Ankara University
Computer Engineering Department
COM332 11.6.20 240 m.

1. **(9p)** List three broad classes of MAC protocols. Explain each of them briefly.

2. **(12p)** Assume that the switch tables in S_1, S_2, S_3, and S_4 is as follows at the beginning.

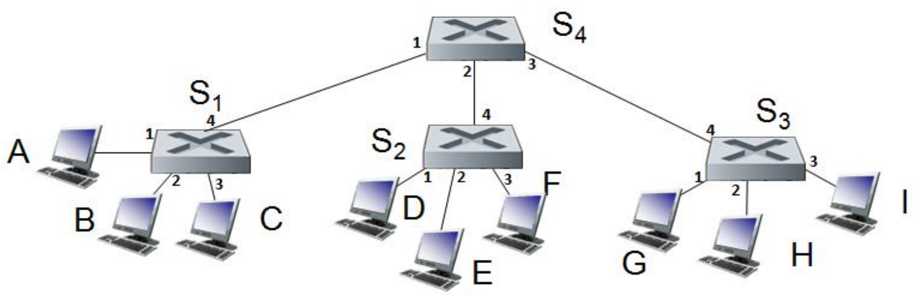
S1 Switch Table	
A	1
C	3

S2 Switch Table	
D	1

S3 Switch Table	
H	2
I	3
A	4

S4 Switch Table	
A	1
I	3

Suppose B sends frame to A, E sends frame to I, G sends frame to C. After these three send operations, show switch tables in S_1, S_2, S_3, and S_4. Ignore TTL column in any switch table.



3. **(12p)** Explain how switch filtering and forwarding works in the following example: Suppose a frame with destination address AB-AB-AB-AB-AB-AB arrives at the switch on interface 2. (Switch has interfaces 1, 2, 3 and 4). The switch indexes its table with the MAC address AB-AB-AB-AB-AB-AB. List three cases that could be happened. What will switch do in each of these three cases?

4. **(7p)**
   a) **(4p)** What are the characteristics of an ideal multiple access protocol (MAC)? (List 4 of them)
   b) **(3p)** List three features of Ethernet Switch.

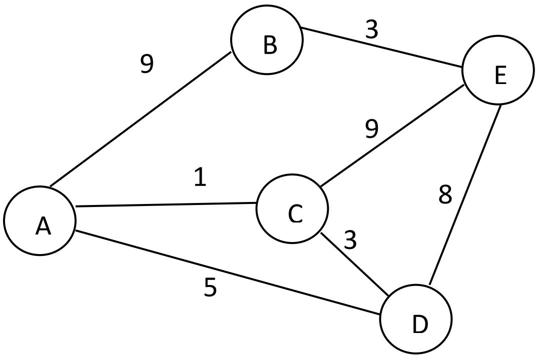
5. **(10p)** Explain Ethernet MAC Protocol in detail. (Carrier Sense Multiple Access with Collision Detection - CSMA/CD).

6. **(12p)** What is Address Resolution Protocol (ARP)? Explain in detail. (Why is it used? What is ARP table? Which information is placed in ARP table?)

7. **(7p)** Explain packet switching and circuit switching. Why packet switching is more efficient?

8. **(9p)** Compare routers and switches in detail.

9. **(10p)** Apply Dijkstra's algorithm to find least cost paths to every other node when the source node is A on the network given below. In each iteration show the values of D(v), p(v) and N´. Construct shortest path tree. D(v): cost of the least-cost path from the source node to destination v. p(v): previous node along the current least-cost path from the source to v. N´: subset of nodes; v is in N´ if the least-coast path from the source to v is definitively known.



10. **(12p)** In modern packet-switched networks, including the Internet, the source host segments long, application-layer messages (for example, an image or a music file) into smaller packets and sends the packets into the network. The receiver then reassembles the packets back into the original message. We refer to this process as message segmentation. Figure 1.27 illustrates the end-to-end transport of a message with and without message segmentation. Consider a message that is **(your_student_id mod 10) x 10^6** bits long that is to be sent from source to destination in Figure 1.27. Suppose each link in the figure is 2 Mbps. Ignore propagation, queuing, and processing delays.
    a) **(4p)** Consider sending the message from source to destination without message segmentation. How long does it take to move the message from the source host to the first packet switch? Keeping in mind that each switch uses store-and-forward packet switching, what is the total time to move the message from source host to destination host?
    b) **(4p)** Now suppose that the message is segmented into **(your_student_id mod 10) x 100** packets, with each packet being 10,000 bits long. How long does it take to move the first packet from source host to the first switch? When the first packet is being sent from the first switch to the second switch, the second packet is being sent from the source host to the first switch. At what time will the second packet be fully received at the first switch?
    c) **(4p)** How long does it take to move the file from source host to destination host when message segmentation is used? Compare this result with your answer in part (a) and comment.

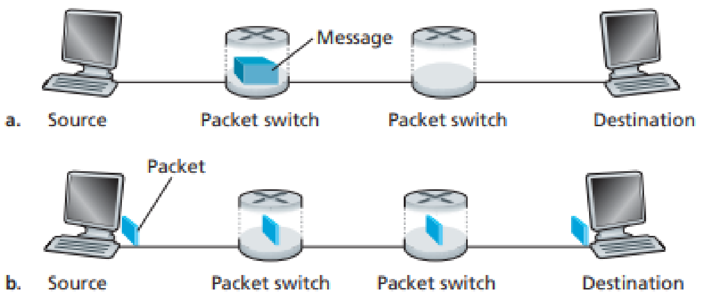


Figure 1.27 ♦ End-to-end message transport: (a) without message segmentation; (b) with message segmentation