UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME : DATA COMMUNICATION NETWORKS

COURSE CODE : BEJ31202

PROGRAMME CODE : BEJ

EXAMINATION DATE : JULY 2022

DURATION : 3 HOURS

INSTRUCTION :
1. ANSWER **ALL QUESTIONS**
2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **OPEN BOOK**

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1   (a)   List **FOUR(4)** advantages and **TWO(2)** disadvantages of TCP/IP model.

(6 marks)

(b)   A commonly used frequency range is 902 MHz to 928 MHz. Calculate the bandwidth of this band.

(3 marks)

(c)   Given that a digital signalling system is required to operate at 10 Mbps.

Channel A: noiseless system and each symbol is capable to encode 4-bit/signal element, and

Channel B: non-noiseless system with signal to noise ratio of 6 dB.

(i)   Determine the minimum required bandwidth of Channel A.

(2 marks)

(ii)   Calculate the minimum required bandwidth of Channel B.

(2 marks)

(iii)   Predict what happen to the channel capacity of Channel A if a higher number of levels is used and Channel B if larger noise power interrupted the channel.

(2 marks)

(d)   Suppose that the bit rate of a UTP cable is 10 Mbps, with a propagation delay of 4 µs/km. A sender wants to transfer a 5 kB file to a receiver connected through a 10,000 km cable. Compare the propagation time and the transmission time for transmitting this file.

(5 marks)

Q2   (a)   One of the TCP features as a transport-layer protocol is its implementation of end-to-end flow control and error control.

(i)   Differentiate the operation of Go Back N with ARQ and Selective Reject for 3 cases: (1) when frame received by the receiver is damaged, (2) when acknowledgement is lost and have not been received by the transmitter, (3) when a frame transmitted by the transmitter is lost.

(6 marks)

(ii)   A well-known World Wide Web server is set up to receive relatively small messages from its client while sending them very large message. Analyse the two (2) ARQ protocols which are Selective Reject and Go Back N that would provide less of a burden to this server.

(4 marks)

(b)   Twisted pair cable, coaxial cable and optical fibre cable are classified as guided transmission medium.

(i) Draw and label the physical construction of these **THREE(3)** transmissions media.

(3 marks)

(ii) Give **ONE(1)** advantage and **ONE(1)** disadvantage of these transmission media.

(6 marks)

(iii) State **ONE(1)** factor that influence the selection of these transmission media.

(1 mark)

Q3 (a) Compare the timing diagram of Circuit switching and Packet switching for the network shown in **Figure Q3(a).** Show and label all introduced delay in each type of switching technique including the propagation delay and transmission delay. Assume three packets flow from Host A to Host B.

(5 marks)

(b) Consider the network topology illustrates in **Figure Q3(b)**. The topology consists of multiple routers interconnected by links. Each link has a static cost associated with it which represents the cost of sending data over that link. Apply Bellman-Ford routing algorithm to the network in **Figure Q3(b)** for node 1 to all other nodes. Show your work by computing a table consisting of each iteration.

(8 marks)

(c) A 3200-bit message must be transmitted through a three-hop wide area network (WAN). Each network link has a maximum capacity of 9600 bps. A fixed packet size of 128 bytes is used to send data over the network. Assuming a propagation delay of 0.002 s per hop and a call setup time of 0.1 s,

(i) calculate the end-to-end delay incur to transmit the whole message on circuit switched network.

(2 marks)

(ii) calculate the end-to-end delay incur to transmit the whole message on virtual circuit packet switching network.

(5 marks)

Q4 (a) A block of 256 sequential 12-bit data words is transmitted serially in 0.016 s. Calculate:

(i) The time duration of 1 word.

(2 Marks)

(ii) The time duration of 1 bit.

(2 Marks)

(iii) The speed of transmission in bits per second.

(2 marks)

(b) Calculate the required time for a 1500-byte block of data be transmitted on a 10-Mbps Ethernet (IEEE 802.3) packet?

(4 marks)

(c) By using your own word, differentiate the operation of ALOHA, CSMA and CSMA/CD.

(4 marks)

(d) Assume that there are only two stations A and B, in a CSMA/CD network. The distance between the two stations is 2000 m and the propagation speed is 2×10^8 m/s. If station A starts transmission at time t_1:

(i) Meanwhile station B to start transmitting at time $t_1 + 8\ \mu s$, determine whether the CSMA/CD protocol allow the station B to transmit or not. Explain your answer.

(3 marks)

(ii) Meanwhile station B to start transmitting at time $t_1 + 11\ \mu s$, determine whether the CSMA/CD protocol allow the station B to transmit or not. Explain your answer.

(3 marks)

Q5 (a) A block of addresses is granted to a small company. We know that one of the addresses is 205.20.40.40/26.

(i) Determine total number of hosts can be assigned in the company using the granted block addresses.

(2 marks)

(ii) Determine the first address in the block.

(3 marks)

(ii) Determine the last address in the block.

(4 marks)

(b) An organization is given a block of IP addresses which is 17.16.40.0/24. You are as a network engineer needs to divide the addresses into subnets for four departments in the organization as the followings:

Human Resource Department: 56 hosts

Accounting Department: 35 hosts

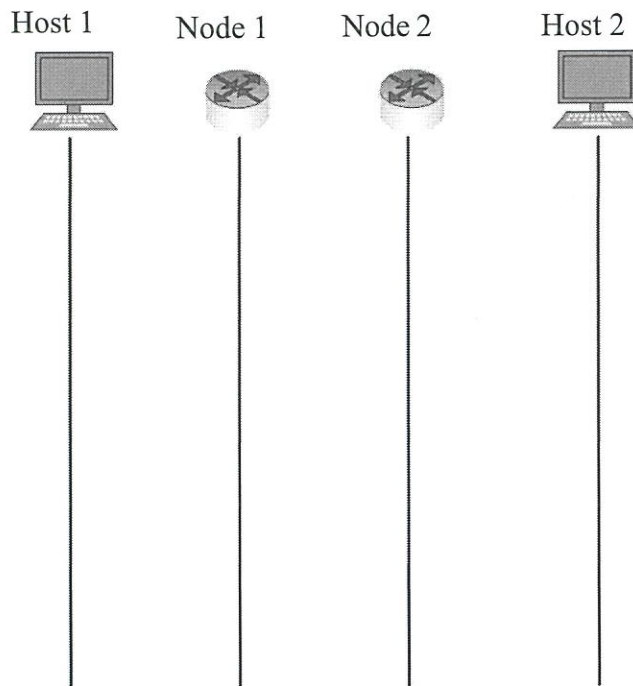Technical Department: 20 hosts

Service Department: 18 hosts

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(i)   Produce possible arrangement of subnet numbers, subnet mask, and range of IP addresses for each department to make this possible.

(10 marks)

(ii)   Calculate number of addresses that are still available after these allocations
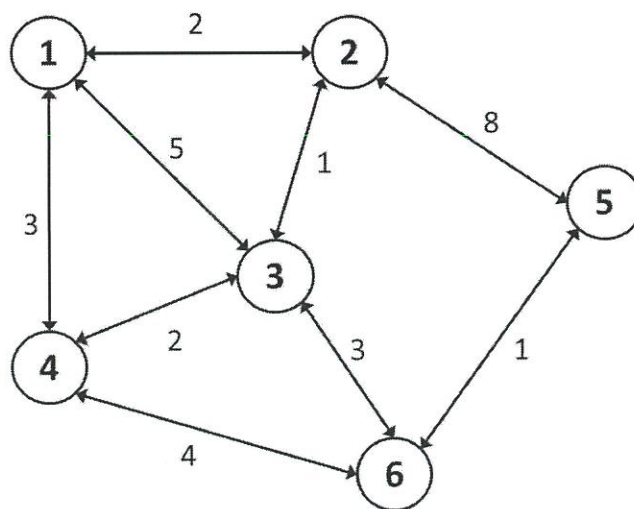
(1 mark)

-END OF QUESTIONS –

FINAL EXAMINATION

Figure Q3(a)

Figure Q3(b)