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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023**

COURSE NAME : COMPUTER NETWORKS
COURSE CODE : BEJ42103
PROGRAMME CODE : BEJ
EXAMINATION DATE : JULY/AUGUST 2023
DURATION : 3 HOURS
INSTRUCTION : 1. ANSWER **ALL** QUESTIONS.
2. THIS FINAL EXAMINATION IS A
CONDUCTED VIA **CLOSED BOOK**.
3. STUDENTS ARE **PROHIBITED** TO
CONSULT THEIR OWN MATERIAL OR
ANY EXTERNAL RESOURCES
DURING THE EXAMINATION
CONDUCTED VIA CLOSED BOOK.

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

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- Q1** (a) (i) Suppose you have the following 2 bytes: 01011100 and 01100101. Calculate the 1's complement of the sum of these 2 bytes?
(3 marks)
- (ii) Assume you have the following 2 bytes: 11011010 and 01100101. Calculate the 1's complement of the sum of these 2 bytes?
(3 marks)
- (iii) For the bytes in **Q1(a)(i)**, give an example where one bit is flipped in each of the 2 bytes and yet the 1's complement doesn't change.
(6 marks)
- (b) In modern packet-switched networks, including the Internet, application-layer messages will be chunked into smaller packets and send the packets into the network. The receiver then reassembles the packets back into the original message. We refer to this process is referred as message segmentation. **Figure Q1(b)** illustrates the end-to-end transport of a message with and without message segmentation. Consider a message that is 9 X 106 bits long that is to be sent from source to destination in **Figure Q1(a)**. Suppose each link in the figure is 3 Mbps. Ignore propagation, queuing, and processing delays.
- (i) Consider sending the message from source to destination without message segmentation. Keeping in mind that each switch uses store-and-forward packet switching, execute the total time to move the message from source host to destination host. Find the duration to move the message from the source host to the first packet switch?
(5 marks)
- (ii) Now suppose that the message is segmented into 800 packets, with each packet being 10,000 bits long. When the first packet is being sent from the first switch to the second switch, the second packet is being sent from the source host to the first switch. Calculate how long does it takes to move the first packet from source host to the first switch and the second packet be fully received at the first switch.
(8 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) the frame received by the receiver is damaged, (2) the acknowledgement is lost and has not been received by the transmitter, (3) the frame transmitted by transmitter is lost.
(4 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 messages. Analyze the **TWO (2)** ARQ protocols which are Selective Reject and Go Back N that would provide less of a burden to this server.
(6 marks)

- (b) Twisted pair cable, coaxial cable and optical fiber cable are classified as guided transmission medium.
- (i) Draw and label the physical construction of these **THREE(3)** transmissions media. (6 marks)
 - (ii) Compare **ONE (1)** advantage and **ONE (1)** disadvantage of each transmission media. (6 marks)
 - (iii) State **ONE (1)** factor that affects the selection of this media. (3 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. (6 marks)
- (b) Consider the network topology illustrated 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. (9 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 incurring transmitting the whole message on circuitswitched network. (4 marks)
 - (ii) calculate the end-to-end delay incurring to transmit the whole message on virtualcircuit packet switching network. (6 marks)

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- Q4** (a) A block of addresses is granted to a small company. 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. (2 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
- (i) Produce possible arrangement of subnet numbers, subnet mask, and range of IP addresses for each department to make this possible. (9 marks)
 - (ii) Calculate number of addresses that are still available after these allocations. (2 marks)
- (c) By using your own words, 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)

-END OF QUESTIONS -

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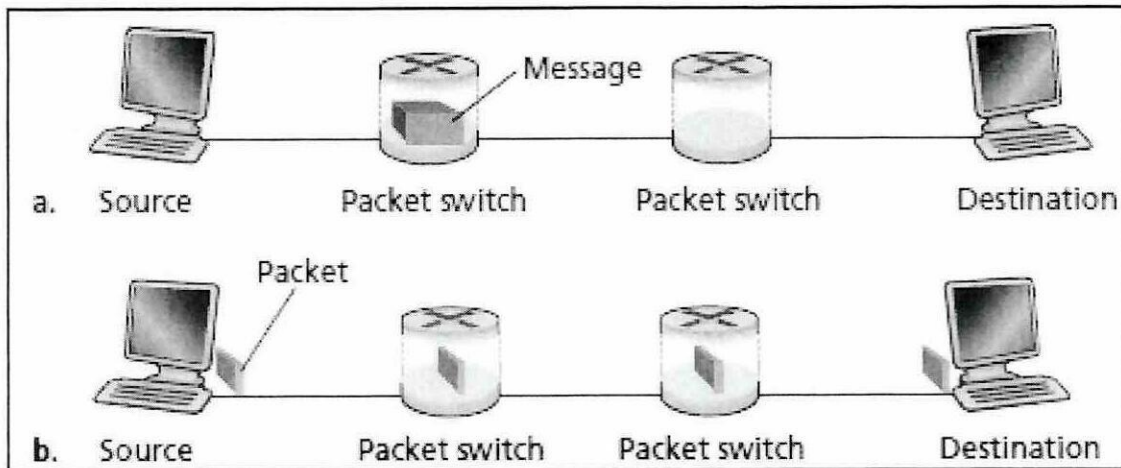


Figure Q1(b)

End-to-end message transport: (a) without message segmentation; (b) with message segmentation.

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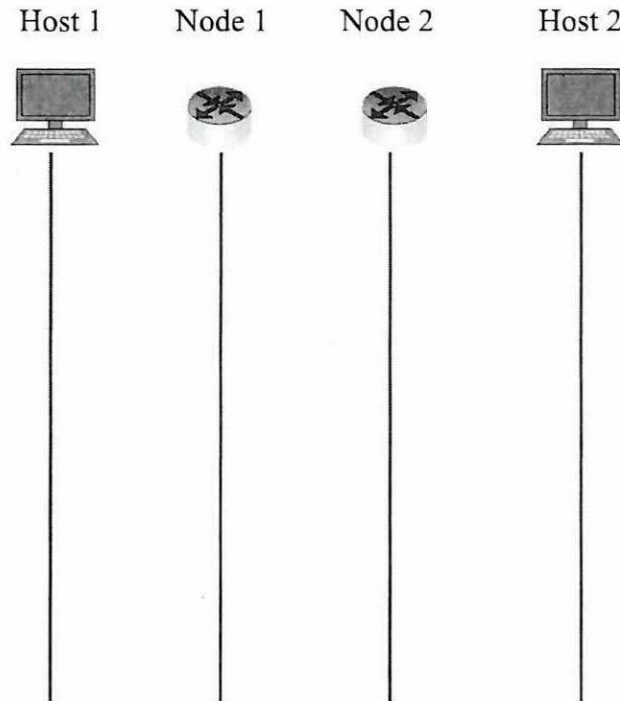


Figure Q3(a)

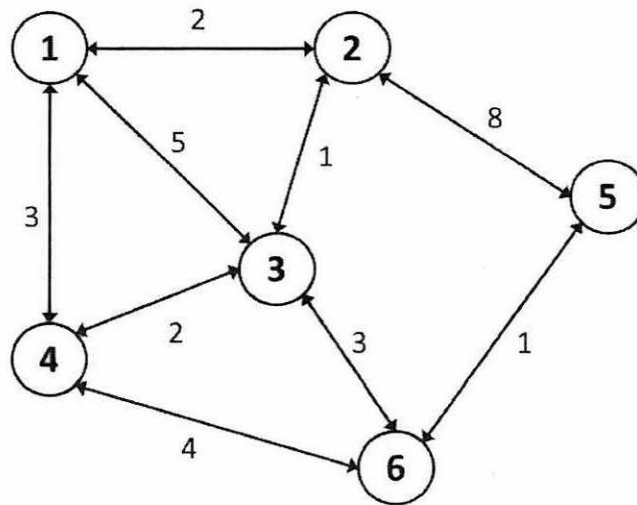


Figure Q3(b)