Course Code: CS3001	Course Name: Computer Networks	
Instructor Names: Dr. Aqsa Aslam, Mr. Shoaib Raza.		
Student Roll No: ' ` K	Section No:	

Instructions:

- Return the question paper.
- All questions must be answered in the answer script and according to the sequence given in the question paper. There are 5 questions on 2 pages. Each question carries 10 points.
- In case of any ambiguity, you may make an assumption, however, your assumption should not contradict any statement in the question paper.

Max Points: 50 points

Time: 60 minutes

Question 1: Consider figure 1, in which a client sends an http request to a server. The path from client to server has three links, of rates R1 = 100 Mbps, R2 = 10 Mbps, and R3 = 1 Mbps, each with link length of 3km. Suppose that the packet length is L= 18000 bits and speed of light propagation delay on each link is 3×10^8 m/sec.

a) What is the transmission delay of R2?
b) What is the propagation delay of R1?
c) Name the sources of packet delay.
d) Which layer in the IP stack moves datagrams from the source host to the destination?
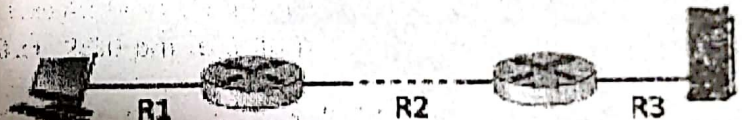
R1   R2   R3

Figure 1

Question 2: Fast.com is registered and hosted with GoDaddy. Both the web server and mail server of Fast are associated with 10.11.21.13 and 10.11.21.14 respectively. The primary authoritative name server of GoDaddy is dns1.GoDaddy.com which is mapped to 172.16.10.1. List down all the resource records (RRs) that will be inserted into the authoritative name server and. com's TLD (top level domain) server.

Question 3: Suppose Huzaifa, with a web-based e-mail account (such as Yahoo, Hotmail or Gmail), sends a message to Zafeer, who accesses his mail from his mail server using IMAP. Discuss how the message gets from Huzaifa's host to Zafeer's host. Be sure to list the series of application-layer protocols that are used to move the message between the two hosts.

Question 4: Assume that the client wants to retrieve the www.google.com home page but has no information about the www.google.com web server's IP address. When obtaining the IP address for the host name www.google.com, assume the round-trip time between local DNS server and DNS root server is 3RTT, between local DNS server and DNS TLD server is 2RTT, and between the clients and the local DNS server is RTT.

a) How long does it take for the first client to obtain the IP address for www.google.com?
b) After that first client, a second client (on the same network) also wants to obtain the IP address for www.google.com. How long does it take for the second client?

Question 5: Consider the scenario shown in figure 2, in which origin servers is connected to a router by a 100 Mbps link with a 50ms propagation delay. That router in turn is connected to two routers, each over a 25Mbps link with a 200ms propagation delay. 1 Gbps link connects a host and a cache (when present) to each of these routers; this link, being a local area network has no propagation delay. All packets in the network are 20,000 bits long.

a) What is the end-to-end delay from when a packet is transmitted by the server to when it is received by the client? In this case, we assume there are no caches, there is no queuing delay at the routers, and the packet processing delays at routers and nodes are all 0.
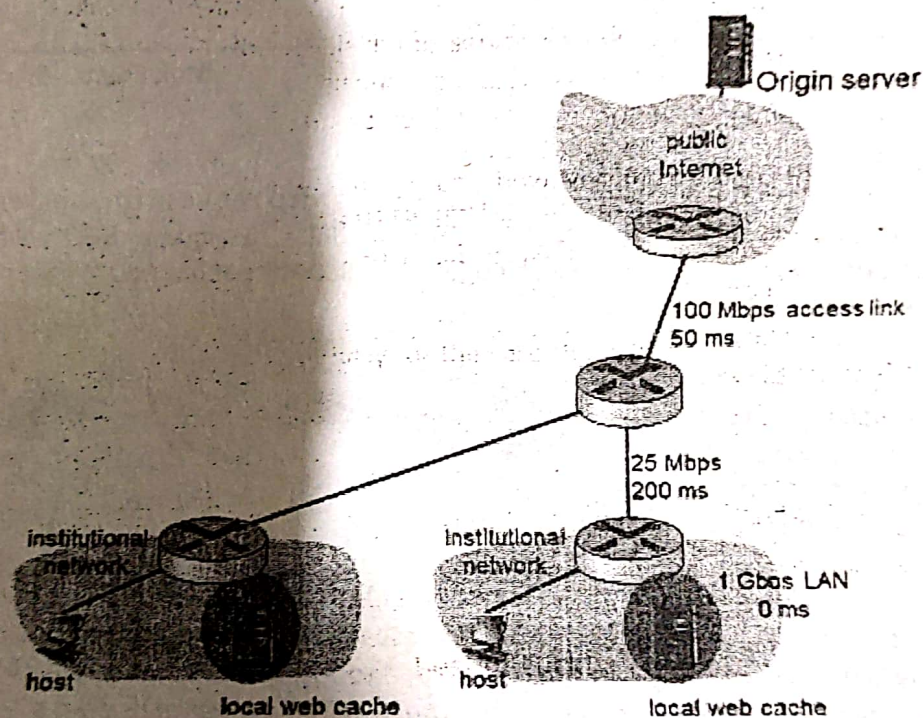

Figure 2

b) What is the maximum rate at which the server can deliver data to a single client if we assume no other clients are making requests? Here we assume that client hosts send requests for files directly to the server (caches are not used or off in this case).

c) Now, we once again assume only one client, however, in this case the caches are on and behave like HTTP caches. A client's HTTP GET is always first directed to its local cache. 60% of the requests can be satisfied by the local cache. What is the average rate at which the client can receive data in this case?

d) What is the average end-to-end delay for the case that 60% of the requests can be satisfied by the local cache?