

BCS The Chartered Institute for IT

BCS HIGHER EDUCATION QUALIFICATIONS BCS Level 5 Diploma in IT

COMPUTER NETWORKS

Tuesday 5th October 2010 - Afternoon

Answer **any** FOUR questions out of SIX. All questions carry equal marks
Time: TWO hours

Answer any Section A questions you attempt in Answer Book A

Answer any Section B questions you attempt in Answer Book B

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.

Section A

Answer Section A questions in Answer Book A

1.
 - a. What is meant by the term *virtual circuit*?
(2 marks)
 - b. Explain how a network connection is established between a user and a server over the Internet using the TCP protocol.
(9 marks)
 - c. If a server is unable to receive data at the rate that the user is sending it over a TCP connection, explain how TCP is able to reduce the flow of data.
(6 marks)
 - d. Explain how you could secure the transmission of data over the Internet.
(8 marks)
2.
 - a. A transmission system uses a data coding scheme that defines a symbol as a voltage that can have one of eight possible values. If the system operates at a transmission rate of 400 symbols per second, determine the data rate measured in:
 - i) baud;
(2 marks)
 - ii) bits per second.
(4 marks)
 - b. Show by means of a diagram how a logic 1 and a logic 0 is represented by using Manchester encoding.
(4 marks)

- c. Show by means of a diagram how the bit sequence, 10001101 would be transmitted using Manchester encoding. **(4 marks)**

- d. The Link Access Protocol (LAP-D) used within the Integrated Services Digital Network (ISDN) has a frame structure that begins and ends with a flag comprising the bit sequence 01111110. The following bytes are to be transmitted within the data portion of the frame:

00110011 11110101 01111110 01001101 11111100

Show by means of a diagram how zero bit insertion (bit stuffing) is used to ensure that the flag sequence of 01111110 can never occur within the data portion of the frame when sending the above sequence of bytes.

(9 marks)

- e. When transmitting the data sequence shown in part (d), how many bits in total have to be sent?

(2 marks)

3.

- a. Within Asynchronous Transfer Mode (ATM) networks, all information is sent as a sequence of ATM cells. How large are these cells and what information is contained within the cell header?

(4 marks)

- b. Explain what is meant by the process of *connection admission control*.

(5 marks)

- c. Within the context of an ATM network, explain what the difference is between constant bit rate (CBR) and available bit rate (ABR) traffic.

(6 marks)

- d. What function is performed by the ATM Adaptation Layer (AAL) protocol?

(6 marks)

- e. Where within an ATM network is the AAL protocol located?

(2 marks)

- f. What type of traffic, typically, would you send over an ATM network using AAL5?

(2 marks)

Section B

Answer Section B questions in Answer Book B

4.

IPv4 internetworks operated by a single organisation sometimes use link state protocols to manage the transfer of routing information.

a)

- i) Explain the behaviour of link state protocols and illustrate your answer by reference to the OSPF (Open Shortest Path First) protocol.

(8 marks)

- ii) Discuss how OSPF uses the concept of network hierarchy.

(7 marks)

- b) Link state protocols are often claimed to be better than distance vector protocols in some respects. Briefly discuss why people make this claim.

(10 marks)

5.

Imagine you are the network manager of a medium sized company that is about to move into a new office building. The new building has an air conditioned computer room, a set of small offices with fixed desks and a large open-plan office. You have been asked to design a new local area network for the new building. In answering the following parts of this question you must provide a **full justification** of all decision and recommendations that you make.

- a) The computer room will house about 12 high performance servers and will be the location of their Internet connection. What type of local area network technology should be installed and what equipment and cabling will be required?

(9 marks)

- b) The small offices with fixed desks will be equipped with desktop computers. What type of local area network technology should be installed and what equipment and cabling will be required?

(8 marks)

- c) The large open plan office, which has flexible seating arrangements, is used by the sales staff who also spend a large amount of their time working on customers premises. The sales staff have all been equipped with modern laptop computers. What type of local area network technology should be installed and what equipment and cabling will be required?

(8 marks)

6.

- a) Briefly explain what is meant by the term **forward error control** (FEC).
(4 marks)
- b) Discuss why FEC is often used with satellite systems but is less used in terrestrial communication systems.
(6 marks)
- c) You are told that a block code system has a Hamming distance of 3. What does this mean in terms of how the codewords differ?
(3 marks)
- d) If we wish to be able to **detect** all 5-bit errors, what must be the Hamming distance of the code we choose to use?
(2 marks)
- e) If we wish to be able to automatically **correct** all 5-bit errors, what must be the Hamming distance of the code we choose to use?
(2 marks)
- f) Design a Hamming block code to be used to transmit 2-bit values and which can both detect and correct all 1-bit errors.
(8 marks)