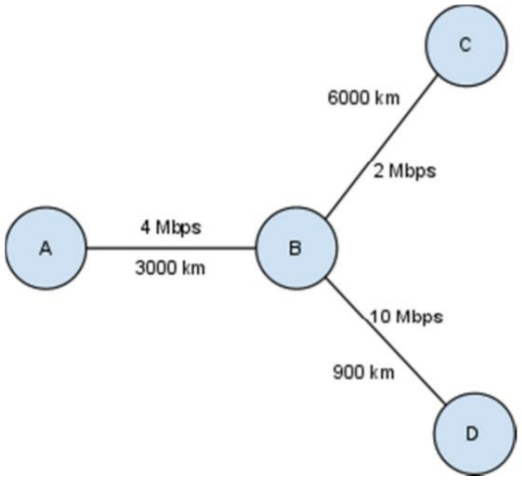
National University of Computer and Emerging Sciences, Lahore Campus

Course:	Computer Networks	Course Code:	CS307
Program:	BS(Computer Science)	Semester:	Fall 2019
Duration:	20 Minutes	Total Marks:	20
Date:	11 Sep, 2019	Quiz:	1
Section:	E (b)	Page(s):	1

Name_____ Roll No._____

Question 1: **[Marks 8]**

Assume data travels through the links at the speed of light.



(a) What is the transmission delay if

- A sends a 700byte packet to B
- B sends a 700byte packet to C

(b) What is the propagation delay between

- A to B
- B to C

Question 2: **[Marks 6]**

A wants to send a 700byte packet to C through **B**. **B** is supposed to follow the store-and forward model, that is, B will receive the whole packet from A and then start transmitting the packet to **C**.

(a) What is the **end-to-end delay** seen by the packet?
(b) What will be the throughput from A to C?

Question 3: **[Mark 6]**

(a) If **C** starts sending 700 byte packets back-to-back to **B**, then how many packets will C have transmitted before B starts receiving the first packet sent by C?
(b) What does this value have to do with the term "**bandwidth-delay product**"? **(Extra Credit)** **[Marks 3]**

1) (a) Transmission Delay = Size of Transfer / Link Bandwidth
A to B: Transmission Delay = (700/ ((4/8) x 10^6)) = **1.4ms or 0.0014s**
B to C: Transmission Delay = (700/ (2/8) x 10^6)) = **2.8ms or 0.0028s**

(b) Propagation Delay = Distance of link / Speed of light
A to B:
Propagation Delay = 3000 / (3 x 10^5) = **10ms or 0.01s**
B to C: Propagation Delay = 6000 / (3 x 10^5) = 20**ms or 0.02s**

2) (a) End to end delay between A to D = (Delay between A to B) + (Delay between B to D)
Delay on a link = Transmission Delay + Propagation Delay.
Therefore,
Delay between A to B = 1.4 + 10 = 11.4ms
Delay between B to C = 2.8 + 20 = 22.8ms.
End to end delay between A to D = 11.4ms + 22.8ms = 34.2

(b) Throughput = min{ A-B, B-C } = min{ 4mbps, 2mbps} = **2Mbps**

3) (a) For C to B, the propagation delay is 20 x 10^{-3}, and the bandwidth is 2Mbps.
Therefore,
Bandwidth-Delay product is (2/8 x 10^6) x (20 x 10^{-3}) = 5000 bytes
This translates to 5000/700 = **7.14packets**

(b) This is similar to computing the volume of a pipe. The amount of data that will be “in flight” on a network link is the product of its bandwidth and the propagation delay.