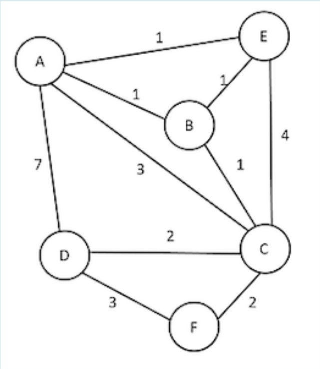
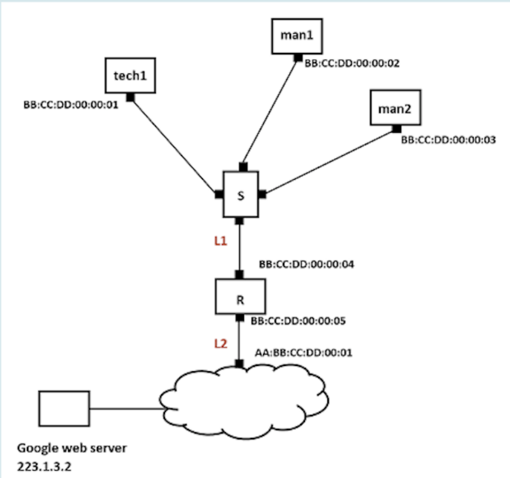


a) ***(26 points)*** Execute the Dijkstra algorithm at node D for the network shown above by filling in the following table. In the table you need to give both the distance D(v) and the previous node p(v). **(Add the nodes with the equal D(v) value to N′ according to their alphabetical ascending order.)**

b) Explain how you calculated the entries in step 3. **(It is necessary for getting point from a).)**

c) ***(6 points)*** Show the shortest path from the node D to the node E using the following table below. **Explain your solution.**

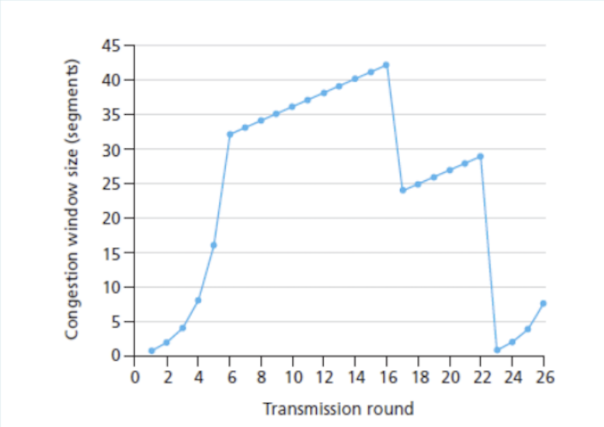


(28 points) Consider the network above. An organization is given the following public IP address: 140.192.50.2. The organization uses the following private IP address block: 192.168.0.0/16. The organization has the following two departments: technical (tech), management (man). Assume that the organization IP address block is divided into these two departments equally. tech1 gets the first available IP address in the IP address block assigned for the technical department. Similarly, man1 and man2 gets the first two available IP addresses in the IP address block assigned for the management department. If you need any other IP address, you could use from available addresses in the management IP address block. For each host and router interface, the figure shows the corresponding MAC addresses. S represents the switch, R represents the NAT-enabled router. Assume that the routers and hosts are correctly configured with the correct routing information, i.e., their forwarding tables are correctly configured. Assume further that the switch tables of the switches and the ARP tables of the router and all hosts are initially empty.

Assume that the host tech1 is sending an HTTP request to a Google web server. The host tech1 knows the Google web server's IP address (223.1.3.2). For all the packets that will be transmitted over link L1 and L2 (in both directions), provide the information requested in the table below. Note that some of the requested information in a row may not be applicable (N/A) for some packets. Packets should be listed in the order of their appearance on the links. Please ignore the HTTP reply packet.

Please explain your solution (how you assign IP addresses and construct the table). It is necessary for getting points.

Packet	Link (L1, L2)	Packet Type (IP,ARP)	Application Layer Protocol	Source MAC Address in Link Layer Header	Destination MAC Address in Link Layer Header	Source IP Address in IP Header	Destination IP Address in IP Header
1							
2							
3							
4							



(19 points) Assuming TCP Reno is the protocol experiencing the behavior shown above, answer the following questions. At the first round, congestion window is equal to 1 as shown in the Figure. You need to calculate the congestion window size at other rounds.

a) Identify the intervals of time when TCP slow start is operating. Explain.

b) Identify the intervals of time when TCP congestion avoidance is operating. Explain.

c) After the 16th transmission round, how packet loss is detected (by which method)? Explain.

d) What is the value of sshthresh at the 24^{th} transmision round? Explain.

e) Assuming a packet loss is detected after the 26^{th} round by the receipt of a triple duplicate ACK, what will be the values of the congestion window size and *sshthresh*? Explain.

f) Suppose TCP Tahoe is used (instead of TCP Reno), and assume that triple duplicate ACKs are received at the 16^{th} round. What are the *sshthresh* and the congestion window size at the 20^{th} round? Explain.