Roll. No.: ______________ Name: ________________________________ Section: ____

CSE232: Computer Networks
Midsem Monsoon 2024 (SOLUTIONS)
Date: October 7, 2024; Duration: 60 mins (3 pm to 4 pm)
Total marks: 26

Instructions:

(1) Write your Roll. No. and Name on each sheet.
(2) Read the questions carefully and answer.
(3) Answer in brief and to the point as much as possible.
(4) Answer up to 2-point decimal for numerical.

Q.1. Match the columns **[4]**
*Note: You may find multiple matches for the left column; Make sure that you choose **EXACTLY ONE MATCH** from the left column to the right column.*

1	Used for delivering emails between servers	**a**	HTTP
2	Retrieves emails from a mail server	**b**	POP
3	Retrieves the IP address of a domain name	**c**	SMTP
4	Retrieves hop-by-hop route that a packet takes to the destination	**d**	ping
5	A transport protocol that does not control the sender's data rate	**e**	Netstat
6	Used to test network connectivity and latency	**f**	UDP
7	Allows browsing and retrieval of web pages	**g**	dig
8	Displays active network connections	**h**	TCP
		i	Traceroute

Ans: 1 ____ , 2 ____ , 3 ____ , 4 ____ , 5 ____ , 6 ____ , 7 ____ , 8 ____

Ans: 1 __(c)__ , 2 __(b)__ , 3 __(g)__ , 4 __(i)__ , 5 __(f)__ , 6 __(d)__ , 7 __(a)__, 8 __(e)__

Q.2. What does the following netcat command do? **nc -l 8080**
(There could be more than one correct answer) **[1]**

A) Opens a TCP connection on port 8080
B) Listens for incoming connections on port 8080
C) Checks the DNS resolution on port 8080
D) Scans the port 8080 on a remote machine

Ans: B or A&B

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Q.3. How might network performance suffer if congestion control is not implemented, even when flow control is in place? Justify at least TWO problems and how they impact the network performance. **[2]**

Ans: Even if flow control ensures that the receiver can handle the data, the absence of congestion control can lead to network-wide traffic jams, resulting in (a) packet loss, (b) retransmissions, and (c) increased latency, negatively impacting overall performance.

Q.4. Suppose a client requests to resolve **"www.example.com".** Show the components traveled by the request (and the traversal sequence) until the response reaches back to the client. Provide specific names of each component. **[1+2+2 = 5]**

For example, your answer should look like: ***Client → Local DNS server → ..... → Client***

(a) Assume that the DNS resolver (with the client machine) makes a recursive query for "www.example.com," and it already has the result in its cache.

Ans:

Client → Client (It is okay if you show loopback or just write Client)

(b) Assume that both the DNS resolver and the local DNS server do not have the result in their respective cache, and answer the following:

(i) Assume a recursive DNS query is used between the client and the local DNS server, and the local DNS server also implements a recursive DNS query.

Ans:

Client → Local DNS server → Root DNS server → TLD server (.com) → Authoritative DNS server (example.com) → TLD server (.com) → Root DNS server → Local DNS server → Client

(ii) Assume a recursive DNS query is used between the client and the local DNS server, and the local DNS server implements an iterative DNS query.

Ans:

Client → Local DNS server → Root DNS server → Local DNS server → TLD server (.com) → Local DNS server → Authoritative DNS server (example.com) → Local DNS server → Client

Q.5. Suppose you are accessing a web page via your browser. If a webpage contains **5 objects** (images, stylesheets, etc.), each object takes **100ms** to receive (i.e., file download time). The download time for the main object is **20ms.** The round trip time, RTT, is **10ms.** Based on the mentioned scenario, answer the following. **[2+3+3 = 8]**

(a) You type in the URL and send a request for the webpage. What are the prerequisites before the browser requests the web object from the web server?

Ans:

(1) Obtain the IP address using DNS resolution [1]; (2) Set up a TCP connection with the web server on port 80 (or 443), where the web server IP address is obtained from step 1 [1].

(b) You type in the URL and send a request for the webpage. Assume the web server IP address is not cached, and DNS resolution takes **10ms**. How long will it take to load the entire webpage if non-persistent HTTP is used? Assume the browser does not support parallelism.

Ans.

Time to load entire webpage = IP resolution time + Time to receive the main (or base) object + Time to receive 5 objects

Time to receive the main object does not depend on whether the HTTP connection is persistent or not.

Time to receive the main object = 2 * RTT + object download time = 2 * 10 + 20 = 40 ms [1]

Time to receive 5 objects (without parallelism) = 5 * *(2* * RTT + object download time) = 5 * (2* 10 +100) = 600 ms [1]

(Non-persistent) Time to load entire webpage = 10 + 40 + 600 = 650 ms [1]

(c) You type in the URL and send a request for the webpage. Assume the web server IP address is cached in the browser. How long will it take to load the entire webpage if persistent HTTP with pipelining is used? Assume the parallelism level supported by the browser is 10.

Ans:

Since the IP mapping is cached, this time is excluded.

Time to load entire webpage = Time to receive the main (or base) object + Time to receive 5 objects

Time to receive the main object does not depend on whether the HTTP connection is persistent or not.

Time to receive the main object = 2 * RTT + object download time = 2 * 10 + 20 = 40 ms [1]

Time to receive 5 objects (with persistent+pipelining) = RTT + object download time = 10 + 100 = 110 ms [1]

(Persistent) Time to load entire webpage = 40 + 110 = 150 ms [1]

Q.6. A sender (S) and a receiver (R) are connected via a router (R) as shown in the figure. The communication link rates between S– R and R–D is 2 Mbps. Assume link propagation delays between S–R and R–D, d_{prop} = 10 millisec; and processing delays at R and D, d_{proc} = 1 millisec. The sender wants to send a message of 5000 bytes which is divided into 1000 byte packets.

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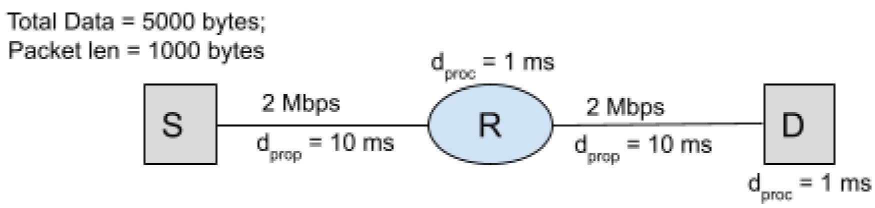


Calculate the total time (in milliseconds) taken for the entire message to reach the destination. Assume no other overheads then the one mentioned above. No ACKs needed. No marks will be awarded without the equation/formula. [3]

Ans:

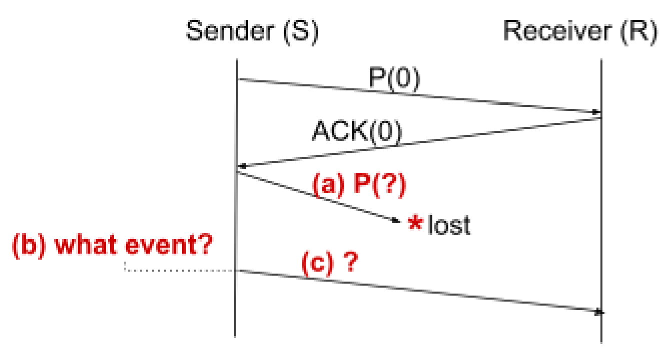
Number of packets, N = 5, L = 1000 bytes

R = 2 Mbps, d_prop = 10 ms, d_proc = 1 ms

d_trans (packet from S to R) = d_trans (packet from R to D)
= L/R = (1000*8)/(2*10^6) = 4 ms [1]

File download time = (N * d_trans) + d_prop + (d_proc + d_trans) + d_prop + d_proc [1]
= 5 * 4 + 10 + (1 + 4) + 10 + 1
= 46 ms [1]

Q.7. Suppose "Stop and Wait" reliable data transport protocol is implemented. Consider the full and final version of the protocol discussed in the class that solves all network problems. "P" indicates packet, "ACK" indicates acknowledgment, and the number in brackets indicates the packet sequence number.
Answer questions (a), (b), (c) in the timing diagram below. Justify your answer in short. [3]



Ans:

- **(a) P(1): Since packet 0 has been successful, the next packet is sent & the sequence number is 1**
- **(b) Timeout (or timer expiration): Since the packet was lost in transit and receiver will not respond, the sender's timer expires**
- **(c) P(1): After timeout, the sender resends the last packet.**

______________________**THE END**______________________