Homework Problems and Questions

Chapter 6 Review Questions

SECTIONS 6.1–6.2

R1. Consider the transportation analogy in **Section 6.1.1** . If the passenger is analagous to a datagram, what is analogous to the link layer frame?

R2. 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?

R3. 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?

SECTION 6.3

R4. Suppose two nodes start to transmit at the same time a packet of length L over a broadcast channel of rate R. Denote the propagation delay between the two nodes as d_{prop}. Will there be a collision if dprop<L/R? Why or why not?

R5. In **Section 6.3** , we listed four desirable characteristics of a broadcast channel. Which of these characteristics does slotted ALOHA have? Which of these characteristics does token passing have?

R6. In CSMA/CD, after the fifth collision, what is the probability that a node chooses $K=4$? The result K=4 corresponds to a delay of how many seconds on a 10 Mbps Ethernet?

R7. Describe polling and token-passing protocols using the analogy of cocktail party interactions.

R8. Why would the token-ring protocol be inefficient if a LAN had a very large perimeter?

SECTION 6.4

R9. How big is the MAC address space? The IPv4 address space? The IPv6 address space?

R10. 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?

R11. 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?

R12. For the network in **Figure 6.19** , the router has two ARP modules, each with its own ARP table. Is it possible that the same MAC address appears in both tables?

R13. Compare the frame structures for 10BASE-T, 100BASE-T, and Gigabit Ethernet. How do they differ?

R14. Consider **Figure 6.15** . How many subnetworks are there, in the addressing sense of **Section 4.3** ?

R15. What is the maximum number of VLANs that can be configured on a switch supporting the 802.1Q protocol? Why?

R16. Suppose that *N* switches supporting *K* VLAN groups are to be connected via a trunking protocol. How many ports are needed to connect the switches? Justify your answer.

Problems

P1. Suppose the information content of a packet is the bit pattern 1110 0110 1001 1101 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.

P2. Show (give an example other than the one in **Figure 6.5**) that two-dimensional parity checks can correct and detect a single bit error. Show (give an example of) a double-bit error that can be detected but not corrected.

P3. Suppose the information portion of a packet (*D* in **Figure 6.3**) contains 10 bytes consisting of the 8-bit unsigned binary ASCII representation of string “Networking.” Compute the Internet checksum for this data.

P4. Consider the previous problem, but instead suppose these 10 bytes contain

a. the binary representation of the numbers 1 through 10.
b. the ASCII representation of the letters B through K (uppercase).
c. the ASCII representation of the letters b through k (lowercase).
Compute the Internet checksum for this data.

P5. Consider the 5-bit generator, $G=10011$, and suppose that D has the value 1010101010. What is the value of R?

P6. Consider the previous problem, but suppose that *D* has the value

a. 1001010101.
b. 0101101010.
c. 1010100000.

P7. In this problem, we explore some of the properties of the CRC. For the generator $G(=1001)$ given in **Section 6.2.3** , answer the following questions.