to directly over the Internet / from outside private network	Difficult / impossible to connect to over Internet // from outside of network
Owner can be looked up using WHOIS protoco	Owner cannot be looked up using WHOIS protocol

EXAM PAPERS PRACTICE

A non-routable IP addresses more secure as cannot be connected to over Internet / from outside network
A can identify location from a routable IP address

2

[18]

Q14.

(a) WWW (**Max 3 marks**)
A system of interlinked / hypertext documents;
Accessed via the Internet;
Using HTTP protocol;
NE web a collection of web pages

Internet (**Max 3 marks**)
A network of interconnected computer networks;
A a network of computers;
Using a globally unique address space;
Using end-to-end communication protocol // Internet Protocol // "TCP / IP";

Supports a range of application protocols;
A two examples of different protocols;

R "TCP"
R "IP"

Max 4

(b) Messages split into packets; **A** chunks
Each packet given destination / source address;
Each packet dispatched to the Internet through a router / gateway;
Packets sent independently;
Packets given a sequence number;
Routers forward packets (until they reach destination);
Path of packet transfer determined by router(s);
Packets reassembled at the destination;

Max 2

(c) **12.23.45.89**

An IP (v4) address (that uniquely identifies a machine on the Internet) // Internet protocol address;

80

A port number // a number that specifies which process on the receiving machine/host to send the data to;
A port;

Denotes that HTTP (server) is recipient of packet // packet is an HTTP packet

2

[8]

Q15.

(a) System will be storing confidential / personal data (that must be kept securely / safely);
Centralised / improved security management // centralised login system // centralised administration // administration will be easier;
Centralised backup;
Harder for users to change security/sharing settings;
Running database from a server will avoid concurrency issues // will avoid problems if two users / computers update (a record in the) database simultaneously;
A will allow simultaneous updates / access
R answers that imply that on a peer-to-peer system there would be a separate copy of the database on each workstation
Running database from server will ensure that it is always available (as server is unlikely to be turned off) // Files would always be available (as server is unlikely to be turned off);
Server (operating system) may allow more simultaneous connections than a workstation // (operating system software on) workstations may not allow enough simultaneous connections for ten users;
NE the database could be stored on the server

Max 2

(b) **Subject-related points:**

How works:
All / most processing done by (central) server;
A all software run on server

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Keystrokes/mouse clicks / user input transmitted from workstation/terminal to server over network;
A workstations are just interfaces
Image / data needed to produce image transmitted from server to terminal over network;
Applications not installed on (thin client) workstations // all applications on server;
Operating system loaded by clients from server at boot;
Selection of hardware:
Higher bandwidth network connection required;
Network must use switch not hub;
Slower processor / reduced RAM / no HDD required in workstations;
A other examples of limited hardware requirements
A 'Dumb terminal'
Server must have multiple processors/a lot of RAM;
NE more powerful / less powerful, higher performance / lower performance, cheaper / more expensive
A the opposite of points e.g. for 'Slower processor' accept 'a thick client system would need a faster processor'.

How to award marks:

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and all 5 of the quality of language criteria (QWCx).

SUB	Candidate has covered both how a thin-client system works and how this affects the choice of hardware, and has made at least four subject-related points.
QWC1	Text is legible.
QWC2	There are few, if any, errors of spelling, punctuation and grammar. Meaning is clear.
QWC3	The candidate has selected and used a form and style of writing appropriate to the purpose and has expressed ideas clearly and fluently.
QWC4	Sentences (and paragraphs) follow on from one another clearly and coherently.
QWC5	Appropriate specialist vocabulary has been used.

EXAM PAPERS PRACTICE

4

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality of language criteria (QWCx).

SUB	Candidate has covered both how a thin-client system works and how this affects the choice of hardware, and has made at least three subject-related points.
QWC1	Text is legible.
QWC2	There may be occasional errors of spelling, punctuation and grammar. Meaning is clear.
QWC3	The candidate has, in the main, used a form and style of writing appropriate to the purpose, with occasional lapses. The candidate has expressed ideas clearly and reasonably fluently.
QWC4	The candidate has used well-linked sentences (and paragraphs).
QWC5	Appropriate specialist vocabulary has been used.

3

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality of language criteria (QWCx).

SUB	Candidate has covered one or both of how thin client systems work and

how this affects hardware choice.

QWC1 Most of the text is legible.

QWC2 There may be some errors of spelling, punctuation and grammar but it should still be possible to understand most of the response.

QWC3 The candidate has used a form and style of writing which has many deficiencies. Ideas are not always clearly expressed.

QWC4 Sentences (and paragraphs) may not always be well- connected.

QWC5 Specialist vocabulary has been used inappropriately or not at all.

1–2

Candidate has made no relevant points.

0

Note: Even if English is perfect, candidates can only get marks for the points made at the top of the mark scheme for this question.

If a candidate meets the subject criterion in a band but does not meet the quality of language criteria then drop mark by one band, providing that at least 4 of the quality of language criteria are met in the lower band. If 4 criteria are not met then drop by two bands.

4

(c) To connect networks using different protocols // to convert transmitted data from one protocol to another;

1

[7]

Q16.

(a) To examine the destination of each packet;
To forward packets from one network to another;
To manage congestion;
Choose an appropriate forwarding route;
Route packets according to destination IP address;
Store incoming packets temporarily;
Change link address in packet;
To store/make use of a routing table;
A data instead of packets
R information / signals

Max 2

(b) SMTP;
POP(3);
IMAP(4);
A full names of the protocols above
A ESMTP // SMAP // LMTP // QMTP

Max 1

(c) **Key Points of Subject Criteria**
Concept that data passed up/down between layers;
A by example – just one needed but must be correct
NE just describing the layers in the correct order

Application layer selects appropriate protocol for the communication // protocol mentioned by example (POP / HTTP);
Application layer is to interact with the user via the email client / web browser;

Transport Layer:

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Transport layer establishes end to end communication // Transport layer establishes a virtual path // TCP layer establishes connection between client and server;
Destination and source application level client/server identified by port numbers;
TCP layer uses these port numbers to route reassembled requests/responses to correct application layer client/server;
TCP layer splits and reassembles requests/responses into packets/from packets;
Packets are numbered by transport layer;
Transport layer deals with error control (acknowledgements/retransmission);

Network layer adds source and destination IP addresses; Routers use destination IP addresses to route packets to destination // network layer involved with packet routing;

Link layer adds source and destination hardware/Ethernet/Link layer/MAC addresses;
Link layer destination and source addresses change from link to link;
Link layer moves packets between 2 internet hosts;
Link layer deals with physical connection/cabling;
A Link layer includes network card / drivers;

Network layer strips IP address (when receiving) // Link layer strips MAC address (when receiving);
Server uses received source IP address to know where to send response;

Server uses received client port number to know to which instance of application layer client to send response to;
Servers use well-known ports;
Client port numbers come from the dynamic range;
Packets of Email client/server and Web browser/Web server travel independent paths;
Packets of Email client/server and Web browser/Web server share links//intermingled on links;

Combination of IP address and Port = Socket / described;

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Note: Accept answers where candidate uses the IP addresses and ports indicated in the figure to match up with statements above

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality of language criteria (QWCx).

SUB	Candidate has made at least 5 valid points covering.
QWC1	Text is legible.
QWC2	There are few, if any, errors of spelling, punctuation and grammar. Meaning is clear.
QWC3	The candidate has selected and used a form and style of writing appropriate to the purpose and has expressed ideas clearly and fluently.
QWC4	Sentences and paragraphs follow on from one another clearly and coherently.
QWC5	Appropriate specialist vocabulary has been used.

5-6

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality of language criteria (QWCx).

SUB Candidate has made at least 3 valid points.
QWC1 Text is legible.
QWC2 There may be occasional errors of spelling, punctuation and grammar. Meaning is clear.
QWC3 The candidate has, in the main, used a form and style of writing appropriate to the purpose, with occasional lapses. The candidate has expressed ideas clearly and reasonably fluently.
QWC4 The candidate has used well-linked sentences and paragraphs.
QWC5 Appropriate specialist vocabulary has been used.

3-4

To achieve a mark in this band, candidates must meet the subject criterion (SUB). The quality of language should be typified by the QWCx statements.

SUB Candidate has provided at least one point from the above.
QWC1 Most of the text is legible.
QWC2 There may be some errors of spelling, punctuation and grammar but it should still be possible to understand most of the response..
QWC3 The candidate has used a form and style of writing which has many deficiencies. Ideas are not always clearly expressed.
QWC4 Sentences and paragraphs may not always be well-connected or bullet points may have been used.
QWC5 Specialist vocabulary has been used inappropriately or not at all.

1-2

Candidate has not made reference to any of the points above.

0

[9]

Q17.

(a) (i) 192.168.0.x where x is not 0 or 255;

1

(ii) 192.168.2.x where x is not 0 or 255;

1

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(b) 255.255.255.0;

1

(c) **Reason:** To reduce (network) congestion//improve throughput//to cut the number of collisions*;
A faster operation/transmission;
Explanation: by cutting the number of collisions*//by reducing the number of stations/computers connected to each section of cabling// because two computers in one segment can communicate at the same time as two computers in another segment;
*Note: * = Do not award two marks for cutting the number of collisions – only award one for either reason or explanation.*

Reason: To improve security;
Explanation: by localising packet transmission to one segment;

Reason: To improve reliability;
Explanation: By limiting effect of cable failure to one segment;

Award marks for either:
- *one reason + explanation*

- *two reasons*
- *two explanations*

Max 2

(d) (i) Less expensive as reduced cabling requirement;
No reliance on central node as data does not all travel through one node;
A less cabling required without reference to reduced cost if candidate has explained why less cables are needed
A computer/station for node

Must have explanation as well as advantage for mark

Max 1

(ii) Improved security as: data only travels down one link // is not sent throughout network // is not sent to all nodes;
Improved reliability as if one link fails the other links/nodes are not affected;
Speed of link remains constant // speed not affected by number of connections/collisions // faster connection as: no collisions/links not shared;
A cable for link
R responses about terminal/computer failure

Must have explanation as well as advantage for mark

Max 1

(e) Below are some example security threats and measures, but they are only examples. Award marks for all reasonable security threats and appropriate measures.

Threats:

Virus	Malicious self-replicating programs which attach to other programs
Spam	Unsolicited junk email
Worm	Malicious self-replicating programs which replicate across networks using security vulnerabilities
Remote Login	Ability to login to a computer via Internet **A** "hacking" if explained
Trojan	A malicious program hidden inside another program // masquerading as another program
Phishing	Attempts to get users to divulge personal information
Pharming	Misdirecting users to a fake website by changing DNS entries
Spyware	Program that collects information from a user's computer without user knowing
Denial of Service	Repeated requests/pings from the Internet could

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Attack	overwhelm (parts of) the network.

Threats must be described not simply named.

Measures:

Use a secure operating system
Regularly install security patches/upgrades for software
Use virus checking software + some explanation of what this will do
Keep virus definitions up to date
Use anti-spyware software + some explanation of what this will do
Use of firewall to control traffic between private network and Internet // explanation of how firewall might work
Use of spam filter in email package
Enable web browser features to detect Pharming
Restrictions on which websites users can visit
White lists/black lists
Enforce strong passwords
Encryption of data during transmission
Authentication of user/computer attempting remote login using digital certificate//smart card//security code generating device
Log files
Network manager keeps informed about latest threats // network manager trains users about threats

Measures must be appropriate to security issues described.
More than one measure can be used for the same threat.

How to award marks:

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and all 5 of the quality of language criteria (QLx).

SUB Candidate has described 2 security threats and 3 appropriate measures OR 3 security threats and 2 appropriate measures. To get 6 marks answer must include 3 threats and appropriate measures.
QL1 Text is legible
QL2 There are few, if any, errors of spelling, punctuation and grammar. Meaning is clear.
QL3 The candidate has selected and used a form and style of writing appropriate to the purpose and has expressed ideas clearly and fluently.
QL4 Sentences and paragraphs follow on from one another clearly and coherently.
QL5 Appropriate specialist vocabulary has been used.

5–6

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality of language criteria (QLx).

SUB Candidate has described at least 2 security threats and described 1 or more appropriate security measures OR candidate has named (but not described) some security threats and has described 3 or more security measures
QL1 Text is legible
QL2 There may be occasional errors of spelling, punctuation and grammar. Meaning is clear.
QL3 The candidate has, in the main, used a form and style of writing appropriate to the purpose, with occasional lapses. The candidate has expressed ideas clearly and reasonably fluently.
QL4 The candidate has used well-linked sentences and paragraphs.

EXAM PAPERS PRACTICE

QL5 Appropriate specialist vocabulary has been used.

3–4

To achieve a mark in this band, candidates must meet the subject criterion (SUB). The quality of language should be typified by the QLx statements.

SUB Candidate has described at least 1 security threat and may or may not have described some appropriate security measures OR candidate has named at least one security threat and has described 1 or 2 security measures.

QL1 Most of the text is legible.

QL2 There may be some errors of spelling, punctuation and grammar but it should still be possible to understand most of the response.

QL3 The candidate has used a form and style of writing which has many deficiencies. Ideas are not always clearly expressed.

QL4 Sentences and paragraphs may not always be well-connected or bullet points may have been used.

QL5 Specialist vocabulary has been used inappropriately or not at all.

1–2

Candidate has made no relevant points.

0

Note: Even if English is perfect, candidates can only get marks for the points made at the top of the mark scheme for this question

If a candidate meets the subject criterion in a band but does not meet the quality of language criteria then drop mark by one band, providing that at least 3 of the quality of language criteria are met in the lower band. If 3 criteria are not met then drop by two bands.

6

[13]

Q18.

(a) Number of signal changes per second // rate at which signals can change; A voltage changes for signal changes as BOD

1

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(b) (i) Each signal level / signal change represents two bits (of data)/more than one bit (of data) // channel supports four / more than two different signal levels/voltages // use of modulation/coding technique e.g. phase modulation
NE Send more than one bit at a time

Must be clear that there are more than two signal levels

1

(ii) **Step**	**Data / Request Sent**
2	Printer indicates ready; **A** Yes, Ack
3	[Computer sends] data;
6	Printer indicates ready to receive further data; **R** job complete **NE** data received

1 mark per correct step

3

(c) Baseband – whole bandwidth of medium dedicated to one channel at a time // only one computer can send data at a time // sends signals with frequencies from 0Hz to a maximum highest frequency.
Suitable for LAN – lower cost electronic components (accept examples) // simpler hardware // good performance at low cost
NE cheaper
Broadband – bandwidth of medium shared so multiple channels can be carried simultaneously // many computers can send data simultaneously // frequency bands assigned to different communications. **TO** multiple wires
Suitable for WAN – expensive to install / maintain communications media over long distance // many more devices/people needs to communicate // more cost effective to share medium.

How to award marks:

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 5 of the 5 quality of language criteria (QLx).

SUB Candidate has described both baseband and broadband and has explained accurately why at least one of these is appropriate to the context.
QL1 Text is legible.
QL2 There are few, if any, errors of spelling, punctuation and grammar. Meaning is clear.
QL3 The candidate has selected and used a form and style of writing appropriate to the purpose and has expressed ideas clearly and fluently.
QL4 Sentences and paragraphs follow on from one another clearly and coherently.
QL5 Appropriate specialist vocabulary has been used.

3–4

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality of language criteria (QLx).

EXAM PAPERS PRACTICE

SUB Candidate has described both broadband and baseband but may not have explained why they are suitable.
QL1 Text is legible
QL2 There may be occasional errors of spelling, punctuation and grammar. Meaning is clear.
QL3 The candidate has, in the main, used a form and style of writing appropriate to the purpose, with occasional lapses. The candidate has expressed ideas clearly and reasonably fluently.
QL4 The candidate has used well-linked sentences and paragraphs.
QL5 Appropriate specialist vocabulary has been used.

2

To achieve a mark in this band, candidates must meet the subject criterion (SUB). The quality of language should be typified by the QLx statements.

SUB Candidate has only described one of baseband or broadband.
QL1 Most of the text is legible.
QL2 There may be some errors of spelling, punctuation and grammar but it should still be possible to understand most of the response.
QL3 The candidate has used a form and style of writing which has many deficiencies. Ideas are not always clearly expressed.
QL4 Sentences and paragraphs may not always be well-connected or bullet

points may have been used.

QL5 Specialist vocabulary has been used inappropriately or not at all.

1

Candidate has made no relevant points.

0

Note: Even if English is perfect, candidates can only get marks for the points made at the top of the mark scheme for this question.

If a candidate meets the subject criterion in a band but does not meet the quality of language criteria then drop mark by one band, providing that at least 3 of the quality of language criteria are met in the lower band. If 3 criteria are not met then drop by two bands.

4

[9]

Q19.

(a) (i) 192.168.0.x where x is not 0 or 255;

1

(ii) 192.168.2.x where x is not 0 or 255

1

(iii) 192.168.2.y where y is not 0 or 255 and the IP address is different to the one in (ii)

1

(b) Star;

1

(c) Identify which other computers are on same segment // can have packets/data sent directly to them;
Identify which other computers are on a different segment // must have packets/data sent to them via the router;
R network for subnet

Max 1

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255.255.255.0 / FFFFFF00 / 11111111111111111111111100000000;

2

(d) Use of WEP/Wired Equivalent Privacy/WPA/WiFi Protected Access;
(Strong) encryption of transmitted data;
R encoding
User/computer must enter/send a passphrase/certificate at start of communication before laptop allowed to connect;
A key for passphrase
A only allow password if used in correct context;
Access point checks MAC/hardware address of laptop and only allows computers with a MAC/hardware address in a list of approved addresses to connect;
R IP address
Disable broadcast of SSID/identity;
Reduce / limit power of transmitter;

Max 2

(e) **Subject-related points:**
(Applies to) bus (topology);

Computer monitors/listens to (data signal on cable/bus);
If (data) signal present // if cable/bus busy continue to wait;
When no (data) signal present // when cable/bus idle start to transmit;
Whilst transmitting, computer monitors cable/bus to check for collision // to check if signal is identical to what it is sending;
Collision occurs if two computers (start) sending at same time // if two packets/frames in transit at same time;
If collision detected, jamming signal/signal warning of collision sent;
To ensure other (transmitting) computers aware of problem // to stop other computers sending data;
Computer that detected collision also stops sending data;
Then waits a random period before attempting to retransmit/repeating transmission/this process;
Period is random to reduce likelihood of collision recurring (between computers that caused collision);
If a collision occurs again then waits a longer random time before attempting to transmit again;
Use of exponential back-off algorithm to determine wait time;

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality of written communication criteria (QWCx).

SUB	Candidate has produced a detailed description of how CSMA/CD works, including what happens if there is a collision (at least 5 points).
QWC1	Text is legible.
QWC2	There are few, if any, errors of spelling, punctuation and grammar. Meaning is clear.
QWC3	The candidate has selected and used a form and style of writing appropriate to the purpose and has expressed ideas clearly and fluently.
QWC4	Sentences and paragraphs follow on from one another clearly and coherently.
QWC5	Appropriate specialist vocabulary has been used.

5–6

To achieve a mark in this band, candidates must meet the subject criterion (SUB) and 4 of the 5 quality of written communication criteria (QWCx).

EXAM PAPERS PRACTICE

SUB	Candidate has produced a reasonable description which may or may not cover what happens in the event of a collision (at least 3 points).
QWC1	Text is legible.
QWC2	There may be occasional errors of spelling, punctuation and grammar. Meaning is clear.
QWC3	The candidate has, in the main, used a form and style of writing appropriate to the purpose, with occasional lapses. The candidate has expressed ideas clearly and reasonably fluently.
QWC4	The candidate has used well-linked sentences and paragraphs.
QWC5	Appropriate specialist vocabulary has been used.

3–4

To achieve a mark in this band, candidates must meet the subject criterion (SUB). The quality of written communication should be typified by the QWCx statements.

SUB	Candidate has produced a very limited or unclear description of how CSMA/CD works.
QWC1	Most of the text is legible.
QWC2	There may be some errors of spelling, punctuation and grammar but it should still be possible to understand most of the response.

QWC3 The candidate has used a form and style of writing which has many deficiencies. Ideas are not always clearly expressed.

QWC4 Sentences and paragraphs may not always be well-connected or bullet points may have been used.

QWC5 Specialist vocabulary has been used inappropriately or not at all.

1–2

Candidate has made no relevant points.

0

Note: Even if English is perfect, candidates can only get marks for the points made at the top of the mark scheme for this question.

If a candidate meets the subject criterion in a band but does not meet the quality of written communication criteria then drop mark by one band, providing that at least 3 of the quality of written communication criteria are met in the lower band. If 3 criteria are not met then drop by two bands.

6

[14]

Q20.

(a) (i) Computers/devices/nodes/PCs connected/linked/communicate together;
R machine
A using a LAN protocol e.g. Ethernet

Over a small geographical area / e.g. a room/a building /a site ;

2

(ii) Bus ;
R line

1

(iii) Serial ;

1

(iv) Ring // star ;

1

(v) Printer; (bar code) scanner; multifunction machine ; modem ; message boards ; server
Providing audio/video or any additional server; console dedicated to audio/video ;
Projector ; FAX machine ; external hard drive ; card reader ;
A bridge / hub, / switch / router / gateway / firewall ;

Max 2

(b) (i) Bargainbooks-r-us.co.uk ;
R answer with anything added to this

1

(ii) The file (name); the page requested; home page;

Max 1

(iii) The web server cannot find the page requested //
(examples) the page has been deleted / moved to different folder / does not exist ;
the page is in the process of being updated / page is currently off-line;

EXAM PAPERS PRACTICE

R anything which implies there is no connection
R timed out

2

(c) (i) Computers (and networks) connected/linked/communicating ;
A using a WAN protocol e.g. TCP/IP
Over a large/wide geographical area / e.g. city/county/country/ globally / e.g. The Internet ;
R WWW

1

(ii) E-mail communication with the outside world (A or B) ;
Email/easier communication between libraries // the library and a borrower (A or B) ;
Enquiries about books available at other libraries (A or B) ;
Electronic transfer of documents/information between libraries (A only) ;
Backup of data/network administration for all libraries is more manageable/done centrally (A only) ;
A Accept benefits which imply access to the World Wide Web / Internet (A or B) ;

Max 2

[14]

Q21.

(a) LAN; because the buildings are on one site

2

(b) (i) Pupils benefit: can access their work/resources on any computer;
Can print on any printer;
Can access information from any computer;
Can use VLE/intranets/shared folder;
Can submit work over network;

Some answers can occur in more than one section but can only be awarded once
Ignore references to Internet

1

(ii) Teacher:
Can access pupil database/information from any computer;
Can register pupils from any computer;
Internal e-mail/communication between staff or between staff & pupils;
Monitoring useage of network;

1

(iii) Head of year / personal tutor: can access pupil attendance data directly;
Can access pupil database from any computer;
Internal e-mail/communication between staff or between Staff & pupils;

1

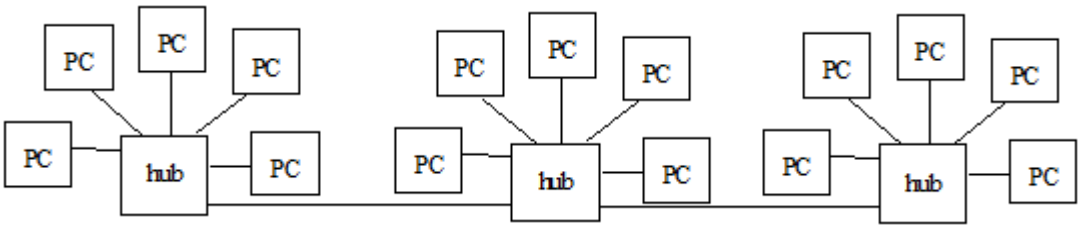
(iv) Head / principal: can get stats of attendance (more easily);
Can get stats of pupils (on courses) (more easily);
Internal e-mail/communication between staff;

1

(c) *1 mark for PC/workstations linked to hub;*

EXAM PAPERS PRACTICE

1 mark for 15 PCs connected to hub(s);
If hubs incorrectly labelled but topology ok, give 1 mark
1 mark for hub to hub links (if all PCs connected to 1 hub give 1 mark for this);



Components must be labelled. Accept PC/Computer as equivalent label no arrows needed for physical diagram allow connection between hubs via backbone
***A** hubs connected via another hub*
***R** link via server*
***I** a server connected to bus or hub*

3

(d) (i) Hub: collision domain involves all computers connected to hub;
Switch: collision domain limited to 2 computers;
Hub broadcasts packet to all computers; switch only sends packet to receiver;

2

(ii) No collisions possible with a switch // collisions reduced;

1

(e) To prevent unauthorised access to a private network // to safeguard the school's network against hackers to prevent unwanted intrusion from outside internal network; to block internal access to specific external sites; block certain ranges of IP addresses; close ports;
R references to viruses

Max 2

[14]

EXAM PAPERS PRACTICE

Q22.

(a) Network card
- allow the PC to communicate/send and receive/transfer data with other devices on the network / uses a standard protocol;
- card holds the unique network address for that device / decides whether data sent along the cable has a destination of 'this' computer;
- card converts parallel data from the PC to a serial stream of data (for sending on the network) / or vice versa;

R 'connnect'

Max 2

(b) Benefits of having a network
- provides for more effective data transfer / easier to transfer data;
- provides for the centralised storage / management of data files / folders / documents / programs / e.g. improved management of documents/contract changes;
- allows specialist applications to be used e.g. internal e-mail, diary scheduling applications;
- more flexible work practices;
- Internet access from any terminal;

- central control over the security of data / backup of data / usage;
- centralised management of software patches/upgrades;
- create an Intranet site;
- sharing files;
- sharing of peripherals /e.g. colour printer;

R Sharing programs // Better communication between users

Max 3

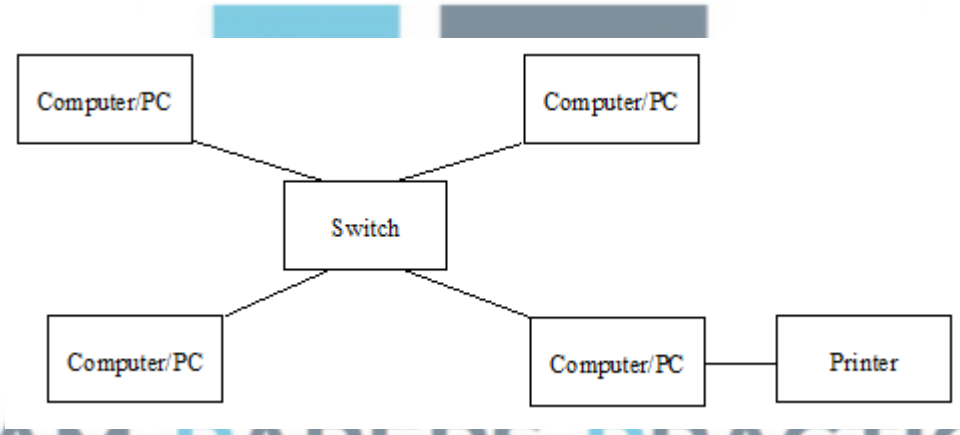
[5]

Q23.

(a) In a peer-to-peer network there are no dedicated servers;
In a peer-to-peer network all computers are equal / have equal status;
Each computer functions as both a client and a server;
User at each computer acts both as user and administrator;
User at each computer controls what is shared with other computers;
A user logged in at one peer computer is able to use resources on any other peer computer;
R each computer directly connected to each other, so can send to each other without a server
R all computers have same rights

Max 1

(b)



EXAM PAPERS PRACTICE

T.O. if a server included in driagram
I boxes
I routers / modems
1 mark for switch with 4 computers/PCs connected;
1 mark for printer connected to computer;

2

(c) (i) Computer C is in a different subnet // network ID is different;
A correct IP address
A there are two subnets
R not on the same LAN

1

(ii) 192.168.5; **A** 192.168.5.0;

1

(iii) 0-255; more correctly: 1-254;
or any in the range 192.168.5.1 - 192.168.5.254

(since 0 means all addresses on subnet, and 255 is reserved as roadcast address)
R a specific IP address

1

(d) (i) A router is a device that receives datagrams/packets from one omputer and uses the IP addresses that they contain to pass on these packets, correctly formatted, to another computer; a router is a device that uses IP addresses to route packets/datagrams;
Router keeps LAN traffic segregated from connection to ISP;

1

(ii) IP address: 222.125.105.15
Reason: router needs to have a presence on Internet so that it can be reached from anywhere;
Public address must be unique over whole Internet // must be visible on Internet // provides identity on Internet;
A because 192.168.5.1 is a private/non-routable address;

2

(iii) 192.168.5.1

1

[10]

Q24.

(a) (i) World-wide collection of networks/computers using TCP/IP;
World wide collection of networks/ gateways/ servers/ computers
Using a common set of telecommunications protocols to link them together;
World-wide collection of networks/ computers using the same protocol;
World-wide collection of networks/computers using a standard protocol;

1

(ii) Collection of servers using Hypertext Transfer Protocol/HTTP//
Collection of data files/ documents using Hypertext Mark-up Language/ HTML/ XHTML/ XML;

1

EXAM PAPERS PRACTICE

(iii) Computers connected within a small geographical area/building/site;
A computers connected using local area network/LAN protocols;

1

(iv) Computers connected over a large geographical area;
A computers connected using wide area network/WAN protocols;

1

(v) Network providing Internet facilities within an organisation/
LAN using Internet protocol;

1

(b) (i) Any valid domain name, e.g. aqa.ac.uk;
R www.aqa.ac.uk

1

(ii) Any valid address in the range 0.0.0.0 to 255.255.255.255;

1

[7]

Q25.

(a) Bus;

R line

1

(b) Star;

1

(c) (i)

(*Advantage:*)	(*Reason:*)
Lower cost//	reduced cabling//
More flexible;	easy to add/remove stations;

A advantage and reason swapped round
A cheaper
R Easy to set up

2

(ii)

(*Advantage:*)	(*Reason:*)
If one cable/wire fails it affects Only one computer//	as each computer is directly connected to central computer//
Simple to isolate faults// Different computers	as messages are sent directly to central computer;
Can transmit at different speeds// system more secure//	**A** each computer has its own line;
Network does not degrade when highly loaded;	

R collision free unless explained
R easy to add / remove computers
R reliability
R faster
R computer/node failure
A advantage and reason swapped round

Reason mark not dependent on gaining advantage mark

2

[6]

Q26.

(a) **A** set of rules/procedures;

1

(b) Bus;
R Ethernet on its own

1

(c) Twisted pair//coaxial (cable)//optical fibre//fibre optic;

1

(d) Need first octet or first and second octet or first, second and third octet to be identical. Also must have four octets.

For example:
192.168.0.1
192.168.0.2
R without full stops

1 mark for four octets;
1 mark for same LAN;

2

(e) (Use candidate's example from (d))

EXAM PAPERS PRACTICE

(i) 192.168.0;

1

(ii) 1 or 2;

1

(f) A (unique) address/identifier assigned to network card // (unique) hardware address/identifier;

1

(g) Any two tasks @ one each
Allocation of port numbers;
Routing a packet/frame/segment to correct application/service;
Splitting messages/data into packets // Disassembling messages // Assembling packets;
Adding TCP headers // Adding sequence nos;
Error handling // sets parity bits;
Checking that transmission successful;
Resending transmission if necessary;
A Sets packet size;

2

(h) Any one of the following applications for one mark;
Telnet;
Internet browser;
http (client) // web server;
email;
FTP;
TFTP;
SMTP;
R Non-networked applications such as word processor

1

(i) Internet Registry // Internet Registrar;
A I.P. Registry/Registrar

1

[12]

EXAM PAPERS PRACTICE

Q27.

(a) Data bus;
carries data to/from processor / memory / devices /components;
Address bus;
carries addresses / identifies locations;
Control bus;
carries control signals / controls devices;
A by example

Max 1 mark for carries Data / carries addresses / carries control signals

6

(b) Network adapter / network card;
A named example e.g ethernet card generate / understand signals / data (that conform to the LAN protocol) /
Allows (successful) communication / Provides a unique network address;
R connect

2

(c) Faster transmission;

1

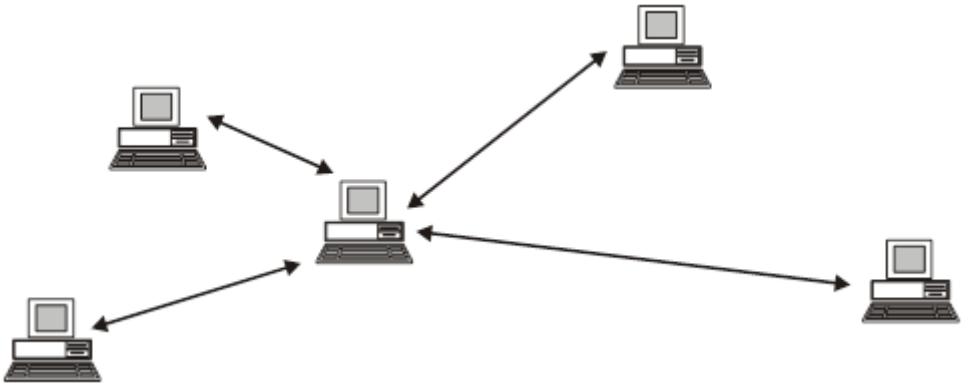
(d) Data transmitted longer distance than is possible with parallel / less expensive to cable;
R cheaper

1

[10]

Q28.

(a)



1 for connections; 1 for directions;

2

(b)

EXAM PAPERS PRACTICE

1 for connections; 1 for directions;

2

[4]

Q29.

LAN;
Justification:
Computers in health centre are in close proximity to each other/geographically close/in same building/on same site;
R Computers within health centre on its own

[2]

Q30.

(a) (i) Too much traffic//Congestion//slow to respond//too many (packet/frame) collisions; (Candidate may answer reduces traffic, etc. This is OK)

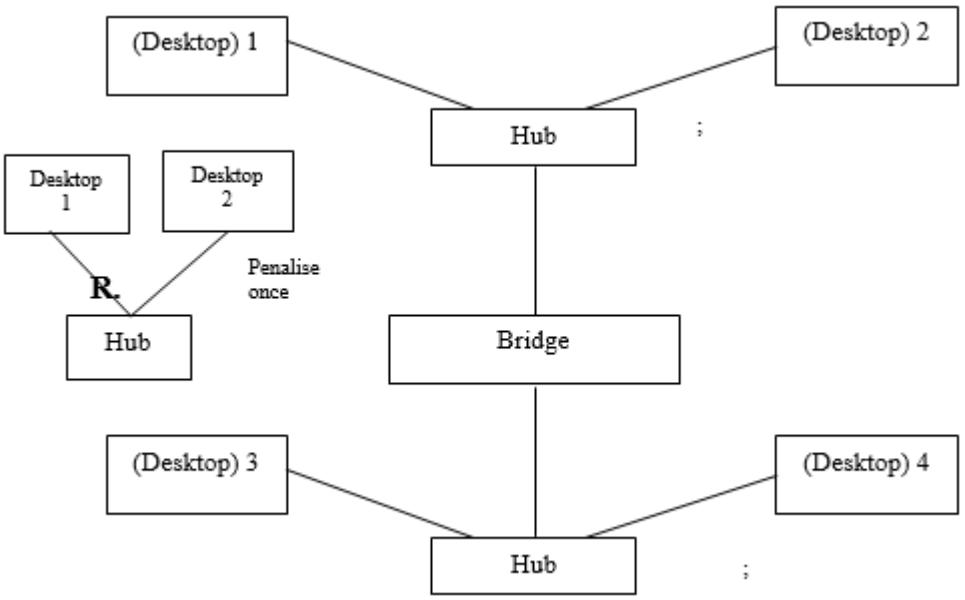
A Performance degrades

1

(ii) Bridge "learns" which desktop PCs connected to each port//bridge stores Ethernet addresses of desktop PCs connected to port **A** and port B;
Bridge blocks packets destined for a desktop PC on same segment from being passed to other segment// Bridge only passes packets destined for a desktop PC on other segment; Packets between machines on same segment are ignored by bridge/blocked by bridge;
Packets between machines(using machine identifiers is OK, e.g. PC1) on different segments transferred by bridge;
A Messages for packets

2

(iii)



1 for first segment hub connected to bridge + desktops 1 & 2
1 for second segment hub connected to bridge + desktops 3 & 4
R Missing bridge correct hubs – penalise once
No hubs – scores zero

2

(iv) **A** user logged in at one peer computer is able to use resources on any other peer computer;
In a peer-to-peer network, there are no dedicated servers;
In a peer-to-peer network all computers are equal/have equal status;
Each computer functions as both a client and a server;
User at each computer acts as both a user and an administrator (determining what data, disk space and peripherals on their computer get shared on the network)//User at each controls what is shared with other computers;
A Network with no central control;
R Each computer is directly connected to each other and so can send to each other without a server
R All computers have same rights

1

(b) (i) To provide access/interface to the Internet/World Wide Web (to individuals/organisations/businesses);

EXAM PAPERS PRACTICE

To act as hosts for Web pages (that individuals/organisations/ businesses wish to publish on the Internet);
To provide electronic mail boxes;
To provide services related to Internet access;

1

(ii) **A** router is a device that receives datagrams or packets from one computer and uses the IP addresses that they contain to pass on these packets, correctly formatted, to another computer;
Device which uses IP addresses to route packets;

1

(iii) 192.168.1.1;

1

[9]

Q31.

(a) Network adapter/network (interface) card/Ethernet card;
A a named card type eg Token Ring Card;
R NIC *on its own*
I hub

1

(b) (i) A= Ring (network); B= Bus (network);

2

(ii) Higher transmission rates possible with high traffic/ performance of B degrades with heavier traffic;
R quicker no collisions;
A fewer collisions;
Transmission of messages is simple (as messages travel in one direction only);

Max 1

(iii) Easy/inexpensive to install;
Easy to add more stations/computers/nodes/clients without disrupting network;
R users instead of node
R cable breaks, **R** computer breaks

Max 1

EXAM PAPERS PRACTICE

(c) (i) A protocol is a set of rules; **A** set of procedures; **A** a rule;
I other terms unless talked out in rest of sentence

1

(ii) To ensure successful communication/transmission/interaction;
(between different computers) answer must imply communication/receiving data not hardware linking
R sending data only
R if connection only

1

[7]

Q32.

(a) Bus;
R line

1

(b) (i) Connections correctly done as a star; allow a hub drawn in no arrows required.
R diagram of a mesh network

1

(ii) *Accept advantage and reason swapped around*

If one cable fails it affects only one computer; as each computer is directly connected to central computer;
R computer fails
Simple to isolate faults; **A** each computer has its own line;
Different computers can transmit at different" speeds;
System more secure; as messages are sent directly to central computer;
Network does not degrade when highly" loaded;
R collision free *unless explained*
R easy to add / remove computers
R reliability
R faster

Max 2

[4]

Q33.

(a) (i) Share printer; share database; central backup possible;
Data consistency; electronic messaging/communication;
Share data/information/files/software; access files from any computer;
Easier to upgrade software;

Max 2

(ii) Network adapter/network card; **R** modem

1

(b) (i) More secure;
If a cable breaks only one node is out of action; **R** computer instead of cable performance does not degrade with increase in traffic;
Easier to find cable fault;

Max 1

EXAM PAPERS PRACTICE

(ii) Cheaper to set up; less cable needed;

Max 1

(c) (i) The name of an internet site/user friendly id of an internet site;
R address

1

(ii) (www.)companyname.co.uk *(any valid domain name)*

1

(iii) *Does not need www, could be ftp or wap also*

1

(d) A communication system providing similar services to the Internet;
Solely within a particular company or organisation/company wide;
An internal; internet;

Max 2

[9]

Q1.

A very good range of responses was received to this question, with approximately half of students achieving five or more marks. Most students addressed all three aspects of the question (hardware, network, database and software). Students tended to make more points about how the hardware could be improved than about the other two areas. This was acceptable but students needed to have covered all three areas to achieve a mark of ten or above.

Some students wrote too vaguely to achieve marks, for example by writing that a “faster processor” would improve performance, without referencing a factor such as the clock speed that would make the processor faster. Other mistakes included believing that the question required students to contrast thin-client and thick-client and that the system was web based.

A small number of students wrote about issues which might be causing the system to perform poorly instead of explaining how the performance of the system could be improved. Such responses were not worthy of a mark.

Q2.

This question was about securing the connection from a wireless device to a wireless access point. Just over half of students achieved some marks. Good responses suggested the use of measures such as not broadcasting the SSID or setting up a MAC address whitelist. Some students lost marks by focussing on general security measures such as login systems or a firewall instead of the security of the access point. Others stated appropriate measures but did not explain how they would make the connections more secure, which was required to achieve the marks. It is important to note that a WPA2 key is an encryption key used to encrypt transmitted data and not a login password.

EXAM PAPERS PRACTICE

Q3.

A broad range of responses were made to this question. Over half of students achieved at least three of the six marks, with approximately 10% achieving full marks. The most common point of confusion related to how a communication started, with many students believing that the first step in the communication was the transmission of a request to send signal, missing out the monitoring of the wireless channel by the transmitter to check if the channel was idle. Some students confused CSMA / CA with CSMA / CD, believing that the system would detect collisions that occurred. Few described the acknowledgement system or explained that the RTS and CTS signals would block other transmissions.

Q4.

This question required students to write an extended response that covered a number of different areas of the specification. Responses often covered the aspects of how the owners could have protected their networks and what legal and ethical issues might have arisen well but neglected the aspect of how it was possible for the data to be collected and were not specific enough with regard to how the company’s practices might have changed as a result of the incident.

With regard to how the data was collected, examiners were looking for students to

recognise that WiFi signals could travel over a wide area and that any WiFi receiver in range could read the data from these packets. Few students made these points, but a reasonable number identified that the data may not have been encrypted or that an outdated encryption protocol such as WEP might have been used.

Good responses recognised that an appropriate measure to prevent the data from being collected would have included encrypting the data using a protocol such as WPA2. In the question's context, measures such as enforcing a MAC address whitelist or using a firewall were not appropriate as the cars were simply collecting information that was being transmitted; they were not trying to connect to the wireless access points. Some students referred to adding a password to the network which was not a strong enough point to be mark worthy; they failed to identify that the "password" they were referring to would actually be used to make a key for an encryption system.

Students are not required to have knowledge of specific legislation for this specification, but should have an understanding of issues around areas of ethical and legal concern such as privacy, data protection, copyright and hacking. Nevertheless, mention of specific relevant legislation was considered mark worthy. Relatively few students took the opportunity to really discuss the legal and ethical issues. For example: given that the data was being transmitted freely through the air, would accessing it really count as hacking, given that the functionality involved was added by a small number of developers, were they or the company responsible for it, would the nature of any offences committed depend upon the type of data collected, did it matter if the data collection was intentional or accidental? Students should be encouraged to consider this sort of reflection when answering this type of question.

Most students recognised that the company needed to have better oversight of the development process but many made general statements about this and did not suggest specific measures that might be taken to improve their practices, such as introducing third-party review of code or improved training of developers on legal and ethical issues. Points relating to testing were not considered mark worthy unless it was explicitly stated that the testing would be focussed on ensuring that the software had no additional functionality or that the data collected by the cars was all relevant to the intended purpose of the system.

Some students appeared to have completely misunderstood the scenario and wrote at considerable length about the rights and wrongs of companies using cars to take photographs in public places rather than about interception of WiFi signals. Students need to ensure that they are answering the question asked rather than a question that they might have prepared for.

EXAM PAPERS PRACTICE

Q5.

More students successfully described a physical topology than a logical topology. This is unsurprising given that the latter is a somewhat abstract concept. Good descriptions of a physical topology recognised that this referred to the layout of the cabling that connected the devices together. Students often missed out on this mark by just stating that the physical topology related to how devices were connected or wired together. This description did not capture the concept of layout and could equally have referred to, for example, the choice of the type of cable used. Good descriptions of logical topology identified that the logical topology would define how the data flowed through the network, for example the protocol that was used. A relatively common misconception was that a physical topology was a wired network and a logical topology was a wireless network.

Q6.

This topic was one of the least well understood topics that were covered on the question

paper. Just a quarter of students were able to achieve three or four marks. Students often either (1) confused server-based with thick client and peer-to-peer with thin client or (2) confused server-based with a star physical topology and peer-to-peer with a bus physical topology. Many students referred to all of the processing being done on the server, each device having its own connection to the server, all communication going through the server or “everything on the network” being stored on the server, none of which are true.

Good responses recognised that some resources (eg files, web pages, databases) would be stored on the server in a client-server system and that the server would provide these resources to clients in response to requests from them. They went on to identify that in a peer-to-peer system resources would be stored locally on each computer and these computers could share their resources with any other computer on the network.

Many students wrote about peer-to-peer systems in the context of BitTorrent file sharing systems. This was acceptable but students should be aware that this is just one type of peer-to-peer system and that it is not the case that peer-to-peer systems must be connected to the Internet or that in every peer-to-peer system files are split into parts and distributed across multiple computers. Another common misconception was that client-server systems had to be connected to the Internet.

Q8.

This question was about methods of using software, including rich (thick) and thin client systems and the use of Software as a Service.

Most candidates achieved some marks and were able to describe the fundamental difference between the two, ie that rich client systems did processing locally whilst thin client systems relied on processing data on a server. Descriptions of the different hardware requirements of the two were less good. As was the case when a similar question was asked previously, many candidates just referred to “better hardware”, “more powerful machines” or even “more hardware”, none of which were markworthy. To achieve marks candidates needed to make specific points such as a rich client needing to have sufficient secondary storage for all the software. Many responses also only concentrated on the hardware requirements of the workstations, ignoring the server and network which would have been required for a thin client system.

EXAM PAPERS PRACTICE

With regard to Software as a Service, most candidates knew what this was, ie software that was accessed and run on a remote server, and many candidates wrote a little about it, but few went on to describe many other features of it, such as the fact that it might be provided on a subscription basis rather than as a one-off purchase or that the server would be operated by a separate company who would take care of tasks such as updating the software.

A small number of candidates got rich and thin client systems the wrong way around or compared peer-to-peer with server based systems instead of answering the question asked. Another occasionally seen mistake was to believe that thin clients connected to rich clients so the rich clients could do the processing.

Q11.

This question was about networking.

For part (a) students had to identify an appropriate IP address. This was satisfactorily tackled with just under two thirds of students achieving the mark. Common mistakes were to give an IP address that started with the same three octets as the IP address assigned to Port Y of the router instead of Port X, to use 0 as the last octet and to give a three-octet IP address.

Over three quarters of students correctly identified the physical topology as being a star in part (b).

The most frequently seen correct response to part (c) related to the increased security offered by the use of non-routable IP addresses. Other good responses related to the limited number of routable IP addresses available using IPv4, and the difficulty of allocating these to devices. Over half of students achieved one mark, but few went on to achieve both the available marks.

For part (d) students had to explain how the subnet mask was used. Explanations were poor and only a quarter of students achieved any marks at all. Good responses explained that the subnet mask was logically ANDed with the destination IP address to produce the subnet ID of the destination. The same process was repeated with the source IP address and subnet mask to produce the subnet ID of the source. These two subnet IDs were then compared and if they were different (as was the case in the example) then the data would have to be sent to the router instead of directly to the destination. Common misconceptions were that the data was passed around the network until it found a computer where it matched the subnet ID, that the subnet mask was capable of doing things itself, and that the mask was a form of security.

For part (e) students had to describe how a firewall worked. Many responses were superficial, referring only to the data being checked, without explaining against what criteria; just over half of students achieved at least one mark, but very few achieved more than this. Appropriate methods that might be used included using an IP address blacklist, blocking specific ports, inspecting the contents of packets and stateful inspection. Some students erroneously believed that a firewall could perform essentially the same function as virus checking software.

Part (f) was about the difference between baseband and broadband. Just under half of students achieved this mark, and the most common mark worthy response explained that baseband carried one channel over the whole bandwidth of a medium whereas broadband divided the bandwidth up into a number of channels. There was some confusion with parallel and serial transmission and a small number of students, though fewer than when this topic was previously asked about, responded that broadband was faster.

EXAM PAPERS PRACTICE

Part (g) was well answered with three quarters of students achieving a mark. The most commonly cited reason was the faster speed of transmission when using a cable or increased reliability, both of which were relevant to streaming television pictures.

Q12.

(a) This parts (i) to (iii) all required students to determine IP addresses. In each part, approximately three quarters of students did so correctly. Common mistakes were to write IP addresses that were formed from three octets instead of four, to write IP addresses that were not appropriate for the segment or to give a value of 0 for the last octet of an IP address.

(b) This part was well tackled with the vast majority of students achieving at least one mark and just under half achieving both marks. Many students discussed collisions or the effects of cable failure. Students who missed out on the second mark usually did so because they failed to explain their answer in enough technical detail.

(c) This parts (i) and (ii) were about Software as a Service, or SaaS. The vast majority of students achieved one mark on each part, although only just over a third achieved both marks for part (i). For part (i), the most commonly seen correct responses related to the fact that the software could be used on Internet-connected computers

outside of the office and that the hardware requirements would be lower for SaaS. Some candidates made good points about the company not having to update the software, but others mistakenly suggested that the company would only have to update the software once, confusing SaaS with a thin client system. With SaaS, the company would not have to update the software at all as this would be handled by the provider of the SaaS. For part (ii), the most commonly seen correct response was that unreliability of the Internet connection or service would make the software inaccessible.

(d) This part was poorly tackled, with just under half of students achieving any marks. The most commonly seen correct response was that a LAN would use baseband and a WAN broadband. Other valid responses included that a LAN would have faster transmission speeds and lower latency than a WAN and that more security issues might need to be dealt with on a WAN. Some students compared the communication media that would be used. Those who did so in detail often achieved a mark, but many made vague or incorrect points such as that a LAN would be wireless and a WAN wired. Some students assumed that a WAN and the Internet were the same thing and gave responses relating to IP addresses that did not really answer the question.

Q13.

Part (a) was well answered, with the majority of candidates achieving all three marks. Common mistakes were to give IP addresses made up of three octets instead of two, to give a value of zero for the Host ID or to include a port number in an IP address.

For part (b), the overwhelming majority of candidates recognised that this was a bus topology.

For part (c), candidates who knew the correct format of a subnet mask almost always got the right answer but quite a lot of candidates appeared not to know what a subnet mask was at all.

Part (d) was poorly answered, with only about a third of candidates achieving the mark. Many candidates confused a Server Operating System with either a Network Operating System or a Thin Client System. Candidates needed to recognise that a Server Operating System was optimised to allow the server to efficiently deliver services to clients on the network. Well explained examples were also creditworthy, but the example of just loading files was not sufficient as this was given in the question.

A good awareness was shown in part (e)(i) of how to maintain the security of a WiFi network. Answers such as the use of WEP / WAP, disabling the broadcast of the SSID and the use of a MAC whitelist were common. A more problematic answer, offered by many candidates, was the use of a password to connect to the network. This answer was credited if the examiner understood that the “password" was in fact a passphrase entered to encrypt the data on the WEP / WAP connection, but it was not credited if the answer could be interpreted as a logon system. Candidates need to be aware that the passphrase entered is not a password checked against a database of valid passwords but instead, it is used to calculate the encryption keys that will be used for data transmission. Candidates also need to be aware of the meaning of important keywords in a question such as “describe". A single word or very brief response is unlikely to be creditworthy if a question has asked for a description of something.

Part (e)(ii) was very well answered, with the most popular answer relating to the relative ranges of WiFi and the most common implementation of Bluetooth class. The most common misconception was that only two Bluetooth devices could connect together at once.

EXAMPLE PREDICTION

Part (f) asked about routing a packet of data from a computer on a LAN to a web server across the Internet. Candidates were expected to explain how the packet would be routed both internally on the LAN and externally on the Internet. Almost all of the mark scheme points were made by some candidates, but very few candidates individually made enough of them. Generally, the routing of packets externally on the Internet was dealt with more successfully than routing on the LAN.

Very few candidates explained how the subnet mask would have been used by the student's computer to identify that the destination web server was not on the same segment as it was, and therefore the packet would first be sent to Router 1. Pleasingly, most candidates recognised that the packet would then be sent on to the gateway but many did not achieve the mark for this point because they failed to explain that this was done because the destination computer was outside of the LAN.

External routing was generally better covered, with candidates explaining how the destination IP address would be used to pass the packet between routers in a hierarchical fashion. A small number of candidates recognised that routing decisions were made by each router (using a routing table) and also explained the distinction between how the IP addresses and MAC addresses would be used.

Common mistakes were to explain about the use of the TCP / IP stack or how packets were formed or to discuss the use of CSMA / CD. These points were not usually wrong, but did not address the question.

For part (g), approximately half of the candidates achieved at least one mark comparing routable and non-routable IP addresses, but few achieved both. Good responses referred to uniqueness, who would issue the IP addresses and whether or not they could be directly reached across the Internet.

Some candidates stated that it was not possible to connect directly to a non-routable IP address. This was not creditworthy as it is possible to connect directly to such an address if you are on the same network. Candidates needed to make clear that they meant “across the Internet" to achieve the mark. Other common mistakes were to give opposing sides of the same point and to confuse the comparison between routable and non-routable IP addresses with comparing static and dynamic IP addresses.

EXAM PAPERS PRACTICE

Q14.

Describing the differences between the WWW and the Internet demonstrated that there are still some students who do not understand the role of the Internet. It was common to see the idea that the WWW was the main focus rather than being an application that uses the connections provided by the Internet. Students who scored full marks provided a good description of the Internet and the WWW and highlighted factors such as the protocols used.

Part (b) allowed students to mention that a message is split into packets and this is how many secured at least one mark. It was clear that students have a better understanding of routing but that this is still an area that could be improved.

The majority of students secured both marks in part (c). Students were not awarded a mark for just stating ‘IP’ and it was necessary to write at least ‘IP address’ to secure the mark.

Q15.

Part (a): Students were required to explain why a server-based network was more appropriate for a college administration system than a peer-to-peer network. Responses

that either explained general advantages of a server-based network or that were written in the context of using a centralised database on a server-based network were both given credit. However, many responses were very weak and amounted to little more than stating that the database could be stored on the server. Good responses considered issues such as security, management, concurrency issues and the creation of backups. Just under half of students achieved any marks for this question part.

Part (b): For this question part, students needed to explain how a thin-client network worked and the impact of this on the hardware that should be purchased to implement one. Most students were aware of the fundamental concept that in a thin-client network the majority of processing tasks were completed by the server. Disappointingly, far fewer then went on to explain that the clients would function primarily as input / output devices with the network being used to transmit input and output from the clients to the server and back again. The worst tackled aspect of the question was the description of the impact of the method of operation on the choice of hardware. Students often wrote vague statements such as, "a more powerful server would be required,"or "the clients could be quite weak". At this level, students needed to give specific examples of hardware requirements such as that the server might require multiple processors to deal with the workload or that the clients may not need a hard disk drive. The most neglected aspect of the hardware part of the question was the impact on the network infrastructure of the volume of data that needed to be transmitted. A small but noticeable number of students wrote about the differences between thick and thin-client systems, failing to directly answer the question. Some students also confused thin and thick-client systems with star and bus topologies.

Part (c): About a quarter of students were able to identify that a gateway was used to link together two networks that used different protocols and would perform protocol conversion. A common mistake was to confuse a gateway with a firewall. Many students just restated what they were told in the question, ie that it would be used so that staff could access the network from outside of the college.

Q16.

When describing the role of a router it was common for weaker students simply to point out that it, ‘routes information,’ and, ‘passes information from the client to the server.’ Answers tended to be vague perhaps indicating that this is currently an area of subject matter that is not particularly well known. Students who identified that a router forwards packets from one network to another and who stated that it inspected the destination IP address were awarded the marks.

EXAM PAPERS PRACTICE

It was pleasing to see that the majority of students could name a protocol associated with e-mail. Incorrect answers included Telnet, FTP and HTTP but the majority correctly answered with SMTP or POP.

When describing the TCP/IP stack it was clear that the stronger students could place a few points into each of the layers and they were rewarded with high marks. It was common for weaker students to mix points up between layers or to fail to provide enough information.

Q17.

Part (a)(i), ii: Approximately two-thirds of candidates responded with an appropriate IP address for each of these question parts. However, as in 2010, a small but significant minority of candidates gave answers that could not possibly be IP addresses.

Part (b): The correct subnet mask was 255.255.255.0. Approximately half of the candidates identified that this was the case.

Part (c): Answers to this question part covered a range of issues: security, reliability and throughput. The most common correct response explained that there would be a reduction in the number of collisions. Candidates needed to ensure that their explanations were sufficiently detailed to achieve both marks.

Part (d)(i): This topic was reasonably well understood, with candidates explaining that cabling costs would be lower as a single cable would run around the entire network. A small but surprising number of candidates believed that a bus network would be faster because only one cable was involved.

Part (d)(ii): There were many good responses, covering issues relating to reliability, security and speed. The most common error was to state that a star topology was more reliable because the failure of a single computer would not affect the others. Rather, it is the limited effect of the failure of a single cable that would improve reliability.
Part (e): Most candidates managed to write lengthy responses to this question part. The quality of these answers was quite variable, with some candidates demonstrating an extensive understanding of network security when connected to the Internet whilst other responses were quite superficial. When answering this type of question candidates need to make sure that they address the entire question. Some candidates lost marks by focussing only on the security measures that the network manager could put in place, either ignoring or only briefly mentioning the threats to which these would be responses. To achieve marks, candidates needed to describe the threats and measures, not simply name them.

Q18.

Part (a): The baud rate is the number of signal changes per second that can be supported by a transmission medium. Approximately half of the candidates stated this correctly, but some defined the bit rate instead.

Part (b)(i): The bit rate can be higher than the baud rate if more than two different signal levels are supported so that more than one bit can be encoded in each signal change. This was recognised by some, but not many, candidates. A commonly held misconception was that the bit rate could be higher than the baud rate if the data being transmitted contained consecutive bits of the same value – for example, transmitting three 1s followed by a single 0 would only need one signal change.

EXAM PAPERS PRACTICE

Part (b)(ii): This question part was well answered, with the vast majority of candidates getting two of the three marks. Most candidates correctly explained the first two missing steps but got the last one wrong. The final stage in the handshake should have been that the printer indicates it is again ready to receive. Many candidates mistakenly believed that the printer indicated that the data had been received or was being printed instead.

Part (c): Candidates showed only a limited understanding of baseband and broadband, with just over a third scoring and marks. Many clearly had little idea what the terms meant and were just guessing based on their general knowledge of “broadband” and knowing what the terms LAN and WAN mean. Those that did achieve some marks often made quite superficial points, usually about the number of communication channels, rather than demonstrating a sound technical understanding of how the two systems differed in their method of operation.

Q19.

Part (a): Many candidates scored full marks by identifying three appropriate IP addresses. A small but not insignificant number of candidates wrote IP addresses consisting of just three decimal numbers, clearly indicating that they did not understand the concept. Candidates also need to be aware that the last octet of an IP address cannot contain

certain values. Some lost marks by giving this as either 0 or 255.

Part (b): The overwhelming majority of candidates correctly identified the topology that was used.

Part (c): Many candidates were able to state the subnet mask correctly but few were able to explain its purpose. A commonly held misconception, presumably derived from the word mask, was that it would hide a computer's IP address from other computers. The purpose of the subnet mask is to allow a communicating device to determine whether or not another device that it is communicating with is on the same subnet, so that data can be sent to it directly, or a different subnet in which case communication must be via the router.

Part (d): There were many very good responses to this question. Candidates used the full range of responses that were given in the mark scheme, with the most popular ones being the use of encryption and needing a key to access the network. A small number of candidates lost marks by discussing general network security measures, such as the use of a firewall, when the question had asked specifically about securing the connection to the wireless access point.
Some candidates understood that access could be limited based upon the address of the computer, but thought that the IP address would be used rather than the MAC address and so did not gain credit.

Part (e): Responses to this question part were mixed. The majority of candidates scored some marks, but only a tenth of candidates provided responses that were awarded all six marks.
Some candidates lost marks through weak descriptions. A good example of this is that a certain time is not the same thing as a random time.

The Quality of Written Communication was similar to responses to question part 2b.

Q20.

In general candidates performed well on this question.

EXAM PAPERS PRACTICE

(a) (i) There were two key concepts required for the two marks. The idea that computers are connected and then proximity, usually explained by the candidate through example e.g. within the same building.

(ii) (iii) and (iv) Were all generally well answered.

(v) Most common answers were printer and scanner, although some more perceptive answers described a server which offered some service to the users of the network.

(b) (i) The old chestnuts were the inclusion of the www or the omission of the .co.uk to or from the domain name and, although one of these errors was allowed as an A (acceptable) answers on previous papers, it did not gain credit. Also spelling errors were penalised.

(ii) All that was required for the mark was an appreciation that this refers to the page. Many candidates described it as the folder where the file was to be found (again, probably thinking back to previous questions where the URL had included a folder).

(iii) Many candidates wrongly thought that this must be because the web site was unavailable and offered a variety of possible reasons. Any answers which

implied there was no connection to this site did not score the mark.

(c) (i) The same thinking applied here as for (a) (i); the idea that there were multiple computers or networks connected, and for the second mark an explanation of 'wide area'.

(ii) The most common failing was for candidates was to describe a borrower and an administrator benefit which were in effect the same, and so scored only one of the two available marks. 'Administrator' was taken in its most general form, and answers which described a benefit to a network administrator were considered acceptable. The most common wrong answer was that "borrowers would be able to return books to other libraries" (when the rubric of the question stated that "There is no system for the exchange of books between libraries").

Q21.

(a) Candidates were generally able to suggest correctly LAN, and the reason. Some candidates decided WAN was appropriate or didn't refer to the size of the site as the reason for the choice of LAN.

(b) This question was not answered very well with many candidates failing to refer to how the benefits related to the network or the PCs on the network.

(c) Many candidates were able to draw PCs connected to hubs. Many candidates, however, drew a bus of computers connected to a hub, rather than PCs directly connected to a hub. Candidates chose to put a bridge or a switch or a server between the hubs to connect them together. Many candidates failed to label their diagrams appropriately.

(d) (i) Some candidates answered this question by successfully identifying that hubs broadcast and switches send to receiver only. Some candidates made reference to the switch, but did not explain the hub or vice versa.

(ii) Most candidates were able to suggest reduced collisions as a reason.

EXAM PAPERS PRACTICE

(e) Many candidates were able to obtain one mark by explaining "to prevent unauthorised access to a private network". Only a few candidates could identify that a firewall can also block internal access to specific external sites. There were many references to viruses.

Q22.

There were some worrying wrong answers in both parts (a) and (b) of this question. Despite a clear scenario for the framing of the question, very few answers for part (b) made specific mention of points of detail from the stem of the question. For example, an answer which states "centralised storage of customer documents and contracts" is a much more convincing answer than "centralised storage of files".

(a) The two concepts that data signals need to be made compatible, and that each PC can be identified by other devices on the network was usually lacking. Network cards providing unique IP addresses was seen often. Even more worrying from a technical point of view is that many think the network card converts analogue to digital signals, confusing the function of the card with a modem. A vague statement about the need to 'connect' the PC with a network appeared frequently and scored zero.

(b) Only the better candidates could describe three distinct benefits. Many seem to think that software is shared; some went as far to say that you only need to buy one copy of a piece of software, clearly not understanding network licences or copyright issues. Sharing files, printers and access to the Internet from any terminal were the most common answers. Poor answers often gave general and imprecise answers such as “better communication” but not then saying how this would be implemented e.g. with an internal email system.

Q23.

(a) Although peer-to-peer networking is now very popular, few candidates could adequately describe it. It was not sufficient that each computer could send to another without a server. In a true peer-to-peer network there are no dedicated servers. Computers function as both client and server.

(b) Although the question asked for a labelled diagram, some candidates did not gain marks because they did not indicate which of their drawn boxes represented a computer and which the switch and printer. Some candidates substituted the switch for a hub, which did not gain credit. Many others drew a standard bus topology, also not worthy of a mark in this question.

(c) Many candidates correctly stated that computer C was in a different subnet/segment to the others. Some candidates thought computer C was in a different network, for which no credit was given.

A pleasing majority of candidates correctly stated that the network ID of this network was 192.168.5 and that host IDs could be any value in the range 1-254. Credit was also given to those who stated the host IDs could be in the range 0-255, even though 0 refers to all addresses on the subnet and 255 is reserved as the broadcast address.

(d) Many candidates failed to give enough detail to gain credit. It was not enough to state that the router routes data packets from one device to another. Candidates needed to state that the router uses IP addresses to do this.

Many candidates correctly stated that 22.125.105.15 was the correct IP address of the two given, which needed to be registered with the Internet registrar. However, not many could state a clear reason. Responses that gained credit included: because the public address needs to be unique over the whole Internet.

Many candidates could identify that the default gateway IP address was 192.168.5.1.

Q24.

This question was very badly answered. Candidates rarely showed that they understood the networking protocols involved.

(a) (i) It was very disappointing to see that so many candidates do not understand the Internet. Many answers confused the Internet with the World Wide Web and there were many answers that lacked the detail required to obtain any credit. At this level candidates should be able to give a technical explanation of the Internet.

(ii) There was much confusion between the Internet and the World Wide Web. Those candidates that were able to distinguish between the two were rarely able to give a technical explanation of the Web.

EXAMPAPERSPRACTICE

(iii) Candidates often failed to obtain the mark by giving a superficial answer. Credit will not be given for stating that: “A Local Area Network is a Network in a Local Area”.

(iv) As in part (iii), candidates often failed to obtain the mark by giving a superficial answer.

(v) Very few candidates understood that an Intranet is a network that provides Internet facilities within an organisation. A local area network is not an Intranet unless Internet protocols are used and few candidates were able to express this. A common misconception was that an intranet is a LAN with access to the Internet.

(b) (i) Answers to the domain name were rarely correct, often starting with http://www.

(ii) Again, there were few correct answers. Common mistakes were to give values less than 4 or values over 255.

Q25.

(a) Good marks were obtained from this part of the question with very few incorrect responses.

(b) Good marks were also obtained here.

(c) Some candidates confused the network topology with the use of the network giving answers that discussed the use of servers on the network. Candidates also found it difficult to identify the difference between an advantage and a reason. There were also a significant number of candidates who mixed up the two networks giving answers for (ii) in (i) and vice versa.

Q26.

Candidates’ knowledge and understanding of networking at the level of CPT 5 is still a source for concern.

EXAM PAPERS PRACTICE

Many candidates were able to define the term protocol correctly getting a mark for referencing a set of rules or procedures. Many were also able to correctly identify the network topology as a bus. In part (c) the examiners were looking for “twisted pair” or “coaxial cable” or “fibre optic”. “Cat 5” was rejected because it is a category of twisted pair. Candidates are advised to avoid manufacturers’ names and instead use generic names. Manufacturers’ names are “here today and gone tomorrow”.

A surprising number of candidates were unable to give sensible examples of IP addresses that could belong to the same network. Candidates must have practical experience that involves examining the IP address of a computer and another computer to which it is connected on the same sub-net. Candidates must also have some practical experience of using a sub-net mask to identify the LAN part and the host part of an IP address. Some candidates lost a mark because they were unable to give four octets or when four octets were given one or more octets were out of range - acceptable range was 0-255.

In part (f) the examiners were looking for an address assigned to network card. This is a hardware address fixed into the card at the time of manufacture. Some candidates described an address assigned to the computer that could easily have been interpreted as an IP address and so did not gain credit.

Some candidates' understanding of the TCP/IP protocol was not good enough to answer part (g) successfully. The TCP layer allocates port numbers so that when a client receives a response from a server the TCP layer can route the response to the application that sent the corresponding request. The TCP layer will split messages from the application layer into packets and will re-assemble packets received into messages which are then passed to the receiving application. The TCP layer is responsible for error handling, establishing a connection and monitoring this connection. It adds TCP headers to each packet that it sends, incorporating a sequence number into each.

In part (c) many candidates were able to give an example of an application found in the application layer. Popular answers were an Internet browser/HTTP client and a web server but there were many other possibilities. Some candidates wrongly answered word processor and missed the point. The application layer in the TCP/IP protocol stack deals with client/server applications.

Disappointingly, many candidates did not connect the type of organisation responsible for recording the allocation of public IP addresses with the office of an Internet Registrar. Instead, they erroneously answered Internet Service Provider. The latter provides one or more access points to the Internet. The mapping from point of presence on the Internet to individual users of an Internet Service Provider is done via IP addresses allocated by the ISP using blocks of IP addresses registered with an Internet Registrar.

Q27.

(a) The names of the three buses were generally known but fewer candidates were able to explain how they operate. A bus is a device that carries signals around the system. Common misconceptions were that buses store data or send data. Incorrect answers included reference to system buses and/or memory buses and many candidates failed to obtain full credit by not expressing themselves well enough.

(b) The network adapter was well known but candidates failed to obtain full credit by being unable to express themselves adequately when explaining its purpose. The question stated that the network adapter connects the computer system to the local area network. An answer that restates this is not going to obtain any credit.

(c) Many candidates understood that faster transmission can be obtained by using parallel transmission. Some simply stated a definition of parallel communication being many bits simultaneously transferred but failed to state why this might be of benefit.

(d) A substantial number of candidates stated that serial transmission was faster. Many more stated that it was cheaper but failed to give any reason as to why this should be the case. Many marks were lost on this part of the question.

Q28.

The star architecture was well known but there were many incorrect answers to the bus. Candidates also failed to obtain full credit by not indicating the direction of data transfer. Those that did indicate the direction of transfer often lost marks through carelessness. Very few candidates obtained full marks.

Q29.

Candidates performed well on this question.

Q30.

EXAM PAPERS PRACTICE

Most candidates made a reasonably successful attempt at this question but **router** was not well understood. Very few candidates knew that routers use the IP addresses of packets to route a packet across the Internet. They forward data packets if the destination is not on the current network. Routers are at the core of the Internet. Without routers we would not have an Internet. The specification states: “define this term and consider when and why routers are used. In particular, consider how routing is achieved across the Internet”. Understanding what is a router and routing is as fundamental to internet working as an understanding of what a nucleus is, and that splitting the nucleus produces a vast amount of energy, is to nuclear physics.

Q31.

(a) Most candidates correctly gave either ‘network card’ or ‘Ethernet card’ with ‘modem’ being the commonest incorrect answer. Many failed to spot the significance of the word ‘each’ in the question and gave variations on ‘file-server’ or ‘hub’.

(b) The vast majority gave the correct answers ‘ring’ and ‘bus’, with ‘star’ being a wrong choice for ‘A’ and ‘line/linear’ the usual wrong choice for ‘B’. Few candidates could think of genuine advantages of the two topologies.

(c) This is pure bookwork and has been asked several times in recent years but was poorly answered with many stating that protocol was needed to ‘prevent errors occurring’ or ‘to prevent collisions’. A significant number of candidates suggested a protocol was a device. It was described as a security system to control the network. Many candidates still give computers human characteristics: ‘protocols are needed so that computers understand each other’ rather than ‘so that different computers can communicate successfully’.

Q32.

(a) Most candidates correctly answered ‘bus’.

(b) (i) Most candidates drew a star network correctly, only a few wrongly drew a mesh topology instead.

(ii) Most candidates gained at least one of the two marks, usually for saying that if a cable breaks only one node is affected. The second mark was often lost because the candidate gave a second advantage rather than a reason. Indeed many candidates swapped the ‘reason’ and the ‘advantage’ round, though candidates were not penalised for this. Greater security was another correct response which a number of the better candidates gave.

EXAM PAPERS PRACTICE

Q33.

(a) (i) Most candidates gained one or two marks here. Sharing data or the database or the need to only update a single database on the server were all answers which gained credit. However some candidates referred to Wide Area Network advantages or compared WANs and LANs, and not LAN and stand-alone operation as the question stated.

(ii) A modem appeared too frequently here. Networking, even at this quite basic level, is not a well-known topic.

(b) (i) The idea of a cable failure not taking down the whole net was reasonably well known but many candidates stated “if the Computer fails…” which did not gain credit.

(ii) Almost all candidates realised the Bus network used less cable. However, some candidates still only stated “The bus network is cheaper”. Without further qualification this response did not gain credit.

(c) (i) This was very poorly answered; usually candidates only referred to an address of a site. Very few candidates understood the idea of a name of a site, which the domain name server resolves into a site address.

(ii) Most candidates gave a suitable example of a domain name, but some candidates quoted an email address, which did not gain credit. The mark scheme this year was very generous, accepting answers where candidates underlined just the company name part of a domain name, insisting that this was the domain name. Candidates need to appreciate that www.name.co.uk may belong to a different organisation than www.name.com and these are two different domain names. The whole expression is the domain name. Just as domain names can have different suffixes (such as .co.uk or .com) they can have different prefixes such as wap. or ftp.

(d) The idea that an intranet was ‘internal’ or company-wide was less well known than the answer that it was ‘like the Internet’. Many candidates set out their answers in terms of a LAN definition, which on its own was not enough to gain credit. Some candidates thought that the intranet consists of just one web page available to employees only. It is actually a communication system providing similar services to the Internet.

EXAM PAPERS PRACTICE