

THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATIONS BCS Level 5 Diploma in IT

COMPUTER NETWORKS

18th October 2006, 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.*

Only non-programmable calculators are allowed in this examination.

1. a) A transmission system uses a coding scheme that defines a 'symbol' as a voltage that can have one of four possible values. If the system operates at a transmission rate of 200 symbols per second, determine the data rate measured in:
- i) Baud
 - ii) Bits per second **(6 marks)**
- Show, with the aid of a diagram, how the bit pattern '10101110' would be encoded using Manchester encoding. **(9 marks)**
- b) The Link Access Protocol (LAP-D) used within ISDN has a frame structure that begins and ends with a flag sequence of '01111110'. Show how zero-bit insertion ("bit stuffing") is used to ensure that this flag sequence cannot occur elsewhere within the frame. **(10 marks)**
2. By considering the ISO Reference Model, explain what functions are performed by the Data-Link and Network Layers. **(8 marks)**
- i) What is meant by the term '*peer to peer protocol*'? **(5 marks)**
 - ii) Consider two wide area networks; one using IP and the other using X.25 as its Network Layer protocol. Explain how the quality of service offered by these two networks differs. **(12 marks)**
3. a) What functions are performed by a router? **(8 marks)**
- b) Why is it important for routers to know about all of the possible routes through a network topology? **(5 marks)**
- c) Explain the main differences between the operation of routing protocols based on the following principles:
- i) Distance vector routing (Bellman Ford)
 - ii) Link state database routing **(2 x 6 marks)**

Turn over]

4. a) Explain, giving reasons, what network device/s you would use in each of the following cases:
- i) Linking a LAN in a building to another LAN in the next building so that data frames can be selectively be forwarded from one LAN to another.
 - ii) Linking a LAN in a building to another LAN in a building situated at the other side of a field so that a number of data frames can be exchanged between the LANs. **(12 marks)**
- b) Referring to data frames in a) and assuming that the data frequently involves characters, suggest giving reasons a framing format that also incorporates burst error detection information. **(13 marks)**
5. a) Discuss the main characteristics of an ATM network with particular reference to routing of data in the network. You are encouraged to use appropriate diagrammatic illustrations. **(17 marks)**
- b) What is congestion and how is it controlled in an ATM network? **(8 marks)**
6. a) Explain the two main approaches used to control errors in transmitted data streams. **(5 marks)**
- b) In a data communication network, a sender encodes all 7-bit ASCII characters using Hamming code before transmission to a receiver. Assuming that a receiver in the network receives the bit pattern 10111001001,
- i) Use the Hamming code scheme to check the bit pattern, indicate any error and show how the error can be corrected:
 - ii) Indicate the ASCII character transmitted
 - iii) Determine the code efficiency of the encoder
 - iv) Outline the limitation of the Hamming code scheme and suggest how this can be overcome. **(10 marks)**
- c) What is a digital signature and how is it generated? Briefly explain in what way a digital signature ensures message authentication. **(10 marks)**