# National University of Computer and Emerging Sciences, Lahore Campus

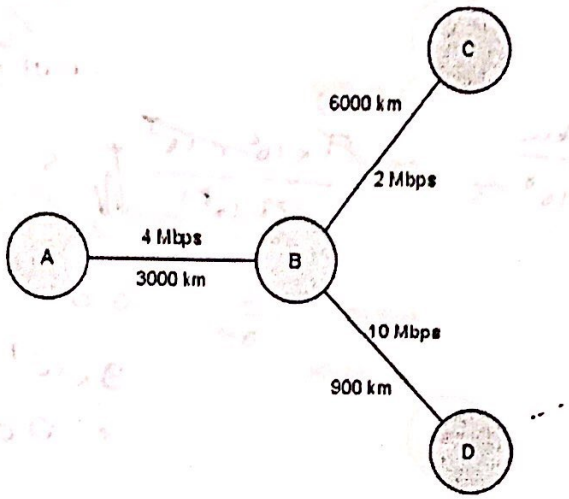
| | | | |
|---|---|---|---|
| Course: | Computer Networks | Course Code: | CS307 |
| Program: | BS(Computer Science) | Semester: | Fall 2019 |
| Duration: | 20 Minutes | Total Marks: | 20 |
| Date: | 11 Sep, 2019 | Quiz: | 1 |
| Section: | E | Page(s): | 1 |

Name M. Anas Bhatti Roll No. L16-4123

11

**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 500byte packet to B ~~0.125 s~~ $\frac{500 \times \frac{2}{8}}{4 \times 10^6} s = \frac{10}{10^4} = 0.001\ s$
- B sends a 500byte packet to D ~~0.125 s~~ $\frac{500 \times 8}{16 \times 10^6 s} = \frac{40}{10^5} = \frac{4}{10^4} = 0.0004\ s$

(b) What is the propagation delay between

- A to B 0.01 s ✓
- B to D 0.003 s

**Question 2:** [Marks 6]

A wants to send a 500byte packet to D 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 D.

(a) What is the **end-to-end delay** seen by the packet? 0.0144 s
(b) What will be the throughput from A to D?

**Question 3:** [Mark 6]

(a) If D starts sending 500 byte packets back-to-back to B, then how many packets will D have transmitted before B starts receiving the first packet sent by D? ~~depends on speed that packets were sent.~~ 3492 packets
(b) What does this value have to do with the term "**bandwidth-delay product**"? (Extra Credit) [Marks 3]

$d_{trans} = \frac{500 \text{ bytes}}{4 \text{ MBps}} = 0.125 \text{ ms}$

$d_{trans} = \frac{500}{10 \text{ MBps}} = 0.050 \text{ ms}$

$d_{prop} = \frac{3000 \text{ km}}{3 \times 10^8 \text{ m/s}} = \frac{3 \times 10^3 \times 10^3 \text{ m}}{3 \times 10^8 \text{ m/s}}$

$= \frac{1}{100} = 0.01 \text{ s}$

$= 0.01 \text{ s}$

$d_{prop} = \frac{900 \text{ km}}{3 \times 10^8 \text{ m/s}} = \frac{9 \times 10^5 \times 10^3}{3 \times 10^8} \text{ s}$

$= \frac{3}{1000} = 0.0$

$3 \times 10^{-3} \text{ s}$

$= 0.003$

Q2.

$d_{trans}^{A \to B} + d_{prop}^{A \to B} = 0.001 \text{ s} + 0.01 \text{ s} = 0.011 \text{ s}$

$d_{trans}^{B \to D} + d_{prop}^{B \to D} = 0.0004 + 0.003 = 0.0034 \text{ s}$

$= 0.0144 \text{ s}$

Q3

0.0004 s

?

0