

BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

COMPUTER NETWORKS

Friday 5th April 2013 – 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.

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| Only non-programmable calculators are allowed in this examination. |
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Section A

Answer Section A questions in Answer Book A

A1. This question is about physical layer transmission systems and Asymmetric Digital Subscriber Line (ADSL) broadband.

- a) The twisted pair telephone line which connects a house to the local telephone exchange was originally designed for the transmission of analogue voice. This is often now referred to as the Plain Old Telephone Service (POTS). What is the typical frequency range used by analogue voice signals?

(2 marks)

- b) Today the twisted pair telephone line is additionally able to support Internet access with data rates measured in Mega-bits-per-second (Mbps) using Asymmetric Digital Subscriber Line (ADSL) technology. Explain how ADSL is able to transmit data over the same line as analogue voice and without the two interfering with one another.

(10 marks)

- c) With reference to ADSL, explain the function performed by the Digital Subscriber Line Access Multiplexer (DSLAM).

(7 marks)

- d) Two customers are connected to the same local telephone exchange and both receive their Internet connection via ADSL. However, one customer has measured their Internet connection download data rate to be 8 Mbps and the other 3 Mbps. Thinking about these two customer's telephone lines, suggest reasons to explain why their actual data rates are so different.

(6 marks)

Turn Over]

A2. This question is about virtual circuits and the Transmission Control Protocol (TCP) and User Datagram Protocol (UDP).

- a) What is meant by a virtual circuit?
(4 marks)
- b) A user wishes to establish a connection from their laptop to a server via the Internet using the TCP protocol. By considering the protocol messages that TCP generates, explain how a virtual circuit is established between the laptop and server using TCP.
(9 marks)
- c) Whilst transmitting data over a TCP virtual circuit, if errors occurred and data was lost, explain how the TCP protocol would be able to detect this has happened and how it would ensure that the lost data is re-transmitted.
(8 marks)
- d) In contrast to TCP, UDP is described as a connectionless protocol. Briefly explain how data is transmitted between two computers using the UDP protocol.
(4 marks)

A3. This question is about the Internet and Multi Protocol Label Switching (MPLS).

- a) In terms of Quality of Service (QoS), the Internet is described as offering a best effort service. What is meant by this description?
(6 marks)
- b) Many telecommunications companies now offer Multi Protocol Label Switching (MPLS) services. How does the Quality of Service (QoS) offered by MPLS differ from that offered by the Internet?
(7 marks)
- c) A company has an office in London and another in Brussels and wishes to connect them in order to transmit both data and telephone calls between the two sites. To provide this interconnection, the company is using a Multi Protocol Label Switching Service (MPLS). Briefly describe the basic principles of how MPLS functions and explain how it would be able to offer a different Quality of Service (QoS) to the telephone calls compared to the data being transmitted between the sites.
(12 marks)

Section B

Answer Section B questions in Answer Book B

B4. A key component of all internet networks is the router. The two main tasks conducted by a router are packet forwarding and routing table construction. This question is about router behaviour and distance vector routing protocols such as Routing Information Protocol (RIP).

- a) This part of this question is about packet forwarding. Assume a router receives an IP packet. Describe the actions the router will perform when forwarding the packet and how this differs for local or remote destinations.

(10 marks)

- b) This part of this question concerns the maintenance of routing tables ("routing").

- i. Briefly explain the behaviour of the class of routing protocols normally described as distance vector protocols and illustrate your answer by reference to Routing Information Protocol version 1 (RIPv1).

(9 marks)

- ii. What were the main difference between RIPv1 and RIPv2?

(6 marks)

B5. This question is about the frames used by the Local Area Network (LAN) technology known as Ethernet /IEEE 802.3.

- a) Produce a sketch diagram to show the fields of a frame as used by Ethernet / IEEE 802.3.

(6 marks)

- b) Explain the role of the preamble and start of frame delimiter fields in an Ethernet / IEEE 802.3 frame.

(6 marks)

- c) How was the original definition of an Ethernet / IEEE 802.3 frame updated by IEEE 802.1Q to permit the use of Virtual Local Area Networks (VLANs)?

(4 marks)

- d) What range of sizes is permitted for the data/payload field of an Ethernet / IEEE802.3 frame?

(3 marks)

- e) Why was it necessary to specify both a minimum length and a maximum length for the data/payload field of an IEEE802.3 frame?

(6 marks)

Turn Over]

B6. This question is about various error checking and correction techniques that are often used in data communications.

- a) A common simple error checking system is known as parity checking.
- i. Assume we are told that an odd parity system is in use and the following binary value is received.

01001011

Explain what we can say about whether or not this value has been corrupted.

(4 marks)

- ii. Imagine a block of eight characters, each of 7 bits, needs to be transmitted. Explain how a combination of vertical and horizontal parity could be used to both detect, and correct, a single bit error.

(8 marks)

- b) Another commonly used form of error checking is known as Cyclic Redundancy Codes (CRCs).

- i. Briefly explain why the use of simple parity bits is not appropriate when trying to detect error bursts.

(4 marks)

- ii. Explain how the CRC system operates and illustrate your answer by referring to the following example.

We wish to transmit 6-bit data values.

We wish to use a 3-bit Frame Check Sequence (FCS).

Overall, we thus transmit a 9-bit sequence.

(9 marks)