CS422 Computer Networks (Spring 2024): Homework 5

(Due Date: 23:59:59PM Wednesday April 17, 2024, Total: 30 points)

1. **True or False (5 points).**

   (a) **[T F]** A datagram from the source host to the destination host may travel across more than one physical links.

   (b) **[T F]** Multiple access protocols are needed at the link layer because the link is shared and multiple simultaneous transmission may collide.

   (c) **[T F]** Random access protocols avoid collisions by dividing channels into small exclusive pieces.

   (d) **[T F]** Slotted ALOHA cannot avoid collisions but CSMA can.

   (e) **[T F]** CSMA/CD use binary (exponential) backoff when collision happens and is detected. The backoff time after the m-th collision is always larger than the one after the (m-1)-th collision.

2. (5 points) Please choose a multiple-access protocol that provides the best performance for the following scenarios. Please consider the following protocols: TDMA, CDMA, CSMA/CD, Slotted Aloha, Token-passing, and polling protocols. You need to: (1) specify your choice, and (2) briefly justify your answer.

   (a) (3 points) There are 10 servers in a server cluster, each of which has infinite data to transmit anytime. That is, each server needs to send data anytime.

   (b) (2 points) There are 10 hosts connected via a single cable to form a local area network. Each of them generates bursty, Internet data traffic.

3. (10 points) Consider three subnets shown in Figure 1. Assume that they use the addresses assigned by Figure 2.

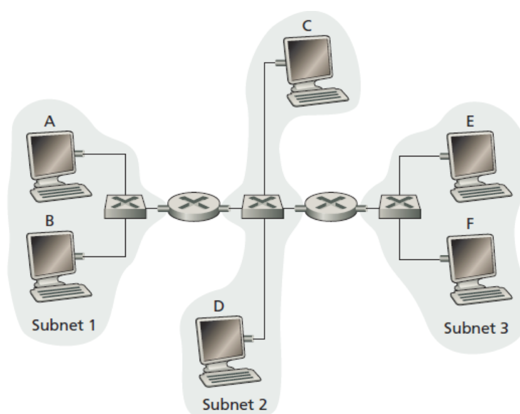

Figure 1: Three subnets, interconnected by routers.

   (a) (3 points) E wants to send a data packet to F. Does router 1 receive this data frame sent from E? What are addresses of source IP, destination IP, source MAC and destination MAC of this data frame sent by E?

   (b) (3 points) E wants to send a data packet to B. Does router 1 receive this data frame sent from E? What are addresses of source IP, destination IP, source MAC and destination MAC of this data frame sent by E? How many different data frames (at least) are needed so that B will receive the datagram from E?

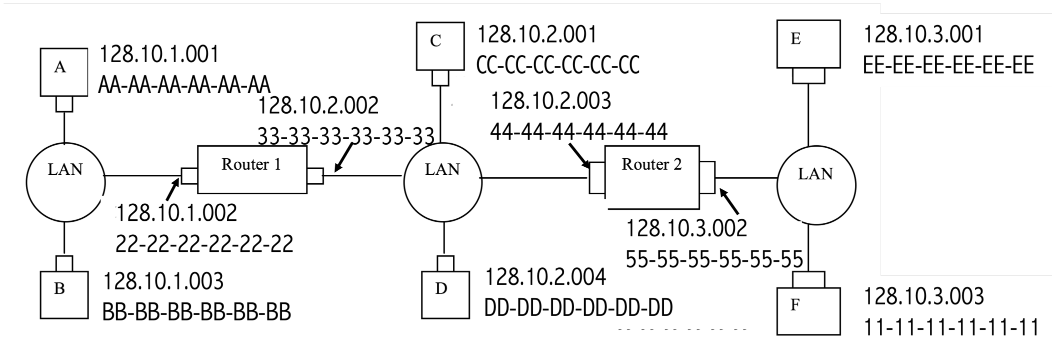

Figure 2: One reference address allocation.

(c) (4 points) A wants to send a data packet to B and B responds to A upon receiving this data packet. Assume that at the start, A and B does not know each other's MAC address and the switch's forward table is empty. Will Router R1 receives ARP request from A? Will Router R1 forward it to subnet 2? Will B send ARP request to learn A's MAC address? Will Router 1 receives the data frame from B to A?

4. (10 points) Figure 3 shows one LAN where nine end hosts (A to I) are connected via four switches: S1, S2, S3 and S4. The topology is the same as the one used in the course lecture. Let us assume that **the switch tables at four switches are empty at the start**. Suppose (1) C sends one data frame to I, (2) then I responds to C, and (3) finally F sends one data frame to C. These **THREE** frames in order are the **ONLY** traffic in this LAN

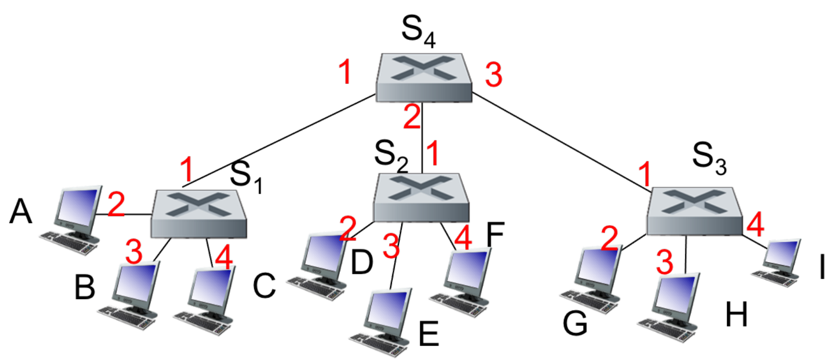

Figure 3: LAN with four switches: S1, S2, S3 and S4.

(a) (2 points) What are the switch tables of S1, S2, S3 and S4 after the frame from C to I arrives at I and before I responds to C?

(b) (2 points) What are the switch tables of S1, S2, S3 and S4 after the response frame from I to C arrives at C?

(c) (2 points) What are the switch tables of S1, S2, S3 and S4 after the last data frame from F to C arrives at C?

(d) (2 points) what nodes (out of A, B, C, D ... I, S1, S2, S3, S4) will physically receive the frame $I \to C$?

(e) (2 points) what nodes (out of A, B, C, D ... I, S1, S2, S3, S4) will physically receive the frame $F \to C$?