BCS THE CHARTERED INSTITUTE FOR IT

BCS HIGHER EDUCATION QUALIFICATIONS
BCS Level 5 Diploma in IT

COMPUTER NETWORKS

Monday 23rd March 2020 – 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 focuses on Inter Networks.

a) What is meant by unicast, multicast and broadcast communication?

(3 marks)

b) Explain the difference between an IPv4 Layer 3 network broadcast address and an Ethernet Layer 2 broadcast address. Provide an example of each.

(3 marks)

c) Explain the difference between an IPv4 Layer 3 multicast address and an Ethernet Layer 2 multicast address. Provide an example of each.

(3 marks)

d) For each of the following IPv4 addresses:

    i)   195.194.225.5/30
    ii)   10.23.151.34/16
    iii) 192.168.3.82/24
    iv)   131.16.234.88/18

Calculate:
- The network address;
- The broadcast address;
- The first and last usable host address;
- Number of usable hosts.

(16 marks)

A2. This question is on Introduction.

a) Describe and illustrate in correct order **EACH** of the different layers of the OSI 7-layer model and document the protocol data units that are used at the lower **THREE** levels of the model.

(10 marks)

b) Map the OSI 7-layer model to the TCP/IP protocol stack using diagrams where necessary.

(6 marks)

c) What are the processes used by **EACH** layer to move data up and down between layers? Illustrate the processes using **ONE** of the communication models as reference.

(9 marks)

[Turn Over]

A3. This question is on Digital Communications.

a) Explain the differences between unshielded twisted pair and shielded twisted pair and indicate a use for **EACH** type of media.

(4 marks)

b) Indicate at least **FOUR** errors associated with twisted pair cabling.

(6 marks)

c) What is the minimum number of copper wires required to interconnect **TWO** devices together to enable full-duplex communication to happen? Illustrate and explain your answer indicating likely cable/pin connections.

(6 marks)

d) Indicate the advantages and disadvantages of using copper cabling versus fibre optics, including the environment in which each might be used.

(9 marks)

B4. This question is on Local Area Networks.

a) Can a blocked port exist in a Root Bridge when using the Spanning Tree Protocol? Justify your answer.

(5 marks)

b) Explain **TWO** scenarios in a switch-based network where a Root Bridge will become a Non-Root bridge.

(6 marks)

c) Explain **TWO** scenarios in a switch-based network where a Non-Root Bridge will become a Root Bridge.

(6 marks)

d) Explain how the use of bridge/switch technology increases the effective bandwidth of a network.

(4 marks)

e) Detail **FOUR** limitations of a switch-based network.

(4 marks)

B5. This question is related to Wide Area Networks and Inter Networks.

a) Differentiate between Circuit Switching and Packet Switching. Give detailed and practical technology examples of both concepts.

(8 marks)

b) Compare and contrast **THREE** different WAN design topologies detailing the advantages and disadvantages of **EACH** topology.

(9 marks)

c)
i) Outline the key differences between link state and distance-vector routing protocols citing relevant examples of **EACH**.

(4 marks)

ii) Which routing protocols might not fit into either category and why?

(4 marks)

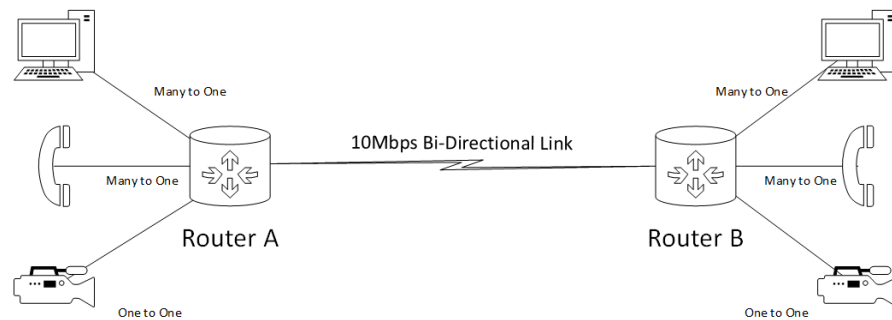**B6.** This question is related to Quality of Service.

a) Detail what will happen when voice over IP (VoIP) media traffic is mixed with typical traditional TCP based application traffic (e.g. Web, FTP and email traffic) in the following scenarios:

    i) A lightly loaded network connection,
    ii) A congested network connection.

(8 marks)

b) A network connection (see attached diagram below) between **TWO** routers operating at 10Mbps is to be shared by:

    i) A real-time webcast video service sending one stream of 30 frames per second of video where each packet burst is 300 kilobits per burst of streamed video data. This stream operates in one direction only from Router A towards router B;

    ii) Up to 30 VoIP telephone calls, each telephone call being bidirectional and using 8,000 one-byte samples per second in each direction aggregated into packets transmitted every 20ms;

    iii) The remaining bandwidth is available for ordinary best effort network traffic.

Assuming a best-effort service is provided for all these traffic types, roughly how many telephone calls can be made before the network link becomes congested?

Note: Used Bandwidth = Video Traffic + Voice Traffic + Best Effort Traffic

Free Bandwidth = Total Available Bandwidth – Used Bandwidth

(9 marks)

c) Suggest how to configure queuing in Router A for traffic to Router B so that the video and telephony services always work with a guaranteed quality of service and at the same time the TCP/UDP traffic is able to use any remaining bandwidth. Use a diagram to illustrate your answer.

(8 marks)

END OF EXAMINATION