National University of Computer and Emerging Sciences, Lahore Campus

Course:	Computer Networks	Course Code:	CS3001
Program:	BS (Computer Science)	Semester:	Fall 2025
Due Date:	04th Sep, 2025		
Section:	H	Roll No.	
Quiz #	1		

Q1: Consider the two scenarios below: **[7] [CLO 1]**

A circuit-switching scenario in which Ncs users, each requiring a bandwidth of 15 Mbps, must share a link of capacity 140 Mbps.

A packet-switching scenario with Nps users sharing a 140 Mbps link, where each user again requires 15 Mbps when transmitting, but only needs to transmit 15 percent of the time. For packet switching, assume total 15 users are connected.

a) When circuit switching is used, what is the maximum number of users that can be supported? **[1 Mark]**

= 9 users

b) Suppose packet switching is used. What is the probability that a given (specific) user is transmitting, and the remaining users are not transmitting? **[1 Mark]**

= 0.01542

c) Suppose packet switching is used. What is the probability that one user (any one among the 15 users) is transmitting, and the remaining users are not transmitting? **[1 Mark]**

= 0.23123

d) When one user is transmitting, what fraction of the link capacity will be used by this user? Write your answer as a decimal. **[1 Mark]**

0.1071 = $\frac{15}{140}$

= 10.7%

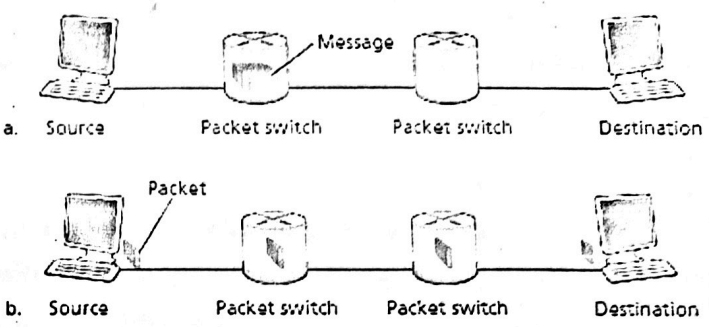
e) What is the probability that more than 9 users are transmitting? **[3 Mark]**

8.34×10^{-6}

$\sum_{k=10}^{15}$

Q2. In modern packet-switched networks, including the Internet, the source host segments long, application-layer messages (for example, an image or a music file) into smaller packets and sends the packets into the network. The receiver then reassembles the packets back into the original message. We refer to this process as message segmentation. Figure illustrates the end-to-end transport of a message with and without message segmentation. Consider a message that is 10^7 bits long that is to be sent from source to destination in the figure. Suppose each link in the figure is 40 Mbps. Ignore propagation, queuing, and processing delays. [13] [CLO 1]

a) Consider sending the message from source to destination without message segmentation. How long does it take to move the message from the source host to the first packet switch? [2]



0.25

b) Keeping in mind that each switch uses store-and-forward packet switching, what is the total time to move the message from source host to destination host? [2]

0.75

c) Now suppose that the message is segmented into 500 packets, with each packet being 20,000 bits long. How long does it take to move the first packet from source host to the first switch? [2]

0.0005

d) 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. At what time will the second packet be fully received at the first switch? [3]

0.001

e) How long does it take to move the file from source host to destination host when message segmentation is used? [4]

=0.251

(0.0005 × 3) + (499 × 0.005)

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Q1: Consider the two scenarios below: [7] [CLO 1]

A circuit-switching scenario in which Ncs users, each requiring a bandwidth of 20 Mbps, must share a link of capacity 150 Mbps.

A packet-switching scenario with Nps users sharing a 150 Mbps link, where each user again requires 20 Mbps when transmitting, but only needs to transmit 20 percent of the time. For packet switching, assume total 13 users are connected.

a) When circuit switching is used, what is the maximum number of users that can be supported? [1 Mark]

= 7 users

b) Suppose packet switching is used. What is the probability that a given (specific) user is transmitting, and the remaining users are not transmitting? [1 Mark]

0.013

c) Suppose packet switching is used. What is the probability that one user (any one among the 13 users) is transmitting, and the remaining users are not transmitting? [1 Mark]

0.1786

d) When one user is transmitting, what fraction of the link capacity will be used by this user? Write your answer as a decimal. [1 Mark]

0.133

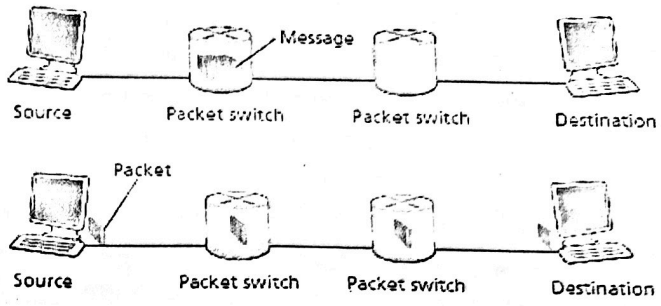
e) What is the probability that more than 7 users are transmitting? [3 Mark]

$= 0.00124$

$\sum_{K=8}^{13}$

Q2. In modern packet-switched networks, including the Internet, the source host segments long, application-layer messages (for example, an image or a music file) into smaller packets and sends the packets into the network. The receiver then reassembles the packets back into the original message. We refer to this process as message segmentation. Figure illustrates the end-to-end transport of a message with and without message segmentation. Consider a message that is 10^6 bits long that is to be sent from source to destination in the figure. Suppose each link in the figure is 5 Mbps. Ignore propagation, queuing, and processing delays. [13] [CLO 1]

a) Consider sending the message from source to destination without message segmentation. How long does it take to move the message from the source host to the first packet switch? [2]



= 0.2

b) Keeping in mind that each switch uses store-and-forward packet switching, what is the total time to move the message from source host to destination host? [2]

= 0.6

c) Now suppose that the message is segmented into 100 packets, with each packet being 10,000 bits long. How long does it take to move the first packet from source host to the first switch? [2]

= 0.002

d) 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. At what time will the second packet be fully received at the first switch? [3]

= 0.004

e) How long does it take to move the file from source host to destination host when message segmentation is used? [4]

$(99 \times 0.002) + (3 \times 0.002)$

= 0.204