Chapter 5 Review Questions

1.

2. Although each link guarantees that an IP datagram sent over the link will be received at the other end of the link without errors, it is not guaranteed that IP datagrams will arrive at the ultimate destination in the proper order. With IP, datagrams in the same TCP connection can take different routes in the network, and therefore arrive out of order. TCP is still needed to provide the receiving end of the application the byte stream in the correct order. Also, IP can lose packets due to routing loops or equipment failures.

3.

4. There will be a collision in the sense that while a node is transmitting it will start to receive a packet from the other node.

5.

6. When a node transmits a frame, the node has to wait for the frame to propagate around the entire ring before the node can release the token. Thus, if L/R is small as compared to t_{prop}, then the protocol will be inefficient.

7.

8. 2^{48} MAC addresses; 2^{32} IPv4 addresses; 2^{128} IPv6 addresses.

9. An ARP query is sent in a broadcast frame because the querying host does not which adapter address corresponds to the IP address in question. For the response, the sending node knows the adapter address to which the response should be sent, so there is no need to send a broadcast frame (which would have to be processed by all the other nodes on the LAN).

10. C’s adapter will process the frames, but the adapter will not pass the datagrams up the protocol stack. If the LAN broadcast address is used, then C’s adapter will both process the frames and pass the datagrams up the protocol stack.

11. After the 5^{th} collision, the adapter chooses from {0, 1, 2,…, 31}. The probability that it chooses 4 is 1/32. It waits 204.8 microseconds.

12. The three Ethernet technologies have identical frame structures.

Chapter 5 Problems

Problem 1

The rightmost column and bottom row are for parity bits.

1 0 1 0| 0
1 0 1 0| 0
1 0 1 0| 0
1 0 1 1| 1
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0 0 0 1| 1

Problem 7

If we divide 1001 into 10101010000 we get 10111101, with a remainder of R = 101.

Problem 8

a) If we divide 1001 into 10010001000 we get 10000001, with a remainder of R = 001.
b) If we divide 1001 into we get 10100011000 we get 10110101, with a remainder of R = 101.
c) If we divide 1001 into 010101010000 we get 010111101, with a remainder of R = 101.

Problem 10

We want $1/(1+5a) = .5$ or, equivalently, $a = .2 = t_{prop} / t_{trans}$. $t_{prop} = d /(1.8 \times 10^8)$

m/sec and $t_{trans} = (576 \text{ bits}) /(10^8 \text{ bits/sec}) = 5.76 \mu$ sec. Solving for d we obtain

$d = 265$ meters. For the 100 Mbps Ethernet standard, the maximum distance between two hosts is
200 m.

For transmitting station A to detect whether any other station transmitted during A's interval, t_{trans} must be greater than $2t_{prop} = 2 \cdot 265\,\text{m} / 1.8 \times 10^8\,\text{m/sec} = 2.94\mu\,\text{sec}$. Because $2.94 < 5.76$, A will detect B's signal before the end of its transmission.

Problem 15

At $t = 0$ A transmits. At $t = 576$, A would finish transmitting. In the worst case, B begins transmitting at time $t = 224$. At time $t = 224 + 225 = 449$ B's first bit arrives at A. Because $449 < 576$, A aborts before completing the transmission of the packet, as it is supposed to do.

Thus A cannot finish transmitting before it detects that B transmitted. This implies that if A does not detect the presence of a host, then no other host begins transmitting while A is transmitting.

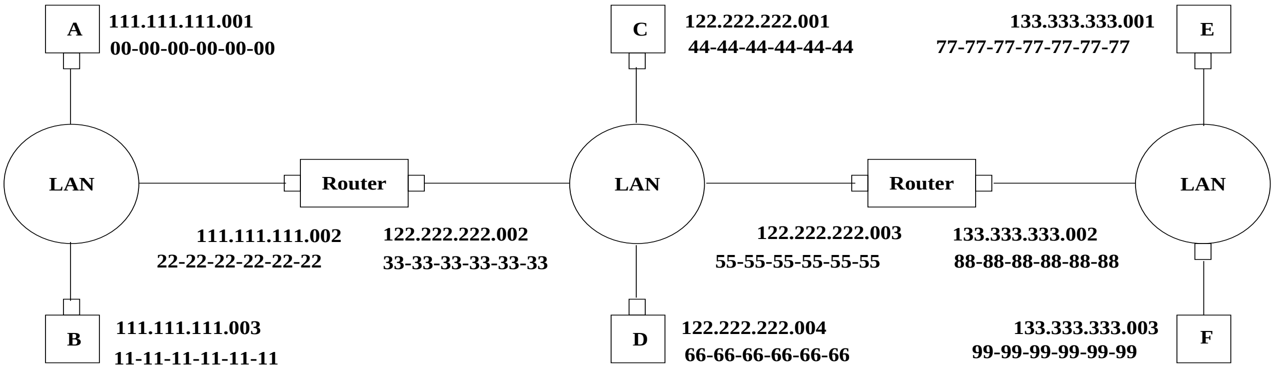
Problem 17

Time, t	Event
0	A and B begin transmission
225	A and B detect collision
273	A and B finish transmitting jam signal
273+225 = 498	B's last bit arrives at A; A detects an idle channel
498+96=594	A starts transmitting
273+512 = 785	B returns to Step2
	B must sense idle channel for 96 bit times before it transmits
594+225=819	A's transmission reaches B

Because A's retransmission reaches B before B's scheduled retransmission time, B refrains from transmitting while A retransmits. Thus A and B do not collide. Thus the factor 512 appearing in the exponential backoff algorithm is sufficiently large.

Problem 19

a), b), c) See figure below.



d)

1. Forwarding table in *A* determines that the datagram should be routed to interface 111.111.111.002.
2. The adapter in *A* creates and Ethernet packet with Ethernet destination address 22-22-22-22-22-22.
3. The first router receives the packet and extracts the datagram. The forwarding table in this router indicates that the datagram is to be routed to 122.222.222.003.
4. The first router then sends the Ethernet packet with the destination address of 55-55-55-55-55-55 and source address of 33-33-33-33-33-33 via its interface with IP address of 122.222.222.002.
5. The process continues until the packet has reached Host *F*.

e)

ARP in *A* must now determine the LAN address of 111.111.111.002. Host *A* sends out an ARP query packet within a broadcast Ethernet frame. The first router receives the query packet and sends to Host *A* an ARP response packet. This ARP response packet is carried by an Ethernet frame with Ethernet destination address 00-00-00-00-00-00.

Problem 22

i) from A to switch: Source MAC address: 00-00-00-00-00-00
Destination MAC address: 55-55-55-55-55-55

Source IP: 111.111.111.001
Destination IP: 133.333.333.003

ii) from switch to right router: Source MAC address: 00-00-00-00-00-00
Destination MAC address: 55-55-55-55-55-55

Source IP: 111.111.111.001
Destination IP: 133.333.333.003

iii) from right router to F: Source MAC address: 88-88-88-88-88-88
Destination MAC address: 99-99-99-99-99-99

Source IP: 111.111.111.001
Destination IP: 133.333.333.003