EE122: Introduction to Computer Networks Homework 6
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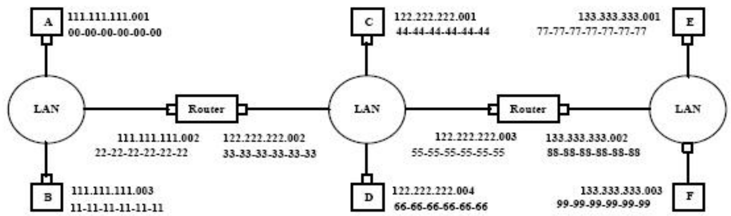

Figure 1: Problem 1

Total points = 10

Question 1 (3 points)

1. Refer to figure **??**
2. Refer to figure **??**
3. Refer to figure **??**
4.
   - Forwarding table in A determines that the datagram should be routed to interface 111.111.111.002.
   - Host A uses ARP to determine the LAN address for 111.111.111.002, namely 22-22-22-22-22-22.
   - The adapter in A creates and Ethernet packet with Ethernet destination address 22-22-22-22-22-22.
   - 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.
   - The first router then uses ARP to obtain the associated Ethernet address, namely 55-55-55-55-55-55.
   - The process continues until the packet has reached Host F .
5. 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.

Question 2 (1 point) Wait for 51,200 bit times. For 10 Mbps, this wait is $\frac{51.2 \times 10^3 bits}{10 \times 10^6 bps} = 5.12 msec.$ For 100 Mbps, the wait is 512 μ sec.

Question 3 (2 points)

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	As transmission reaches B height

Question 4 (2 points)

1. Let Y be a random variable denoting the number of slots until a success: $P(Y = m) = \beta(1-\beta)^{m-1}$, where β is the probability of a success. This is a geometric distribution, which has mean $1/\beta$. The number of consecutive wasted slots is $X = Y - 1$ that

$$x = E[X] = E[Y] - 1 = \frac{1-\beta}{\beta} \tag{1}$$

$$\beta = Np(1-p)^(N-1) \tag{2}$$

$$x = \frac{1 - Np(1-p)^(N-1)}{Np(1-p)^(N-1)} \tag{3}$$

$$efficiency = \frac{k}{k+x} = \frac{k}{k + \frac{1-Np(1-p)^(N-1)}{Np(1-p)^(N-1)}} \tag{4}$$

2. Maximizing efficiency is equivalent to minimizing x , which is equivalent to maximizing β . We know from the text that β is maximized at $p = 1/N$.
3. As $N \to \infty$, $efficiency = \frac{k}{k+e-1}$
4. As $k \to \infty$, $efficiency = 1$

Question 5 (2 points)

1. $\frac{900m}{2\times10^8 m/sec} + 4 \times \frac{20bits}{10\times10^6 bps} = (4.5\times10^{-6} + 8\times10^{-6})sec = 12.5\mu sec.$
2. At time t = 0 , both A and B transmit. At time t = 12.5 μsec, A detects a collision. At time t = 25 μsec last bit of B 's aborted transmission arrives at A. At time t = 37.5 μsec first bit of A 's retransmission arrives at B. At time $t = 37.5\mu sec + \frac{1000bits}{10\times10^6 bps} = 137.5\mu sec$, A 's packet is completely delivered at B.
3. 12.5μsec+ 5$\times$100μsec = 512.5μsec