THE BCS PROFESSIONAL EXAMINATION

Diploma

October 2003

EXAMINERS' REPORT

Computer Networks

General

There was a pass rate of 50% for this examination. The majority of successful candidates demonstrated a sound understanding of both the theoretical and practical issues covered in the examination.

A scrutiny of the scripts of those candidates who failed suggested that there was a distinct lack of practical experience and insufficient preparation for the examination. It would be beneficial if future candidates could concentrate on the understanding of current protocols and standard for both local and wide area networks.

Overall the success rate was much improved compared to previous sittings. Candidates did particularly well on question 3 and apart from Q6 all other questions were equally popular.

Question 1

1. *a)* Explain, with the aid of appropriate diagrams, what is meant by:

i) Frequency modulation

ii) Amplitude modulation

iii) Phase modulation **(6 marks)**

b) Define the term *baud rate*. **(2 marks)**

c) Explain how available bandwidth and the signal to noise ratio for a particular transmission medium affects the maximum transmission speed. **(8 marks)**

d) Show, with the aid of appropriate diagrams, how the bit pattern "10011" can be encoded using:

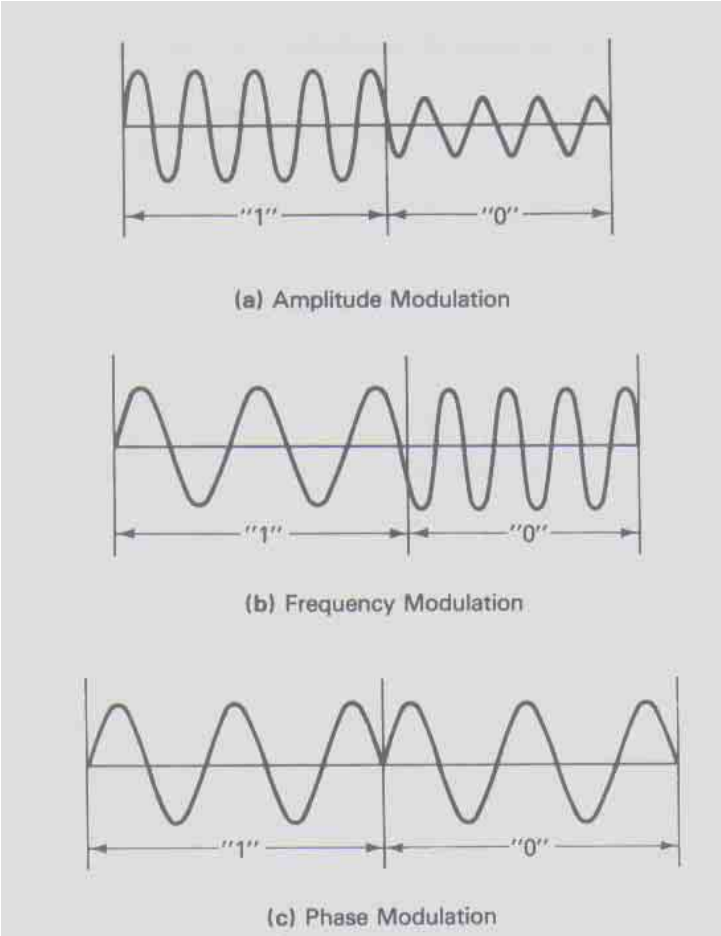
i) Manchester encoding

ii) Differential Manchester encoding.

What are the advantages of using Manchester encoding? **(9 marks)**

Answer Pointers

1 a) Discussion to include a description of the 3 types of modulation, with reference to a diagram(s) similar to the diagram overleaf:



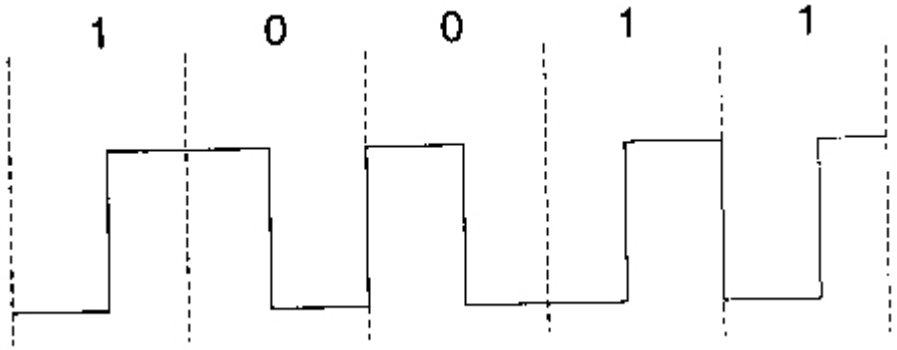
6 marks, 2 per explanation

b) Baud rate is the change rate of the carrier signal (ie the signalling rate or modulation rate)

2 marks

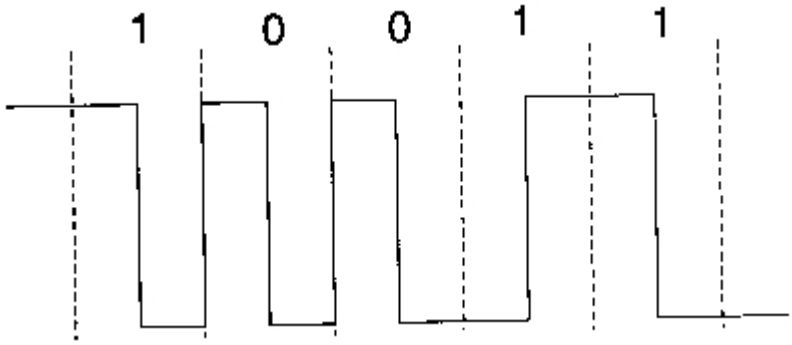
c) 2 marks for demonstrating an understanding of the signal to noise ratio, remaining 6 marks for an explanation of how the SNR and bandwidth affects transmission speed (including examples)

d) i) Manchester Encoding



3 marks

ii) Differential Manchester Encoding



3 marks

The advantages of adopting Manchester encoding are that each bit, when transmitted, contains an identifiable transition between signally states. This is easy to detect and not susceptible to signal degradation as a constant signal level would be.

3 marks

Examiner's Guidance Notes

Weaker candidates showed a total lack of comprehension regarding modulation techniques. Similarly, understanding of SNRs was weak. Although most candidates had heard of Manchester encoding, very few could offer a convincing explanation.

Question 2

2. *a)* What actions would you take if an installed LAN reached its capacity? **(8 marks)**

b) Why might Ethernet be a better proposition than a Token Ring for a network carrying low traffic loads? **(8 marks)**

c) A particular router has a MTBF of 12000 hours and a MTTR of 10 hours. What is its availability? **(3 marks)**

d) How can the reliability of any network configuration be improved? **(6 marks)**

Answer Pointers

2 a) Discussion to include some of the following points:

If LAN capacity limits are being reached then the network should be partitioned and then relinked with a bridge or router to recreate a single network. The network traffic being generated then needs to be examined to ensure that the partitioning will isolate a reasonable volume within each area. It is not sensible to partition and then require all traffic to pass through the bridge, eg when a file server is on the other side of a bridge from the bulk of file server requests. 3 marks

Another possibility is that the peak performance for that network is being reached – further traffic would create performance degradation. 2 marks

It would be normal to use network tools to monitor the traffic flows to establish the pastern of which stations are exchanging data. Once this analysis is complete , you can determine the best location for a bridge or router. 3 marks

b) Discussion to include:

- At low traffic levels it is probable that the LAN is idle at the instant at which any individual station is seeking to gain access.
- With an Ethernet network the access method used means the station is able to gain access immediately.
- With a Token Ring network to access the transmission medium, a station needs to be holding the token.
- On average, even in a no-load network, this will require the token to rotate halfway around the network.
- Hence access is not as immediate an in the Ethernet case.

1 mark per point + 3 for discussion, total = 8 marks

c) availability = MTBF / (MTBF+MTTR)
In this case:
Availability = 12000 / (12000+10)
= 0.99916 or 99.916 %

d) Discussion to include:

- Include well-proven and standard products that are multiple sourced so that component availability is high
- Examine the network and identify potential major impact points (eg a failure of a network card on a client PC is not so important as the failure of a network card in a server)
- Similarly examine bridges and routers.
- It may be prudent to make appropriate standby provision – either by the addition of a redundant component as a “hot spare” within the network or simply by having a spare component readily available so that it maybe “swapped in” in the event of failure

1 mark each + 2 for discussion = 6 marks

Examiner’s Guidance Notes

Most candidates considered the possibility of installing a higher-speed LAN but did not think that partitioning would be a cost-effective alternative. Candidates had a vague recollection that Token Ring may be less efficient than Ethernet under low loads but were unable to say why. As ever, the mathematical skills of candidates bordered on the non-existent, causing problems for part c of this question.

Question 3

3. *a)* What are the seven layers of the OSI reference model? Give a brief description of the functionality provided by each layer. **(7 marks)**

b) Explain the differences between UDP and TCP. **(10 marks)**

c) You are responsible for designing a network application that runs in a TCP/UDP/IP environment.

i) Under what circumstances might you choose to use TCP?

ii) Under what circumstances might you choose to use UDP? **(8 marks)**

Answer Pointers

3 a)

Layer 7	File Transfer, access and management, document and message interchange etc.	**Application layer**
Layer 6	Data representation, transformation and security	**Presentation layer**
Layer 5	Dialogue and synchronisation control	**Session layer**
Layer 4	End-to-end transfer management (connections, error or flow control segmentation)	**Transport layer**
Layer 3	Network routing and addressing	**Network layer**
Layer 2	Framing, data transparency, error control	**Data link layer**
Layer 1	Mechanical and electrical network interface definitions	**Physical layer**

OSI Reference Model

1 mark per layer, max = 7 marks

b) Discussion to include:
TCP, being a stream based protocol, incurs overheads in the setting up and relinquishing of the stream. This is only appropriate if the set up time is small compared with the amount of data being transmitted. In the case where only small amounts of data need to be transferred, UDP allows that data to be sent in a datagram form, without a significant overhead.
The drawback is that UDP datagrams do not provide a reliable service in the way that a TCP stream does.

So, TCP and UDP address different needs - either the transmission of data reliably, albeit with an overhead, or the transmission of data without the guarantee of delivery in sequence but without so many overheads.

10 marks, as appropriate

c) Discussion to include:

- When the network application exchanges large amounts of data with a peer or server application
- When reliability of data transfer is important
- Where network capacity is sufficient to absorb overheads

- Where data is transmitted to a number of different destinations
- Where the average size of each data parcel exchanged is small
- Where quick transmission is of the essence
- Where guaranteed delivery is not required, eg because error correction and detection are
- catered for elsewhere in the application's protocol stack

1 mark per point or equivalent, + 1 floating = max 8 marks

Examiner's Guidance Notes

The majority of candidates were able to give a convincing rendition of the OSI stack, although some failed dismally at even this standard task. Most people recognised that TCP and UDP were connection-oriented and connectionless and gave a standard answer. Unfortunately, this answer tended to be repeated in part c) rather than being tailored to the actual question.

Question 4

4. *a)* What are the main reasons for developing a network Disaster Recovery Plan? **(6 marks)**

b) What techniques are used within a network Disaster Recovery Plan? **(8 marks)**

c) What steps are required to set up a network Disaster Recovery Plan? **(5 marks)**

d) What are the major threats to network operation? **(6 marks)**

Answer Pointers

4 a) To ensure business continuity for mission–critical operations and applications [1 mark]
To provide continuous availability to users [2 marks]
To comply with legislative requirements [2 marks]
To ensure a high-availability network [2 marks]
To enable a systematic response to incidents and disasters [2 marks]
To comply with best practice for ICT [2 marks]
Other valid examples [2 marks]
But maximum [6 marks] for this section

b) Install redundant equipment [2 marks]
Ensure that replacement equipment can be sourced [2 marks]
Build extra capacity into network [2 marks]
Plan alternate routeing [2 marks]
Remove and/or reduce risk areas where possible [2 marks]
Other valid examples [1 mark]
But maximum [8 marks] for this section

c) Set up a planning team [1 mark]
Analyse current network capability [1 mark]
Analyse potential hazards/threats [1 mark]
Specify impact of failure on users, identify critical areas of business [1 mark]
Write the plan [1 mark]
Test the plan [1 mark]
Specify criteria, and responsibility, for invoking the plan [1 mark]
Ensure that business can return to normal after invocation of plan [1 mark]
But maximum [5 marks] for this section

d) Theft of network components, and/or deliberate damage [1 mark]
Equipment failure [1 mark]
Poor quality equipment [1 mark]
Poor network design [1 mark]
Poor cable installation [1 mark]
Wrongly configured network components [1 mark]
Under capacity network that cannot cope with increased use [1 mark]
Unauthorised use of the network [1 mark]
The introduction of viruses [1 mark]
Other valid examples [1 mark]
But maximum [6 marks] for this section

Question 5

5. The development, implementation and operation of data networks is dependent on agreed standards.

a) Why is there a need for standards? **(4 marks)**

b) What are the advantages of standards? **(6 marks)**

c) What are the disadvantages of standards? **(4 marks)**

d) What is DSL? **(4 marks)**

e) What is ADSL? **(3 marks)**

f) What is ISDN? **(4 marks)**

Answer Pointers

a) The communication industry has accepted that they are essential [2 marks]
Different vendors, different countries need to communicate [2 marks]
Standards now permeates all areas of computer networks [2 marks]
Other valid examples [2 marks]
But maximum [4 marks] for this section

b) Productivity and efficiency may be increased because of large scale, low cost production runs [2 marks]
Smaller companies can compete [2 marks]
Technology transfer and the dissemination of information is facilitated [2 marks]
International trade can expand [2 marks]
Simplification, as only one item of equipment is required as opposed to many [2 marks]
Other valid examples
But maximum [6 marks] for this section

c) Standards tend to freeze technology [2 marks]
Standards take a long time to be certified [2 marks]
Certification can cause a delay in new technology being implemented [2 marks]
There are different standards bodies producing many different standards [2 marks]
Other valid examples [2 marks]
But maximum [4 marks] for this section

d) Digital Subscriber Line or Digital Subscriber loop. DSL provides high-speed networking,

broadband, over ordinary phone lines. Provides an 'always on' feature. High theoretical maximum data rates, but the rates tend to be much lower in practice, as they are heavily dependent on the quality of the telephone cabling infrastructure. Only works over limited physical distance, maximum 5.5 kilometres from the local exchange. [4 marks]

e) Advanced Digital Subscriber Line. This provides greater bandwidth than DSL. Capable of much greater data rates than DSL. Availability limited by physical distance. [3 marks]

f) Integrated Services Digital Network. A network technology that supports transfer of of simultaneous voice and data traffic. ISDN service generally supports data rates of up to 128 Kbps. ISDN emerged as an alternative to traditional dial-up networking during the 1990s. The relatively high cost of service, though, has limited its popularity with home users. [4 marks]

Question 6

6. *a)* What is Network Capacity Planning? **(10 marks)**

b) What are the benefits of Network Capacity Planning? **(10 marks)**

c) What are the major components of Network Capacity Planning? **(5 marks)**

Answer Pointers

Network Capacity Planning involves development of network simulations based on current physical and logical architectures.

The evaluation of "what if" scenarios to improve current network performance
The evaluation of "what if" scenarios to improve current network availability
The evaluation of "what if" scenarios to improve current network reliability
The simulation of a number of network alternatives for an organisation - incorporating changes in design, technologies, components, configurations, cost, and applications
The determination of a network design which best suits an organisation's goals and strategies.
The identification of network use that will cause excessive delays on the network
The identification of application and/or transactions that are network resource hungry
[2 marks] each, but maximum of 10 marks

b) Shorter time to full deployment by avoiding delays due to network infrastructure problems
Development of a realistic baseline to represent the current network environment
More effective implementation due to accurately predicting any demands any new application will make on the network
Higher probability that quality of service will be met by anticipating and providing for increased demand
Improvement to the return on investment by maximising the efficiency of the network infrastructure and optimising performance of new and existing applications
Reduction of costs by delaying purchase of network and server upgrades
Other valid examples
[2 marks] each, but maximum of 10 marks

c) Define requirements and metrics
Review current network topology
Capture network traffic
Create and validate network baseline model
Evaluate design alternative

Other valid examples
[1 mark] each – but maximum of 5 marks for this section