National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	Computer Networks	Course Code:	CS3001
Degree Program:	BCS , BSE	Semester:	Spring 2023
Exam Duration:	60 minutes	Total Marks:	50
Paper Date:	27th February 2023	Weight	15%
Section:	ALL	Page(s):	5+1 (Rough Page)
Exam Type:	Midterm 1		

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Instructions/Notes:
- Attempt all questions on the provided space in the question paper.
- Even if you do use rough sheets, they should NOT be attached with final paper.
- For any ambiguity, make assumption, answer accordingly by stating your assumption.

Question #	1	2	3	4	5
Total Marks	5	10	9	16	10
Obtained Marks	4	06	09	15.5	04
CLO #	1	1	1	2	2

Question 1: Answer the following multiple-choice questions by filling the following table. **No Cutting/overwriting.**

[1+1+1+1+1 = 5 Marks] (CLO 1)

1.1)	A
1.2)	B
1.3)	~~B~~
1.4)	B
1.5)	D

1.1. Which protocol has separate data and control connections?
- A. FTP
- B. HTTP
- C. SMTP
- D. MAP

1.2. Which of the following statement is correct
- A. HTTP is a Push protocol, while SMTP is a Pull protocol
- B. HTTP is a Pull protocol, while SMTP is a Push protocol
- C. Both HTTP & SMTP are Push protocols
- D. Both HTTP & SMTP are Pull protocols

1.3. For email retrieval from the receiver's mail server, the following protocol can be used
- A. FTP
- B. SMTP
- C. IMAP
- D. None of the above

1.4 The two main types of switching networks are
- A. Routers and Switches
- B. Circuit-switched and Packet-switched
- C. Wi-Fi and Ethernet
- D. None of the above

1.5. Which of the following is a delay that packets can experience in packet-switched networks?
- A. Transmission Delay
- B. Propagation Delay
- C. Queueing Delay
- D. All of the above

Question 2: Consider a packet-switched network with five links connected in series, as shown below:

S ----- R1 ----- R2 ----- R3 ----- R4 ----- D [5+5 = 10 Marks] (CLO 1)

The transmission rate of each link is 10 Mbps (mega bits per second, where 1M = 10^6) and the propagation delay of each link is 20 ms. There is a processing delay of 5 ms at each router. The size of each packet is 1000 bytes, including the header. There are no queuing delays on any of the links.

(a) What is the end-to-end delay for a packet to travel from S to D?

Transmission rate of each link = $R = 10\text{Mbps} = 10 \times 10^6 \text{ bps}$
Propagation delay of each link = $d_{prop} = 20\text{ms}$
Processing delay at each router = $d_{proc} = 5\text{ms}$
Size of each packet = $L = 1000 \text{ bytes} = 8000 \text{ bits}$

End-to-End Delay = $d_{end\text{-}end} = d_{proc} + d_{trans} + d_{queue} + d_{prop}$

$d_{queue} = 0$

d_{trans} from S to R1 = $\frac{L}{R} = \frac{8000}{10 \times 10^6} = 8 \times 10^{-4} \text{ sec}$

Total no. of links = 5

d_{trans} from S to D = $5(8 \times 10^{-4}) = 4 \times 10^{-3} \text{ sec} = 4\text{msec}$

d_{prop} from S to D = $5(20 \times 10^{-3}) = 0.1\text{sec}$

Total no. of routers = 4

$d_{proc} = 4(5 \times 10^{-3}) = 0.02\text{sec}$

$D_{end\text{-}end} = 0.02 + 4 \times 10^{-3} + 0 + 0.1 = 0.124\text{sec}$

5

(b) Calculate the average throughput in KB/sec (kilo bytes / second) in the complete file transfer of 4KB (kilo bytes, where 1K = 10^3) and time taken by this file to transfer (assuming the same packet size of 1000 bytes)?

File Size = 4KB = 32×10^3 bits, Packet Size = 8000 bits, No. of packets = 4
All links have same transmission rate.
So, $\min\{R_1, R_2, R_3, R_4, R_5\} = R = 20\text{msec}$

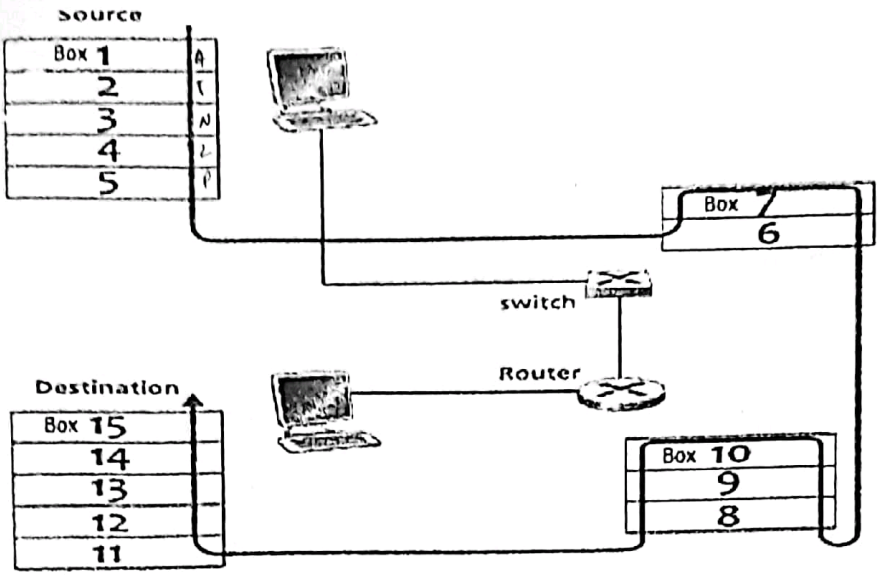
Average Throughput = $\frac{32 \times 10^3}{20 \times 10^{-3}} = 1600{,}000 \text{ bps} = 1600 \text{ Kbps} = 200 \text{ KBps}$

Average throughput = 200 KB/sec

Time taken to transfer one packet = 0.124sec
In store-and-forward method
Total time = $0.124 + 3(0.0258) = 0.2014\text{sec}$
Alternatively
Total time = ~~$4(0.124) = 0.496\text{sec}$~~

2

Question 3: In the scenario below, imagine that you're sending an http request to another machine somewhere on the Internet. [9 Marks] (CLO 1)



9

Which layer from the TCP/IP stack corresponds to the following scenarios / box number:

Scenario / Box	Layer
Moves datagrams from the source host to the destination host	Network
Handles messages from a variety of network applications	Application
Passes frames from one node to another across some medium	Link
Bits live on the wire	Physical
Handles the delivery of segments from the application layer, may be reliable or unreliable	Transport
Box 7	Link
Box 10	Network
Box 6	Physical
Box 12	Link

Question 4: Suppose you would like to create a startup and register its domain name called www.TheFastCompany.com . To register the domain name, you will ask the DNS Registrar to enter Resource R... (RR) in the DNS distributed database. Assume that your company has 10,000 web servers and it's own DNS serv... named **dns.fastcompany.com** with IP address 152.79.111.58 **[3 + 1 + 8 + 4 = 16 Marks]** (CL...

(a) You are required to write the two RRs needed to be updated by the DNS Registrar to make this whole syste... work by filling the table below (Ignore TTL): [3]

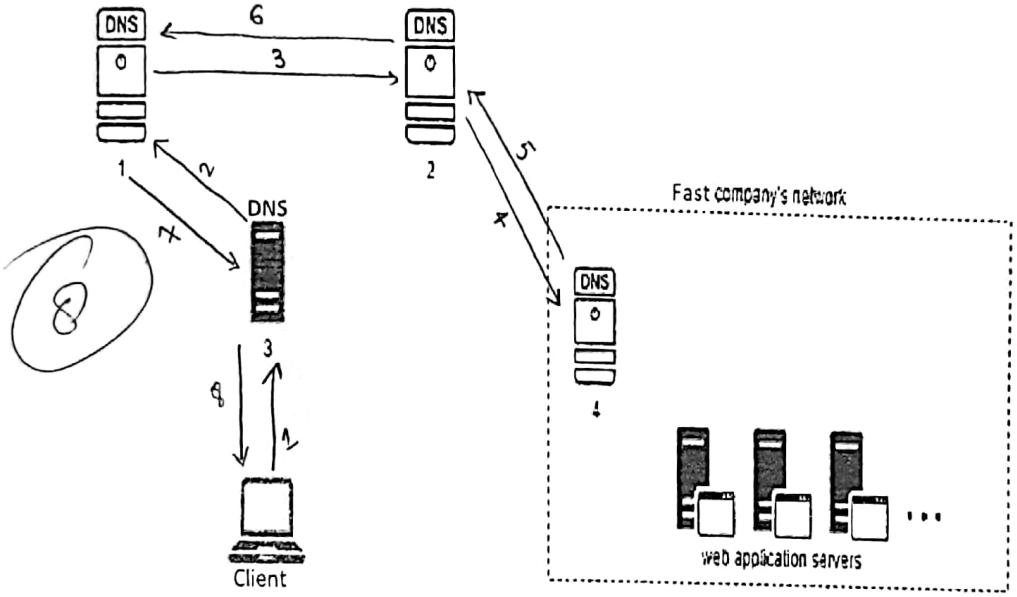
Answer:

NAME	VALUE	TYPE
TheFastCompany.com	152.79.111.58	'A'
TheFastCompany.com	dns.authreditive.FastCompany.com	'NS'

(b) In which name server will the two RRs be inserted that you filled in the table above? **Answer:** TLD [1]

(c) Refer to the diagram below, draw arrows showing **direction** of a recursive DNS query initiated from a DNS client requiring translation for your company's domain name into an IP address and label each arrow with the correct **sequence number** of the respective DNS query: [8]

Answer:



(d) Refer to the above diagram, label (name) the DNS Servers 1 till 4 [4]

Answer:

1. Root
2. TLD
3. Local
4. Authoratitive

Question 5: A client is looking to get 18 total objects from an HTTP server with which it maintains a round trip time (RTT) of T. The transmission time of each object is α. Assume that the IP addresses to acquire all objects are already known to the client i.e. no need for DNS queries. Assume that no TCP connection yet exists between the client and the server and the packet sizes in establishing any TCP connections are negligible. What is the minimum time it would take the client to get all the objects (via HTTP) from the server under each of the following conditions?

[2+4+2+2=10 Marks] **[CLO 2]**

(a) Non-persistent HTTP with no parallel TCP connection. **[2]**

Answer:

$\Rightarrow 18(2T+\alpha)$ $2RTT+\alpha$

$18(2T+\alpha)$

2

(b) Non-persistent HTTP with the browser configured for 5 parallel connections? **[4]**

Answer:

gives 5

$\rightarrow 2RTT+5\alpha + 13(2RTT+\alpha)$

serves 5 objects in parallel connection

$2(2RTT+5\alpha) + 3(2RTT+\alpha)$ if parallel connections are used for remaining ones.

1

(c) Persistent (but not Pipelined) HTTP with no parallel TCP connection? **[2]**

Answer:

$\Rightarrow T+18\alpha$ $RTT+18\alpha$

$T+18\alpha$

2

(d) Persistent and Pipelined HTTP with no parallel TCP connection? **[2]**

Answer:

$2T+18\alpha$

$3T+18\alpha \rightarrow$ if 1T for connection + 1 for request + 1 for response as in halfduplex pipes

2