THE BCS PROFESSIONAL EXAMINATION
Diploma

April 2001

EXAMINERS' REPORT

Computer Networks

Of the 170 candidates who sat the examination 70% were successful. The overall average mark for the paper was 44%. There was an even distribution of attempts across all questions. Question 2 was the least popular question, and question 6 was the most popular question. The examiner's comments on each question are as follows:

QUESTION ONE

a) Explain how the 'continuous RQ' protocol operates. Your answers should include a FULL description of the protocol using appropriate diagrams. (20 marks)

b) Continuous RQ frames contain frame sequence numbers. How many bits are required to represent the frame sequence number? Explain your reasoning. (5 marks)

This question was attempted by 71% of the candidates, the majority of whom were well aware of the operating principles of continuous RQ protocols. They were also able to deal correctly with the calculations required for part b) of the question. Candidates may well be advised to use timing diagrams to illustrate the operation of the protocol.

QUESTION TWO

a) Explain the operating characteristics and cost differences between dial-up and private (leased) circuits. (13 marks)

b) The Intergrated Services Digital Network (ISDN) service most commonly supplied is described as 2B+D. Explain the difference between B and D channels. (8 marks)

c) Describe FOUR of the advantages of ISDN over normal analouge dial-up telephone lines. (4 marks)

The majority of candidates who attempted this question were obviously experienced in the practical issues associated with dial up vis à vis leased lines. Candidates were well aware of the lower data rates associated with dial up services but were able to argue that there was a balance to be achieved between cost and performance associated with the two systems. Not all candidates were familiar with the 2B+D system of transmission. In part c) the examiner was expecting candidates to refer to the high quality needed for sound and video, lower levels of attenuation, and higher data rates.

QUESTION THREE

a) Communication protocols transfer information frames of varying sizes. For a given communication link there will be an 'optimum frame size'. Define, using an appropriate example, what is meant by the term 'optimum frame size'. (10 marks)

b) Describe TWO techniques which are commonly used to help attain this frame size, explaining the 'costs' associated with each. (10 marks)

c) What is the optimum frame size for Ethernet? Explain your answer. (5 marks)

This question proved to be more difficult for candidates than had been expected by the examiner. Most candidates were not familiar with more than one frame size over the range of protocols which were expected to be considered. Few candidates were able to express in comparative terms the factors which should be considered in determining the optimum frame size. The examiner had expected that candidates would argue that optimum frame size would be defined as the total number of bits in a frame, including address bits, control bits and data bits required to transfer the most amount of data with the minimum number of retries over a given period. In the event, most candidates simply stated the structure of a frame within the protocol with which they were familiar. Most candidates were aware of the relationship between length of line, propagation delay and transmission speed in determining frame size.

QUESTION FOUR

a) Explain how *Bit Synchronisation* and *Block Synchronisation* are achieved in the CSMA/CD ('Ehthernet') protocol. (6 marks)

b) Describe the operation of the media access protocol known as CSMA/CD. Your description should include an explanation of the implications of the selection of a particular size of collision window and the action taken when a collision occurs. (11 marks)

c) Show how the CSMA/CD protocol's performance (as measured by message delivery time) varies with increasing load. This protocol is often described as 'non-deterministic'. Explain what is meant by this. (8 marks)

Bit synchronisation and block synchronisation are procedures which were well understood by the majority of candidates. The relative merits and limitations of the two systems were not at all understood by the majority of candidates, nor were the application areas competently identified.

All of the candidates who attempted part b) made a creditable reply. It is obvious that this protocol is widely used and therefore well understood by candidates working in the networks industry. It was noticeable that some candidates, approximately 40%, were not familiar with the relationship between propagation delay and the size of the collision window. Candidates who scored most marks illustrated their answers using fairly accurate timing diagrams to show the effect of a collision and the resultant action.

QUESTION FIVE

a) Explain the definition of "Class A", "Class B" and "Class C" IP Networks. (6 marks)

b) Explain the action of the sub-net mask, and with the aid of a diagram, show how it works. (7 marks)

c) The default sub-net mask for the class of network you have is 255.255.0.0 but the network manger has decided the whole network will use the mask 255.255.255.128.

i) How many sub-networks can you have on your network? Explain how you obtained the answer.

ii) Again explaining how you obtain the answer, how many nodes can you have on each sub-net? (12 marks)

This was a very popular question. Nearly all candidates were familiar with the concept that the address space was used to distinguish between network and host so that Class A, B and C were used for different sizes of networks. E.g: Class A large number of nodes, Class B for smaller LANS and Class C to enable sub-net applications.

b) Masking was not at all well understood. The ability to use masking to limit transfer within a sub-net and only if the comparative address is non-zero is the message passed to a router, is a concept which ought to have been familiar to candidates.

c) Candidates who successfully completed part c) were aware of the inefficiency of the IP address space. Changing to 255.128 can effectively allow more sub-nets and still have 128 on each.

QUESTION SIX

a) With reference to computer networks, describe the essential features and operating principles of the following:

i) Router
ii) Bridge
iii) Adaptive routing algorithm
iv) Circuit switching (12 marks)

b) With the aid of schematic diagrams, explain the principle of operation of a single bit error correction facility with which you are familiar. (6 marks)

c) What is meant by the term 'burst errors'?

Describe the operation of a system which is able to correct burst errors.

Identify the limitations of the system with respect to the time interval over which the bust occurs and the time interval between successive bursts. (7 marks)

The majority of candidates attempting this question gained more than the average mark for the question. Most students used very clear diagrams to illustrate the four items. There was, however, some confusion in the answers given by a few candidates as to whether or not routers were associated with level 2 of level 3 of the ISO model.

b) Half of the candidates described a single bit parity check as an error correcting system. The examiner was expecting candidates to explain the operation of a single bit Hamming error correction system.

c) This part of the question was attempted by only a few candidates. Most candidates chose to describe a CRC system, some described a block Hamming system. No candidate described a Hagelberger code which was expected by the examiner.