Systems and Networking Unit II Exam

Group A

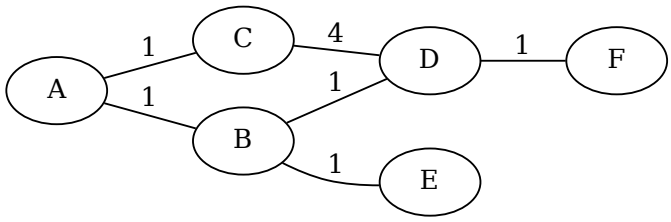
Friday, January 20, 2023

True or false

1. The MAC address of a node changes if the node is moved from a network to another. [T/F]
2. Two end systems belonging to two different LANs can have the same IP address. [T/F]
3. The Slow Start phase is implemented in TCP Reno. [T/F]
4. Pure Aloha protocol is more efficient than slotted Aloha. [T/F]
5. The field Source Address in a frame header does not change when traversing a router. [T/F]
6. ARP is a Routing Protocol. [T/F]

Problems

1. Calculate the **entries of the routing tables** at routers A and D, for the first three rounds of a distance vector routing protocol, using the distance metric for the following example:



2. A TCP server has received and acknowledged up to byte 2500. Explain the actions that the server will take following the given events:
   a) The server receives a 1000-byte segment with sequence number 3001.
   b) The server receives a 500-byte segment with sequence number 2501.
   c) The server receives a 500-byte segment with sequence number 2001.
   d) The server receives a 500-byte segment with sequence number 3501.

3. A network using CSMA/CD has a bandwidth of 10 Mbps. If the maximum propagation time is 51.2 µs, what is the minimum size of the frame?

4. Consider a datagram network using 8-bit host addresses. Compute the number of addresses that are routed through each interface, assuming that the router uses longest prefix matching and has the following forwarding table:

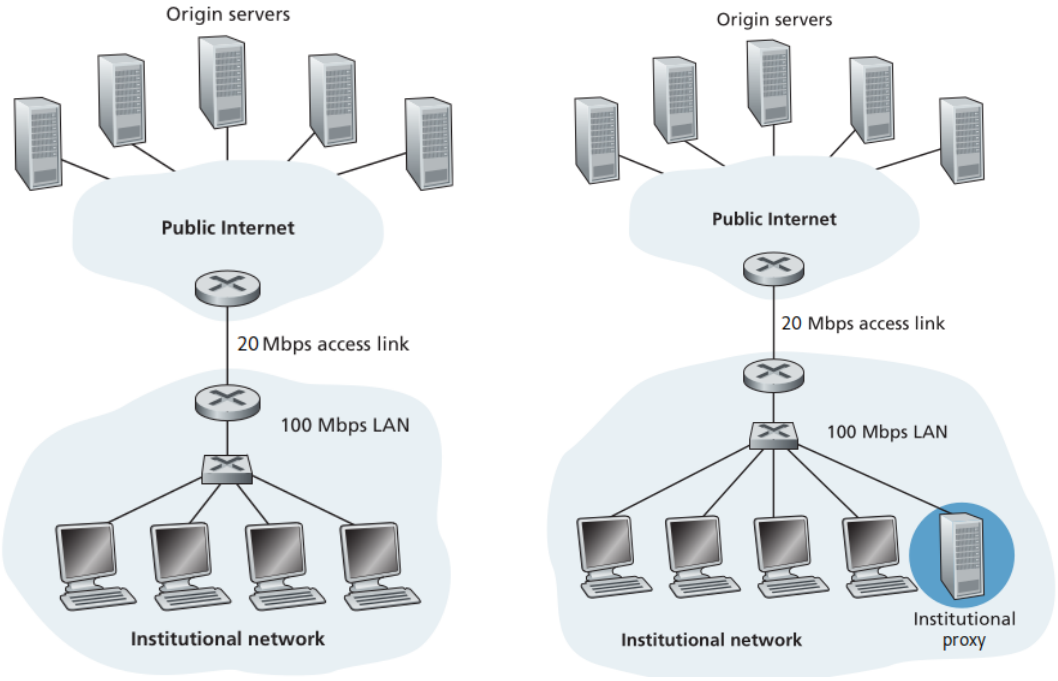
Prefix match	Interface
0	0
001	1
0100	2
11	3
1	2

5. Consider Scenario 1. An institutional network utilizes a 20 Mbps link to connect to the public internet and reach some origin web servers. The content files stored on the origin servers have an average size of 100 Kbits. The cumulative request reate from the institution browsers is 150 req/sec. The time between the moment in which the router on the internet side of the access link forwards an HTTP request to the origin servers and the moment in which it receives a response from them is 5 seconds (internet delay). Assume that HTTP requests are negligibly small. Consider Scenario 2 where the institutional network adopts a proxy server which serves requests within the LAN in 5 msecs, with an average hit rate of 0.7. With the proxy, the average access link delay experienced by requests drops to 10 msecs.

   a) Calculate the utilization of the LAN and of the access link in Scenario 1.

   b) Calculate the utilization of the access link in the second scenario.

   c) Calculate the average delay experienced by the requests in the second scenario.



6. Consider sending a large file of F bits from host A to host B. There are three links and two switches between A and B. Host A segments the file into segments of S bits each and adds 60 bits of header to each segment, forming packets of $L = 60 + S$ bits. Each link has a transmission rate of R bps. Find the value of S that minimizes the delay of moving the file from host A to host B, disregarding queueing and propagation delays.