National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	Computer Networks	Course Code:	CS307
Program:	BS(CS)	Semester:	Fall 2019
Duration:	1-hour	Total Marks:	35
Paper Date:	23-09-2019	Weight	15
Sections:	B,C,E,F	Page(s):	4
Exam Type:	Mid-1		

30+2

Student Name: Afaq Ahmad **Roll No.** L16-4380 **Section:** E

Instruction/Notes: Attempt questions on this paper. You may use rough sheet but it should not be attached to this paper as it will not be marked. Blotting this paper will result in negative marking.

1	✓	b	6	✗	a
2	✓	c	7	✗	c
3	✓	b	8	✗	b
4	✓	c	9	✓	c
5	✓	a	10	✓	c

Question 01: Select the correct answer and fill the table given above. **(10)** 7/100

1. If the size of the packet is increased, the following delay will be increased
   a. Queuing delay
   b. ✓ Transmission delay
   c. None of the above
   d. Both of the above
2. The following is NOT a packet switching delay
   a. Queuing delay
   b. Processing delay
   c. ✓ Connection establishment delay
   d. Transmission delay
3. FTP uses the same TCP connection to send control messages and data.
   a. True
   b. ✓ False
4. Which of the following access network technology will be disconnected if you get a phone call while using Internet:
   a. FTTH
   b. DSL
   c. ✓ Dialup
   d. Cable network
5. In an ideal world scenario, we would like the Internet to
   a. ✓ Behave like circuit a switched network but use packet switching
   b. Behave like a packet switched network but use circuit switching
   c. Always use packet switching
   d. Always use circuit switching
6. A traffic intensity of 1 means
   a. ✓ Optimal usage of network resources
   b. Infinite delays
   c. Waste of network resources

d. None of the above

7. Which of the following could be a potential drawback of having layered models for networks
   a. Redundancy of functionalities on different layers
   b. Too many addressing schemes
   c. ✓ Security implementation on each layer
   d. All of the above
8. A UDP packet can be referred to as
   a. Frame
   b. ✓ Datagram
   c. Segment
   d. Message
9. The behavior of HEAD method in HTTP is similar to
   a. POST
   b. DELETE
   c. ✓ GET
   d. All of the above except that it is used for debugging too
10. If a user wants to download three files simultaneously, there will be _____ number of TCP connections between FTP client and FTP server
    a. 2
    b. 3
    c. ✓ 4
    d. 5

15/15

Question 02: Consider the network connectivity between Node A and B shown in *figure 1*. Take the following assumptions and solve the questions given below:

Assume:

All links length = 3 Kms, Links transmission capacity = 50 Mbps, propagation speed = 300 meters/microseconds
Processing delay = 0; packet size = 1000 bytes **(3+4+4+4)**

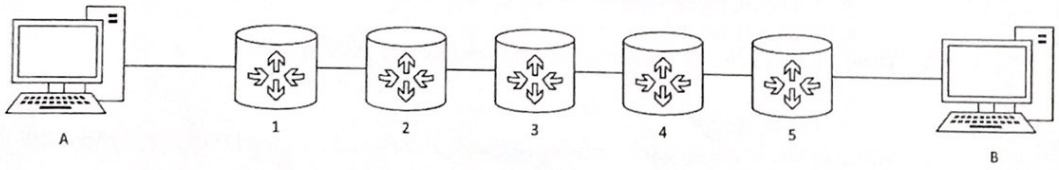

Figure 1

3/3 a) Find the total delay from A to B

$d = 3000m$, $R = 50 \times 10^6$ bps, $s = \frac{300\ m/s}{10^{-6}} = 3 \times 10^8 m/s$, $L = 8000$ bits ✓

Total delay $= 6\frac{L}{R} + 6\frac{d}{s} = \frac{6 \times 8000}{50 \times 10^6} + \frac{6 \times 3000}{3 \times 10^8} = \frac{48}{50 \times 10^3} + \frac{18}{3 \times 10^5}$

$= 0.96 \times 10^{-3} + 0.06 \times 10^{-3} = 1.02 \times 10^{-3}$ s ✓

Total delay = 1.02 msec ✓

4/4 b) Suppose that the link between router 2 and 3 has a transmission capacity of 100 Mbps. What will be the end-to-end delay in this case?

$$\text{Delay} = \frac{5L}{R} + 6\frac{d}{s} + \frac{L}{100\times10^6} = \frac{5\times8000}{50\times10^6} + 6\,\frac{\times3000}{3\times10^8} + \frac{8000}{100\times10^6}.$$

$$= 0.8\times10^{-3} + 0.06\times10^{-3} + 0.08\times10^{-3} = 0.94\times10^{-3}\,s.$$ ✓

4/4 c) Suppose three packets are already queued at router 3 when a packet from Node A travelled to router 3. What will be the end-to-end delay? (assume transmission capacity of all links to be the same).

$$\text{Delay} = \frac{6L}{R} + \frac{6d}{s} + \frac{3L}{R} = 1.02\times10^{-3} + \frac{24000}{50\times10^6}$$ ✓

$$= 1.02\times10^{-3} + 0.48\times10^{-3} = 1.5\times10^{-3}\,\text{sec}.$$ ✓

4/4 d) What is the maximum number of bits that can be on the link at any given time?

For max. no. of bits of a link: $d_{trans} = d_{prop} \Rightarrow \frac{L}{R} = \frac{d}{s}$.

$$L = \frac{d}{s}\times R = \frac{3000\times50\times10^6}{3\times10^8} = \frac{1500\times10^8}{3\times10^8} = 500\,\text{bits}.$$

So max. bits = 500 bits ✓

Good stuff! ✓✓

8+2/10 **Question 03:** An Internet user located in Lahore requests a 125 KB web page from a server located in Islamabad. The received page references 5 image files, 250 KB each. User is connected to the Internet via a 10 Mbps access link. Assume that it takes 50 ms for a small HTTP message to travel from client to server (and vice versa). Also assume that user's access link is the connection bottleneck. **(2+4+4)**

2/2 a) What is RTT? Calculate the value of RTT in this above connection

RTT is the time equal to the time taken by a small message (req/response) to go from client to server ~~plus~~ the time from server to client. ✓

$$RTT = 50\,ms + 50\,ms = 100\,ms.$$ ✓

3/4

4/4

b) Calculate the total time taken for the web page (including image files) to display on user's screen if non-persistent HTTP is used with one connection at a time (ignore processing delays)

Total Time $= 2RTT + \frac{125\times8\times10^3}{10\times10^6} + 5\left(2RTT + \frac{250\times8\times10^3}{10\times10^6}\right)$

$= 12RTT + \frac{125\times8\times10^3}{10\times10^6} + \frac{125\times10\times8\times10^3}{10\times10^6}$

$= 12(100\times10^{-3}) + 11\left(\frac{1000\times10^3}{10\times10^6}\right) = 1200\times10^{-3} + \frac{11\times10^6}{10\times10^6}$

$= 1.2 + 1.1 = 2.3$ sec.

2+2/4 c) How long would it take to display the same web page with persistent HTTP (single connection)? −2

Total Time $= 2RTT + \frac{125\times8\times10^3}{10\times10^6} + 5\left(RTT + \frac{250\times8\times10^3}{10\times10^6}\right)$

$= 7RTT + 11\left(\frac{1000\times10^3}{10\times10^6}\right) + RTT + 5\left(\frac{250\times8\times10^3}{10\times10^6}\right)$

$= 7(100\times10^{-3}) + \frac{11\times10^6}{10\times10^6} = 700\times10^{-3} + 1.1$

$= 0.7 + 1.1 = 1.8$ sec.

Considering this correct!

4/4

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Student Name: Abdul Rehman · **Roll No.** 16-4297 **Section:** E

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1	b		6	d	
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19.5

Question 01: Select the correct answer and fill the table given above. (10)

7/10

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7. Which of the following could be a potential drawback of having layered models for networks
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10. If a user wants to download three files simultaneously, there will be _____ number of TCP connections between FTP client and FTP server
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Question 02: Consider the network connectivity between Node A and B shown in *figure 1*. Take the following assumptions and solve the questions given below:

Assume:

All links length = 3 Kms, Links transmission capacity = 50 Mbps, propagation speed = 300 meters/microseconds
Processing delay = 0; packet size = 1000 bytes **(3+4+4+4)**

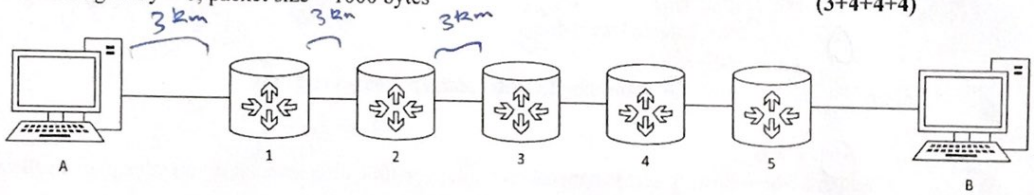


Figure 1

a) Find the total delay from A to B

length = 3kms = 3000m = d
Transmission capacity = 50 Mbps = R
Propagation speed = 300 m/μs = $\frac{300}{10^{-6}}$ m/s = 300×10^6 ms^{-1} = c
Processing delay = 0
packet size = 1000 bytes = L
queuing delay = 0
No. of links = N = 6

Total delay = $d_{trans} + d_{process} + d_{prop} + d_{que}$

$= N\left(\frac{L}{R}\right) + N\left(\frac{d}{S}\right) + 0 + 0 = 6\left(\frac{20}{50\times10^6}\right) + 6\left(\frac{3000}{300\times10^6}\right)$

$= 1.8 \times 10^{-4}$ s

2.5 2/4

b) Suppose that the link between router 2 and 3 has a transmission capacity of 100 Mbps. What will be the end-to-end delay in this case?

$$= 5\left(\frac{1000 \times 8}{50 \times 10^6}\right) + \left(\frac{1000 \times 8}{100 \times 10^6}\right) + 6\left(\frac{3000}{300 \times 10^4}\right)$$

$$= 1.7 \times 10^{-4} s$$

c) Suppose three packets are already queued at router 3 when a packet from Node A travelled to router 3. What will be the end-to-end delay? (assume transmission capacity of all links to be the same).

$$= \text{total delay} + 3 \times (\text{queuing delay})$$

$$= 1.8 \times 10^{-4} + 3\left(\frac{1000 \times 8}{50 \times 10^6}\right)$$

$$= 2.4 \times 10^{-4}$$

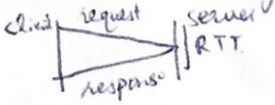
d) What is the maximum number of bits that can be on the link at any given time?

Maximum number of bits that can be on the link is equal to the throughput of the ~~link~~ connection on given time.

Question 03: An Internet user located in Lahore requests a 125 KB web page from a server located in Islamabad. The received page references 5 image files, 250 KB each. User is connected to the Internet via a 10 Mbps access link. Assume that it takes 50 ms for a small HTTP message to travel from client to server (and vice versa). Also assume that user's access link is the connection bottleneck. **(2+4+4)**

a) What is RTT? Calculate the value of RTT in this above connection

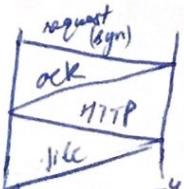
RTT stands for round trip time. It means the time taken by a message to go the server from client and then coming back.



page size - 125 KB

access link speed = 10 Mbps. (time for 10 Mbytes)

time for 125 KB = $\frac{125}{10^4}$ s



so, ~~total~~ RTT = $3(50 \text{ ~~milli~~}) + \left(50 \text{ ms} + \frac{125}{10^4} s\right) + 50 \times 10^{-6} + 125 \times 10^{-4}$

$= 1.265 \times 10^{-2}$ s

3/4

b) Calculate the total time taken for the web page (including image files) to display on user's screen if non-persistent HTTP is used with one connection at a time (ignore processing delays)

time taken by 250kb = $\frac{250}{10^4}$ s =

~~total = RTT (50+1) + 5(50+)~~

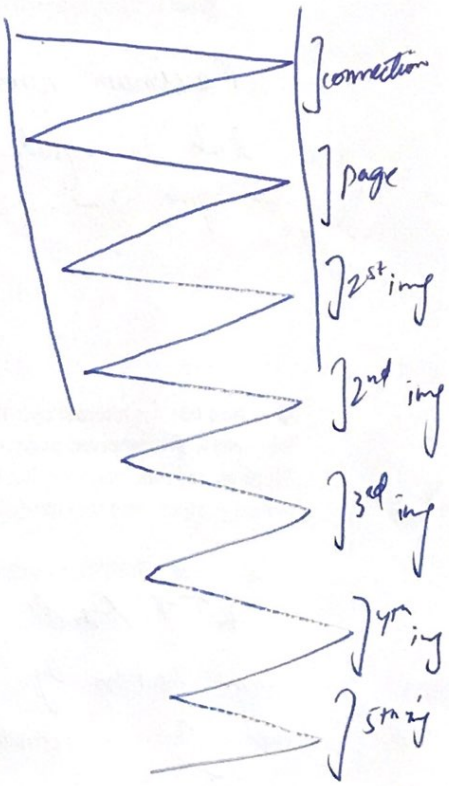
total = $\left((3 \times 50 \times 10^{-3}\text{s}) + \frac{125}{10^4} \times 8 \times 1000\right) + 5\left((3 \times 50 \times 10^{-3}) + \left(\frac{250}{10^4} \times 8 \times 1000\right)\right)$

= 1.0375 s.

c) How long would it take to display the same web page with persistent HTTP (single connection)?

$= 3(50 \times 10^{-3}) + \left(\frac{125}{10^4} \times 8 \times 1000\right) + 5\left(50 + \frac{250}{10^4} \times 8 \times 1000\right)$

= 250.7875 s.



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Student Name: Usama Roll No. 151-4187 Section: E

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6

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2/10

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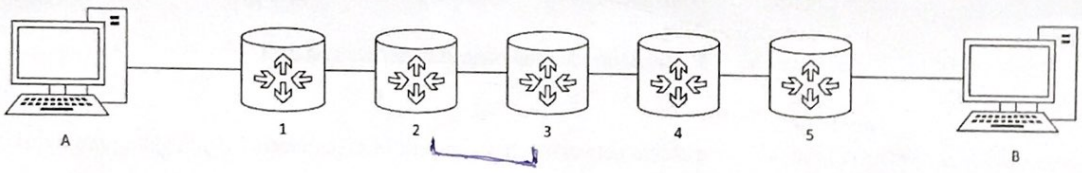

Figure 1

a) Find the total delay from A to B

As all links have same length & transmission speed along with propagation speed & packet size, so transmission & propagation delay of all will be same & we will simply add that

2/

Transmission delay $= \frac{L}{R} = \frac{1000 \times 8 \text{ bits}}{50 \times 10^6 \text{ bps}} = 1.6 \times 10^{-4}$ ✓

Propagation delay $= \frac{d}{v} = \frac{3 \times 1000}{300 \times 10^{-3} \text{ m/sec}}$
$= 1 \times 10^4$ X

✓ Total delay $= 6(1.6 \times 10^{-4}) + 6(1 \times 10^4)$
$= 9.6 \times 10^{-4} + 6 \times 10^4$
$= 60000.00096$ X

OR

$T_T = \frac{3 \times 1024}{50 \times 10^6 \text{ bps}}$
$= 6.144 \times 10^{-5}$

$T_P = \frac{1000 \times 10^{-3}}{300 \times 10^{-3}}$
$= 3.33$

Total delay $= 6(6.144 \times 10^{-5} + 3.33)$
$= 19.98$

b) Suppose that the link between router 2 and 3 has a transmission capacity of 100 Mbps. What will be the end-to-end delay in this case?

Transmission delay = $L/R = \frac{3 \times 1024}{100 \times 10^6} = 3.072 \times 10^{-5}$ X

Propagation delay = $d/v = \frac{1000 \times 10^{-3}}{300 \times 10^{-3}} = 3.33$ X

Total $_{e-e}$ = $3.072 \times 10^{-5} + 3.33$

= 3.33 X

0.5

c) Suppose three packets are already queued at router 3 when a packet from Node A travelled to router 3. What will be the end-to-end delay? (assume transmission capacity of all links to be the same).

Transmission delay = $L/R = \frac{3 \times 1024}{50 \times 10^6} = 6.144 \times 10^{-5}$

Propagation delay = $d/v = \frac{1000 \times 10^{-3}}{300 \times 10^{-3}} = 3.33$ X

Total $_{end\ to\ end}$ = $3(6.144 \times 10^{-5} + 3.33)$

= 9.99 X

0.5

d) What is the maximum number of bits that can be on the link at any given time?

Maximum bits = 8000 bits X

0

Question 03: An Internet user located in Lahore requests a 125 KB web page from a server located in Islamabad. The received page references 5 image files, 250 KB each. User is connected to the Internet via a 10 Mbps access link. Assume that it takes 50 ms for a small HTTP message to travel from client to server (and vice versa). Also assume that user's access link is the connection bottleneck. **(2+4+4)**

a) What is RTT? Calculate the value of RTT in this above connection

5 image files = 5×250 = Total 1250 KB

Internet speed = 10 Mbps

Speed = 50 ms

X

$RTT = \frac{50 \times 1250}{10} = 6250$

0

b) Calculate the total time taken for the web page (including image files) to display on user's screen if non-persistent HTTP is used with one connection at a time (ignore processing delays)

Total time taken

RTT - ?

$T_T = \frac{L}{R} = \frac{125 \times 1024}{10 \times 10^6} = 0.0128$

$T_p = \frac{d}{s} = \frac{1250}{50} = 25$ X

Total time = $0.0128 + 25 = 25.0128$

c) How long would it take to display the same web page with persistent HTTP (single connection)?

As its persistent HTTP, so time will be very less means you can say speed of light. It will be very fast.

Are you saying the answer is 3×10^8 m/s??

4/4