Networks and Distributed Systems	**Homework 1: Link Layer**
CS3700 Spring 2015	**September 21, 2014**

This homework is due at the beginning of class on January 28, 2015 and is worth 1.5% of your grade.

Name: _____

CCIS Username: _____

Problem	Possible	Score
1	20	
2	25	
3	30	
4	25	
Total	100	

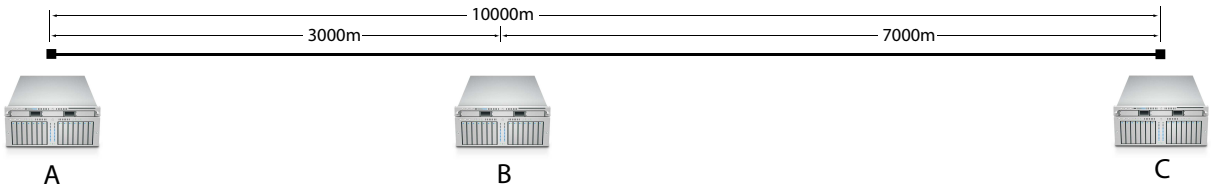
1a. Why is it important for protocols configured on top of Ethernet to have a length field in their header indicating how long the message is? (5 pts)

1b. 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. (10 pts)

1c. Give **two** reasons why Ethernet sends a 64-bit preamble before every packet consisting of alternating 0s and 1s. (5 pts)

2a. Suppose that we have an Ethernet which has a bandwidth of 5 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 10,000 meters? (10 pts)

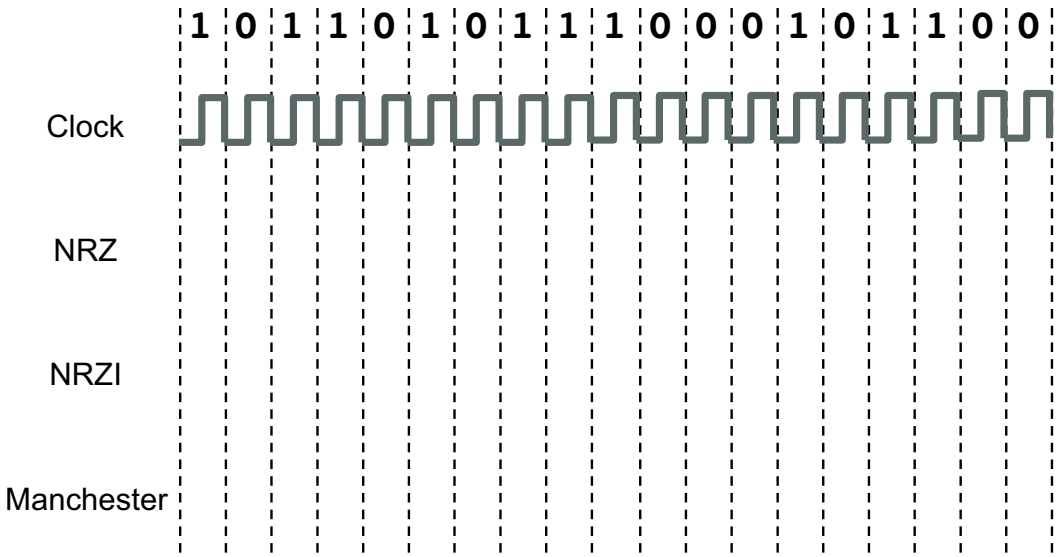
2b. Suppose the layout of our LAN is as shown below.



What would happen if host A transmitted a frame that was smaller than this minimum frame size? Under what circumstances would problems occur? (10 pts)

2c. What is the minimum frame size that host B could send without any problems? (5 pts)

3a. Draw in the NRZ, NRZI and Manchester encodings for the bit pattern below.



You can use Figure 2.10 of Peterson and Davie as a model. (10 pts)

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. .

01011011111111011111111001

You may not need to use all of the boxes. (10 pts)

3c. If the bit pattern below is received at a HDLC receiver, what is the interpretation of this pattern?

01111110101111101101111100001111111 0

You may not need to use all of the boxes. (10 pts)

4a. Show that two-dimensional parity allows detection of all 3-bit errors. (10 pts)

4b. Give an example of a 4-bit error that would not be detected by a two-dimensional parity. What is the general set of circumstances under which 4-bit errors will be undetected? (5 pts)

4c. Show that two-dimensional parity provides the receiver enough information to correct any 1-bit error (assuming the receiver knows only 1 bit is bad), but not any 2-bit error. (10 pts)