BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS

BCS Level 5 Diploma in IT

Friday 30th September 2016 - Morning

COMPUTER NETWORKS

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 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)**

A2. This question is about the service provided by the Transmission Control Protocol (TCP) and User Datagram Protocol (UDP).

a) What is the difference in the service offered to applications by the TCP and UDP protocols? **(8 marks)**

b) For each of the following applications determine whether you would use TCP or UDP and explain the reasons for your choice.

i. File transfer **(3 marks)**

ii. Watching a real time streamed video **(3 marks)**

iii. Web browsing **(3 marks)**

iv. A Voice Over IP (VoIP) telephone conversation **(3 marks)**

c) Both TCP and UDP use port numbers. What are these port numbers used for? **(5 marks)**

A3. 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. What is the typical frequency range used by analogue voice signals? **(2 marks)**

b) Nowadays 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. Complement your answer with an image that shows how ADSL works. **(9 marks)**

c) With reference to ADSL, explain the function performed by the Digital Subscriber Line Access Multiplexer (DSLAM). **(8 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 5Mbps and the other 2Mbps. Thinking about these two customer's telephone lines, suggest at least two reasons to explain why their actual data rates are so different. **(6 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"). This question considers router behaviour and routing protocols such as EIGRP.

a) The first part of this question concerns the forwarding of individual packets ("switching").

i. What are the main demands on the internal resources of a router when it is taking forwarding decisions for individual packets? **(4 marks)**

ii. To what extent are other routers involved in the internal forwarding decisions and actions of a router when it processes an individual packet? **(4 marks)**

b) This second 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. **(4 marks)**

ii. In what ways are link-state protocols often considered to be superior to distance-vector routing protocols? **(6 marks)**

iii. Briefly describe the routing protocol known as EIGRP and explain how it copes with routing inside a large and complex autonomous system. **(7 marks)**

B5. This question is about error control in communications systems.

a) Briefly explain the difference between single-bit errors and burst errors. **(3 marks)**

b) Imagine that a noise event causes a burst error to occur that lasts for 0.1 ms (millisecond).

i. If data is being transmitted at 10Mbps. If how many data bits will be affected? **(3 marks)**

ii. If data is being transmitted at 100Mbps. If how many data bits will be affected? **(3 marks)**

c) Under what circumstances is the use of parity bits an appropriate error control technique? **(3 marks)**

d) Explain the meaning of the term "residual error rate" in the context of error detection schemes. **(3 marks)**

e) Under what circumstances is the use of cyclic redundancy checks (CRC) an appropriate error control technique? **(3 marks)**

f) Very briefly outline how the CRC method functions. **(7 marks)**

B6 This question is about the ISO Reference Model and the TCP/IP protocol stack.

a) The ISO Reference Model defines seven protocol layers, each of which is responsible for a specific range of functions. By considering this model, mention two main functions performed by a protocol operating at the network layer. **(2 Marks)**

b) Give the names of the seven layers of the ISO Reference Model and the names of the four corresponding layers in the TCP/IP protocol stack, showing the correspondence explicitly. **(11 marks)**

c) Figure 1 shows a small scale network comprising one switch and one router. A personal computer is connected to the switch and a server is connected to the router. All switch and router ports are IEEE 802.3 CSMA/CD.

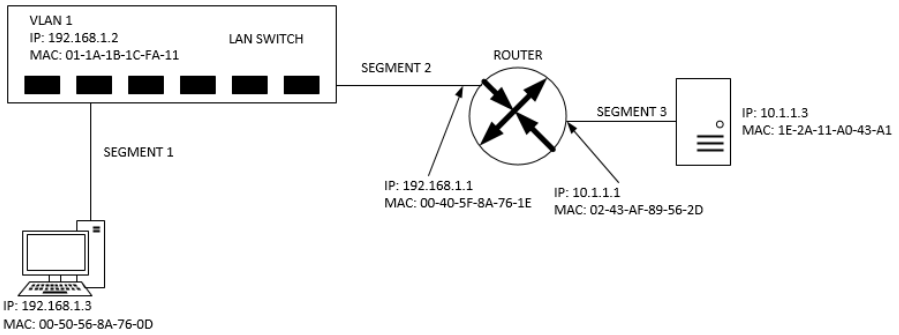

Figure 1

For this network, consider data being sent from the personal computer to the server and indicate the values of the source and destination address fields of the frame and the IP header for each segment. **(12 marks)**