Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	DATA COMMUNICATION NETWORK
COURSE CODE	:	BEB 40903
PROGRAMME	:	BEJ
EXAMINATION DATE	:	JUNE / JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Discuss the consequences for each of the following networks if one connection line fails:

(i) Five devices arranged in bus topology
(ii) Five devices arranged in star topology
(iii) Five devices arranged in ring topology
(iv) Five devices arranged in mesh topology

(8 marks)

(b) A channel is to be upgraded to a higher capacity. Analyse how the capacity can be improved if:

(i) the bandwidth is doubled.
(ii) the SNR is doubled.

(4 marks)

(c) Show the pattern of the NRZ-I encoding scheme using each of the following data streams. Assume that the last preceding signal level was positive.

(i) 00000000
(ii) 11111111
(iii) 01010101
(iv) 00110011

(8 marks)

(d) Explain the following:

(i) The importance of data fragmentation.
(ii) How and where fragmentation occurs.

(5 marks)

Q2 (a) Examine which of the following applications are delay-sensitive when you use the Internet:

(i) Sending an e-mail
(ii) Copying a file
(iii) Watching a streaming video

(6 marks)

(b) A frame of 5 million bits is being sent on a link with 10 routers each having a queuing time of 2 μs and a processing time of 1 μs. The length of the link is 2000 km. The speed of the link is 2×10^8 m/s and the data rate is 5 Mbps.

(i) Analyse which component of the total delay is dominant.

(6 marks)

(ii) Propose (by showing the related calculation) how to reduce the value of the dominant delay without affecting the performance of the system.

(4 marks)

(c) A network of 1 Mbps is sending frames of 1000 bits each. Stations are 600 km apart and the signals propagate at 3×10^8 m/s. Determine the vulnerable time of the following networks:

(i) ALOHA
(ii) Slotted ALOHA
(iii) CSMA

(5 marks)

(d) Assume a channel has a bandwidth of 1 MHz bandwidth and SNR of 18dB. Calculate the appropriate bit rate and the signal level.

(4 marks)

Q3 (a) In CRC, the dataword (the original data) is 5 bits and the codeword (the data being transmitted) is 8 bits. Determine:

(i) the number of 0s to be added to the dataword to make the dividend.
(ii) the size of the remainder.
(iii) the size of the divisor.

(5 marks)

(b) An audio-visual real-time application uses packet switching to transmit 32 kbps speech and 64 kbps video over the network connection as shown in **Figure Q3 (b)**. Two choices of packet length are being considered: In option 1 a packet contains 10 ms of each speech and audio information; in option 2 a packet contains 100 ms of each speech and audio information. Each packet has a 40-byte header.

(i) Calculate the percentage of overhead for each option.

(4 marks)

(ii) Analyse all the delay components for both choices of packet length. Assume that the signal propagates at a speed of 1 km /5 μs.

(8 marks)

(iii) Evaluate your finding in (ii).

(2 marks)

(c) In the Internet, with regards to the packets at the transport layer, explain:

(i) Why some packets may be lost.
(ii) Why some packets may be duplicated.
(iii) Why some packets may be received out of order.

(6 marks)

Q4 (a) Explain the consequences of replacing bridges with routers in LAN.

(4 marks)

(b) The following are estimates of the population of major regions of the world: Africa 900 million; South America 500 million; North America 400 million; East Asia 1500 million; South and Central Asia 2200 million; Russia 200 million; Europe 500 million. Suppose each region is to be assigned 100 IP addresses per person. Determine if this is possible. If not, what are the options?

(5 marks)

(c) Suppose a router receives an IP packet containing 600 data bytes and has to forward the packet to a network with maximum transmission unit of 200 bytes. Assume that IP header is 20 bytes long. The data length of each fragment must be a multiple of eight bytes. Show all the fragments that the router creates.

(5 marks)

(d) When one end station, *A* needs to be connected to another end station, *B*, three phases are involved, which are the setup, data-transfer, and disconnection. End-to-end addressing is important in certain switching phases. Explain why:

(i) A circuit-switched network needs end-to-end addressing during the setup and disconnection phases.

(ii) A datagram network needs end-to-end addressing during the data-transfer phase.

(iii) A virtual-circuit network needs end-to-end addressing during all three phases.

(6 marks)

(e) Find the error, if any, in the following IPv4 addresses:

(i) 111.56.045.78
(ii) 221.34.7.8.20
(iii) 75.45.301.14
(iv) 11100010.23.14.67
(v) 12.74.16.18

(5 marks)

Q5 (a) Consider the network in **Figure Q5 (a)**.

(i) Use the Bellman-Ford algorithm to produce the set of shortest paths from all nodes to destination node.

(ii) Now suppose the link between node 2 and 4 breaks down. Produce the new routing table using the same algorithm.

(iii) Evaluate the performance of the network before and after the link between node 2 and 4 breaks down.

(9 marks)

(b) Assume a system is using a five-layer protocol. If the application layer (i.e the top layer) sends a message of 150 bytes and each layer (including the top and bottom layer) adds a header of 20 bytes to the data unit, calculate the percentage of overhead of the transmitting system before being passed to the receiving end.

(5 marks)

(c) In a certain data-link layer protocol, the first frame is sent and acknowledged. The second frame is sent, but lost. After time-out, it is resent. The third frame is sent and acknowledged, but the acknowledgement is lost. The frame is resent.

(i) Draw the timeline diagram of this protocol.

(ii) Identify the problem of the protocol.

(iii) Explain how the problem can be solved.

(5 marks)

(d) An organization is granted the block 211.17.180.0/24. The administrator wants to create 32 subnets. Find:

(i) the subnet mask.

(ii) the number of addresses in each subnet.

(iii) the first and last valid addresses in subnet 32.

(6 marks)

- END OF QUESTIONS –

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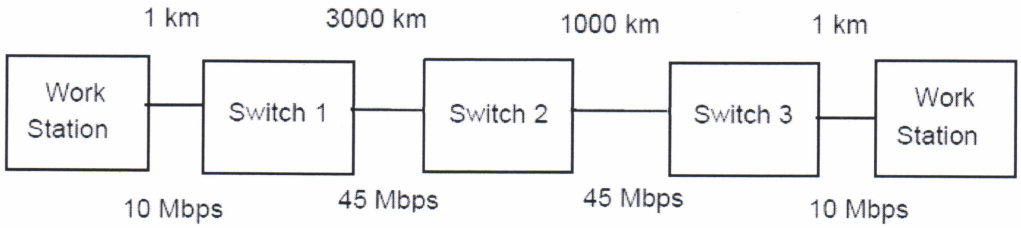

Figure Q3 (b)

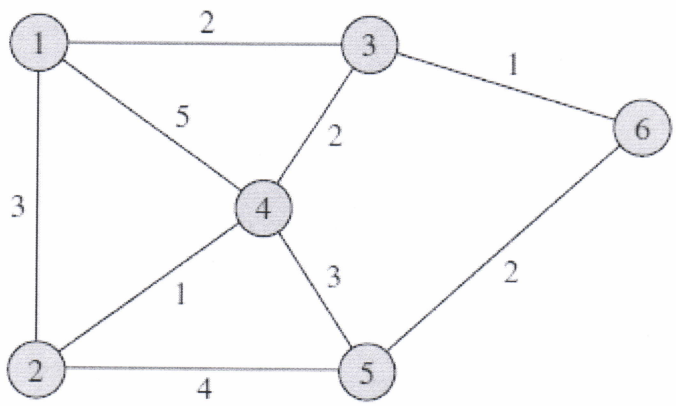

Figure Q5 (a)