**Q1.**

When transmitting data, the wireless network uses the following systems:

•   Carrier Sense Multiple Access with Collision Avoidance (CSMA / CA) with Request to Send / Clear to Send (RTS / CTS)

•   Majority Voting.

Explain the process the transmitting device will go through to transmit data and what the receiving device would then do when it receives data.

**(Total 8 marks)**

**Q2.**

A network with a physical star topology can have a logical bus topology.

Describe the difference between a physical and a logical topology.

**(Total 2 marks)**

**Q3.**

A systems analyst is planning a system for the administration of student courses to be used in an office in a college. The system must allow users at ten workstations to access and update a central database.

(a)     The analyst initially plans to use either a peer-to-peer or a server-based network.

Explain why a server-based network is likely to be more appropriate than a peer-to-peer network in this situation.

**(2)**

(b)     After considering other alternatives, the analyst finally decides to use a thin-client network.

Explain how a thin-client network works and how the use of a thin-client network instead of a traditional rich-client (thick-client) network will affect the selection of the hardware to be used by the system.

In your answer you will be assessed on your ability to use good English, and to organise your answer clearly in complete sentences, using specialist vocabulary where appropriate.

**(4)**

(c)     The system will be networked within the college. This network will then be connected to the Internet so that staff who are out of the college can log in and access the system.  
This connection will use a gateway.

What is the purpose of the gateway?

**(1)**

**(Total 7 marks)**

**Q4.**

Three students share a house when they go to university and have set up a peer-to-peer network between their computers for sharing files and playing multi-user games.

Explain why a peer-to-peer network might be a better choice for the students than a client-server network.

**(Total 2 marks)**

**Q5.**

Define the term ‘protocol’.

**(Total 1 mark)**

**Q6.**

Explain how the use of a MAC (Media Access Control) address white list can increase the security of a wireless network.

**(Total 2 marks)**

Mark schemes

**Q1.**

**Marks are for AO1 (understanding)**

**CSMA/CA and RTS/CTS**

•   Transmitting device checks for traffic;

•   If (data) signal present/another transmission is in progress, then the transmitter continues to wait;

•   If the channel is detected as idle, the transmitter would send a request to send (RTS);

•   Receiver/WAP (**A.** router **R.** server) responds (to RTS) with a Clear to Send (CTS) signal

•   If CTS is not received, the transmitter would wait a random amount of time/until the end of the transmission before resending the RTS;

•   When CTS is received, the transmitter begins transmitting data;

•   Receiver sends acknowledgement (ACK) (if all data is received);

•   If no ACK received then data is resent;

**Max 6** for CSMA/CA and RTS/CTS

**Majority Voting**

•   The transmitter would send each bit / byte / bit pattern (**R.** data) an odd number of times (greater than 2); **A.** multiple times / specified odd number greater than 2

•   The receiver checks the bits / byte / bit pattern received and if they are not all the same it assumes the one it received the most copies of is the correct value;

**R.** Receiver knows the data is correct

**Max 2** for majority voting

**Max 8** in total

**[8]**

**Q2.**

**Marks are for 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

**N.E** How the devices / computers are connected to each other

**N.E** “Setup” for layout

**N.E** List of topologies eg bus, star

**Logical:** How the data / packets flow around a network // architecture of the communication mechanism in a network;

**A.** Conceptual way that data moves around a network

**A.** The type of protocol used (must be related to logical topology)

**N.E** How a network operates / behaves

**[2]**

**Q3.**

(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  
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. |

**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]**

**Q4.**

**Marks are for AO1 (understanding)**

A peer-to-peer network does not need a central server;

A peer-to-peer network will be cheaper / easier to set up / maintain;

The students are unlikely to need the extra security provided by a client-server network;

The students are unlikely to need the extra services provided by a client-server network;

**Max 2**

**[2]**

**Q5.**

**Mark is for AO1 (knowledge)**

A set of rules (which govern communication);

**[1]**

**Q6.**

**Marks are for AO1 (understanding)**

A MAC/Media Access Control address is unique to every NIC/Network Interface Card;

A white list only allows those MAC addresses that have been authorised to connect to the network // devices whose MAC addresses are not in the white list are not allowed to connect to the network;

**A**. Device for NIC

**A**. Address for MAC Address

**R**. first mark if not clear that MAC address is unique to NIC/device

**R**. IP address for MAC address

**[2]**