

THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATION

Diploma

COMPUTER NETWORKS

21st April 2004, 10.00 a.m.-12.00 p.m.

Answer FOUR questions out of SIX. All questions carry equal marks.

Time: TWO hours.

The marks given in brackets are indicative of the weight given to each part of the question.

1.
 - a) Explain *circuit switching* and *packet switching* techniques. What are the advantages and disadvantages that the packet-switching technique has over the circuit-switching technique? **(15 marks)**
 - b) What is frame relay and why is it preferred to X.25 packet-switching service in wide area networks? **(10 marks)**

2.
 - a) Explain the term data transparency and how it may be achieved using:
 - i) character stuffing
 - ii) zero bit insertion**(8 marks)**
 - b) What are the TWO main approaches used to control errors in transmitted data streams? **(6 marks)**
 - c) A 7-bit ASCII character is encoded using Hamming code and transmitted. The bit pattern received is represented as follows: 00110010001.
 - i) Show how the above bit pattern is checked by applying the Hamming coding at the receiving end; indicate any error and correct it.
 - ii) Extract the original 7-bit ASCII character.
 - iii) Determine the code efficiency of the encoder.
 - iv) Explain the limitation of using Hamming code as an error correcting technique, and outline the simple technique which can be used to overcome the limitation. **(11 marks)**

3.
 - a) Explain the difference between *passive* and *active* security threats in the context of a typical LAN within the internet environment. **(8 marks)**
 - b) What are the FIVE basic ingredients of a conventional encryption scheme? Taking the encryption algorithm DES as an example, explain how the vulnerability of a conventional encryption scheme can be improved? **(11 marks)**
 - c) Define the terms public key and private key as applied to a public key encryption scheme. What are the main steps involved in the operation of such a scheme? **(6 marks)**

Turn over]

4. Explain by means of a diagram the frame format used by an IEEE 802.3 CSMA/CD LAN. Clearly show the size and function of each of the fields within the frame. You may ignore the Preamble and Start of Frame Delimiter. **(12 marks)**
- a) Why does *CSMA/CD* set a maximum limit to the frame size? **(6 marks)**
- b) By considering a maximum size frame (1518 bytes) and a minimum size frame (64 bytes) determine the percentage of the frame that is used to carry protocol data. Hence, suggest why a maximum size frame will result in a higher effective data rate than a minimum size frame. **(7 marks)**
5. a) With reference to the ISO Reference Model, explain what functions are performed by the Network and Transport layers. **(7 marks)**
- b) Two computers are communicating via a wide area network. What quality of service is offered to their respective Transport layer protocols if the Network layer is provided by:
- i) IP?
- ii) X.25? **(10 marks)**
- c) If two computers use IP as their Network layer protocol, what quality of service is offered to their respective higher layer protocols if the Transport layer is provided by:
- i) TCP?
- ii) UDP? **(8 marks)**
6. a) Two computers A and B and a server S are connected to a CSMA/CD LAN. These computers and the server support the *TCP/IP* protocols. Why does each computer and server need both a MAC and IP address? **(6 marks)**
- b) If computer A knows the IP address of the server, explain how it can use the Address Resolution Protocol (ARP) to determine the MAC address of the server. **(10 marks)**
- c) If a server supports more than one application explain how TCP port numbers can be used to allow computer B to access these two applications at the same time. **(9 marks)**