This homework is due at the beginning of class on February 7th, 2011.

Name: _____

Problem	Possible	Score
1	20	
2	30	
3	30	
4	20	
Total	100	

1a. Consider the following datagram packet switched network with the annotated performance characteristics. How much time does it take to transmit **two packets of size 1000 bytes** from Host A to Host B? You must show your work. *Hint: Because the bandwidths of the links are increasing from Host A to Host B, the two packets will not arrive back-to-back at Switch 2 and Host B. You may find it helpful to construct a diagram like that on slide 10 of Lecture 4.* (10 points)


Processing delay: 20ms **Processing delay**: 50ms

Host A   Switch 1   Switch 2   Host B

Bandwidth: 1 Mb/s **Bandwidth**: 2 Mb/s **Bandwidth**: 8 Mb/s
Latency: 20ms   **Latency**: 40ms   **Latency**: 160ms
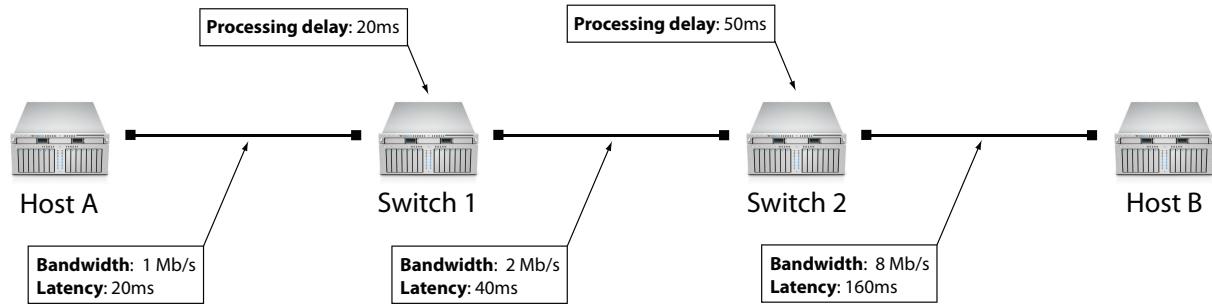
1b. (continuation of 1a) How much time does it take to transmit **two packets of size 1000 bytes** from Host B to Host A? You must show your work. *Hint: Because the bandwidths of the links are decreasing from Host B to Host A, the second packet will experience queuing delays in the switches.* (10 points)

2a. Why is it important for protocols configured on top of Ethernet to have a length field in their header indicating how long the message is? (Peterson and Davie, problem 2.39)   (6 points)

2b. What kinds of problems can arise when two hosts on the same Ethernet share the same hardware address? Describe what happens and why that behavior is a problem. (Peterson and Davie, problem 2.40)   (8 points)

2c. Suppose that we have an Ethernet which has a bandwidth of 10 megabits/second. If the speed of light in copper is assumed to be 2.5×10^8 meters/second, what is the minimum frame size that we must select for a LAN of length 5,000 meters? (8 points)

2d. (continuation of 2c) Suppose the layout of our LAN is as shown below. What would happen if host A transmitted a frame that was smaller than this minimum frame size? Under what circumstances would problems occur? (8 points)
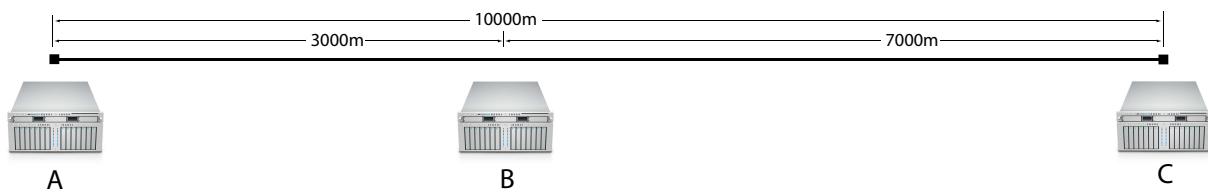
2e. (continuation of 2d) What is the minimum frame size that host B could send without any problems? (extra credit 10 points)

3a. Draw in the NRZ, NRZI and Manchester encodings for the bit pattern below (use Figure 2.10 of Peterson and Davie as a model). (10 points)

1 0 1 1 0 1 0 0 0 1 1 1 1 0 1 0 1 1 1

Clock

NRZ

NRZI

Manchester
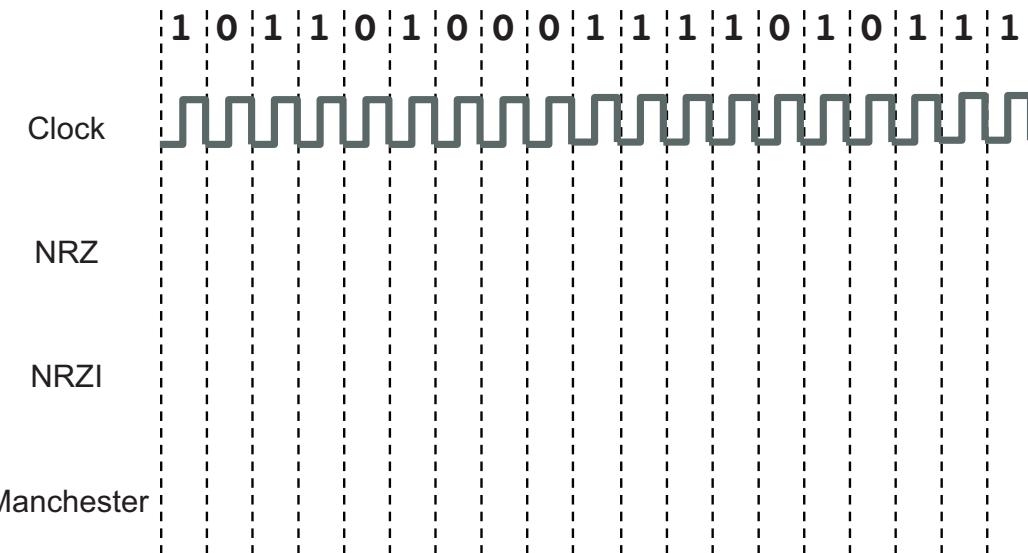
3b. Apply the HDLC bit-stuffing protocol to the pattern below and write down the resulting sequence in the boxes provided. You do not need to include any start frame/end frame sequences. You may not need to use all of the boxes. (10 points)

011111010111111100101 0 10011

3c. If the bit pattern below is received at a HDLC receiver, what is the interpretation of this pattern? You may not need to use all of the boxes. (10 points)

0111111010111101101111000011111110

The following problems concern simple networking tools. Login to one of the CCIS Linux machines to complete the problems.

4a. Run `man ping`, skim the manual page that is displayed. In a couple of sentences, describe what the `ping` tool does. (2 points)

4b. Now, run `ping www.ccs.neu.edu`. Stop it after a few seconds by hitting `Control-C`. What information is reported by the ping tool? (2 points)

4c. Now, try `ping www.cs.washington.edu`. What are the most important differences between this result and what you saw in 4b? (2 points)

4d. What network problems do you think `ping` can help diagnose? (4 points)

4e. Run `man traceroute`, skim the manual page that is displayed. In a couple of sentences, describe what the `traceroute` tool does. (2 points)

4f. Now, run `traceroute www.ccs.neu.edu`. Let it run until it has finished. What information is reported by the `traceroute` tool? (2 points)

4g. Now, run `traceroute www.cs.washington.edu`. Let it run until it has finished. What are the most important differences between this result and what you saw in 4f? (2 points)

4h. What network problems do you think `traceroute` can help diagnose? (4 points)