BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

COMPUTER NETWORKS

Monday 2nd April 2012 - 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

A1. This question is about physical layer transmission systems and fibre optics.

a) A digital 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 2400 symbols per second, determine the data transmission rate measured in:

i) Baud

(2 marks)

ii) Bits per second

(4 marks)

b) By considering a fibre optic transmission system, explain how wavelength division multiplexing (WDM) can be used to increase the data carrying capacity.

(6 marks)

c) A fibre optic transmission cable links two cities, A and B, and comprises 3 fibre pairs. A fibre pair provides full-duplex communications with one of the pair carrying data from A to B whilst the other carries data from B to A. Each individual fibre can support up to 16 different wavelengths of light and each wavelength can operate at 2.5Gbps.

i) Determine the total bit carrying capacity of this cable measured in bits per second. Include both the A to B and B to A transmissions.

(5 marks)

ii) If a telephone voice call generates 64kbps of full-duplex data, determine how many simultaneous voice calls can be carried by the cable.

(8 marks)

A2. This question is about the ISO OSI Reference Model.

a) The ISO OSI Reference Model defines seven protocol layers, each of which is responsible for a specific range of functions. By considering this model, explain the main functions performed by a protocol operating at:

i) The Physical layer

(3 marks)

ii) The Transport layer

(3 marks)

b) In a Local Area Network, personal computers (PCs) are connected to a switch. Consider two PCs communicating with each other via this switch. Produce a protocol layer diagram that shows how data is passed between these two PCs and in which you clearly show all of the layers of the ISO OSI Reference Model that are used within each PC and within the switch. Clearly mark on this diagram what is meant by a peer to peer protocol.

(12 marks)

c) A protocol that operates at a particular layer of the ISO OSI Reference Model adds additional bytes to the data it receives from the layer above it. These additional bytes are often referred to as the protocol header and footer or simply, the protocol overhead. By considering layer 3 of the ISO OSI Reference Model, explain what might be included within these protocol overhead bytes.

(7 marks)

A3. This question is about the TCP and UDP protocols.

a) What is the difference in the quality of service (QoS) offered to applications by the TCP and UDP protocols?

(8 marks)

b) Both the TCP and UDP protocols use port numbers. What are these port numbers used for and what is meant by the term well known port?

(7 marks)

c) By considering the operation of the TCP protocol, explain how it is able to overcome errors in the transmission and ensure that data is transferred reliably over a network.

(10 marks)

Section B

Answer Section B questions in Answer Book B

B4. The two main functions of an Internet Protocol router are the forwarding of individual packets ("switching") and the maintenance of routing tables ("routing").

a) Routing within a single corporate network is often established using distance vector protocols. Briefly explain the behaviour of distance vector protocols and the problems associated with them.

(4 marks)

b) The protocol known as RIP (Routing Information Protocol) is a distance vector protocol. Describe the problems and restrictions that are present in RIPv1 and how RIPv2 solves some of them.

(8 marks)

c) Routing between large networks operated by different administrations is often achieved using the Border Gateway Protocol (BGP).

i) Briefly explain why RIP would be unsuitable in this environment.

(3 marks)

ii) Briefly explain the behaviour of BGP, the messages it exchanges and the particular important of the Path Attribute known as the AS_Path.

(10 marks)

B5. This question concerns wireless local area network (WLAN) technology and the IEEE 802.11 standards.

a) Briefly describe the nature of a network known as an Ad-Hoc Wireless LAN and the connectivity that it directly provides.

(3 marks)

b) What frequency ranges are typically used by IEEE 802.11 Wireless LANs and what other types of equipment also use some of those frequency ranges.

(6 marks)

c) Briefly explain the role of an Access Point within an infrastructure Wireless LAN.

(4 marks)

d) Describe the issue known as the "hidden station problem".

(6 marks)

e) Discuss how the use of "distributed coordination function with request to send / clear to send" (DCF with RTS/CTS) helps to solve the hidden station problem.

(6 marks)

B6. This question is about designing an appropriate network configuration to fit a given scenario. Imagine you are an expert consultant who has been engaged to produce the network design plan.

A local company is expanding its business and is moving into brand new buildings on a new industrial estate. The company will have three buildings (X, Y and Z) which are approximately 50 metres apart and are in line of sight of each other. Building X will contain six three-person offices for the administrative staff. Each member of the administrative staff will have a desktop computer. Building Y contains a central computer room with three high capacity fileservers, two web servers, a database server and two high performance computation servers. The company allows customers to buy products from a catalogue accessible on one of the web servers. Building Z contains the staff canteen and lounge area and also a large open-plan office used by the company's sales staff who work on laptop computers.

a) What type of network and supporting equipment should be deployed in building X?

(5 marks)

b) What type of network and supporting equipment should be deployed in building Y and its computer room?

(5 marks)

c) What type of network and supporting equipment should be deployed in building Z?

(5 marks)

d) What are the networking options to interconnect the three buildings?

(10 marks)