44100113: COMPUTER NETWORKS
HOMEWORK 4: CHAPTER 5

Submission Due: 23:59P.M., Dec 1, 2022

Notes:
1. All exercises are in accordance with the 6th edition (International Edition). We change data values in some problems, which are highlighted.
2. These limited exercises are not enough to cover all the knowledge required in our course. You should read the textbook by yourselves.

Chapter 5: THE LINK LAYER: Links, Access Networks, and LANs

Exercise 1 (R2, CHAPTER 5)
If all the links in the Internet were to provide reliable delivery service, would the TCP reliable delivery service be redundant? Why or why not?

Exercise 2 (R3, CHAPTER 5)
What are some of the possible services that a link-layer protocol can offer to the network layer? Which of these link-layer services have corresponding services in IP? In TCP?

Exercise 3 (R10, CHAPTER 5)
Suppose nodes A, B, and C each attach to the same broadcast LAN (through their adapters). If A sends thousands of IP datagrams to B with each encapsulating frame addressed to the MAC address of B, will C's adapter process these frames? If so, will C's adapter pass the IP datagrams in these frames to the network layer C? How would your answers change if A sends frames with the MAC broadcast address?

Exercise 4 (R11, CHAPTER 5)
Why is an ARP query sent within a broadcast frame? Why is an ARP response sent within a frame with a specific destination MAC address?

Exercise 5 (P1, CHAPTER 5)
Suppose the information content of a packet is the bit pattern 1010 1010 1010 1011 and an even parity scheme is being used, What would the value of the field containing the parity bits be for the case of a two-dimensional parity scheme? Your answer should be such that a minimum-length checksum field is used.

Exercise 6 (P14, CHAPTER 5)
Consider three LANs interconnected by two routers, as shown in Figure 5.33.
a.A ssign IP addresses to all of the interfaces. For Subnet 1 use addresses of the form 192.168.1.xxx; for Subnet 2 uses addresses of the form 192.168.2.xxx; and for Subnet 3 use addresses of the form 192.168.3.xxx.

b. Assign MAC addresses to all of the adapters.
c. Consider sending an IP datagram from Host E to Host B. Suppose all of the ARP tables are up to date. Enumerate all the steps, as done for the single-router example in Section 5.4.1.
d. Repeat (c), now assuming that the ARP table in the sending host is empty (and the other tables are up to date).

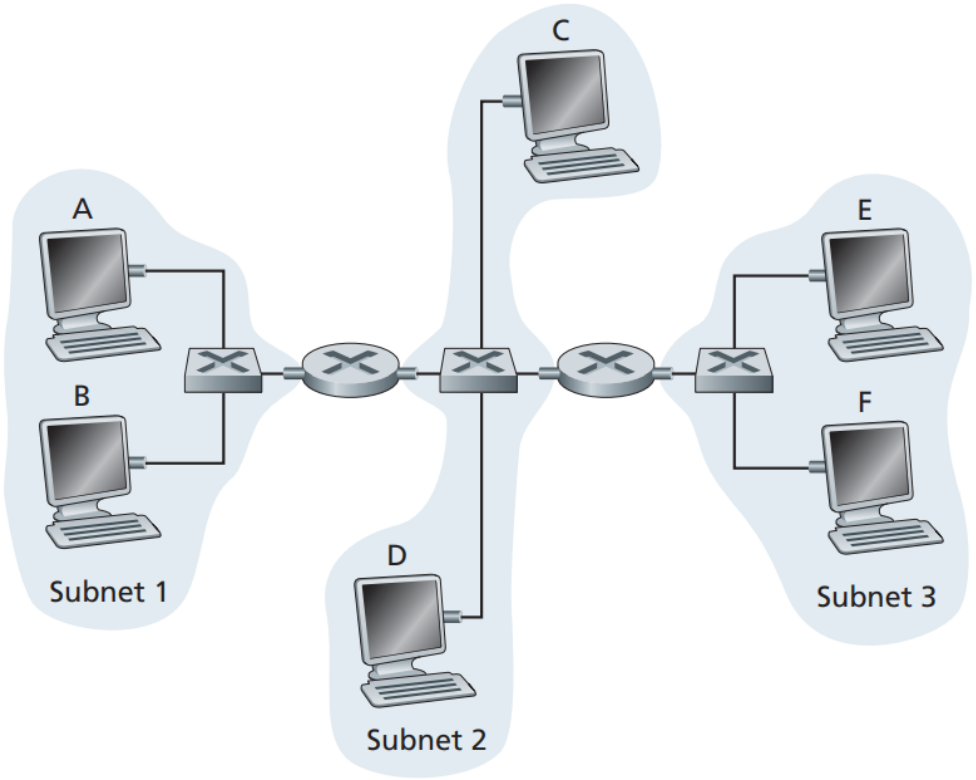

Figure 5.33 ♦ Three subnets, interconnected by routers

Exercise 7 (P18, CHAPTER 5)
Suppose nodes A and B are on the same 10 Mbps broadcast channel, and the propagation delay between the two nodes is 325 bit times. Suppose CSMA/CD and Ethernet packets are used for this broadcast channel. Suppose node A begins transmitting a frame and, before it finishes, node B begins transmitting a frame. Can A finish transmitting before it detects that B has transmitted? Why or why not? If the answer is yes, then A incorrectly believes that its frame was successfully transmitted without a collision. *Hint*: Suppose at time $t = 0$ bits, A begins transmitting a frame. In the worst case, A transmits a minimum-sized frame of 512 + 64 bit times. So A would finish transmitting the frame at $t = 512 + 64$ bit times. Thus, the answer is no, if B's signal reaches A before bit time $t = 512 + 64$ bits. In the worst case, when does B's signal reach A?

Exercise 8 (P21, CHAPTER 5)

Consider Figure 5.33 in problem P14. Provide MAC addresses and IP addresses for the interfaces at Host A, both routers, and Host F. Suppose Host A sends a datagram to Host F. Give the source and destination MAC addresses in the frame encapsulating this IP datagram as the frame is transmitted (i) from A to the left router, (ii) from the left router to the right router, (iii) from the right router to F. Also give the source and destination IP addresses in the IP datagram encapsulated within the frame at each of these points in time.

Exercise 9 (P22, CHAPTER 5)

Suppose now that the leftmost router in Figure 5.33 is replaced by a switch. Hosts A, B, C, and D and the right router are all star-connected into this switch. Give the source and destination MAC addresses in the frame encapsulating this IP datagram as the frame is transmitted (i) from A to the switch, (ii) from the switch to the right router, (iii) from the right router to F. Also give the source and destination IP addresses in the IP datagram encapsulated within the frame at each of these points in time.