Networks and Distributed Systems	**Homework 1: Physical and Link Layer**
CS3700 Spring 2019	**January 10, 2019**

This homework is due at the beginning of class on January 24, 2019 and is worth 2% of your grade.

Name: _____

CCIS Username: _____

Problem	**Possible**	**Score**
1	20	
2	25	
3	30	
4	25	
5	10	
Total	110	

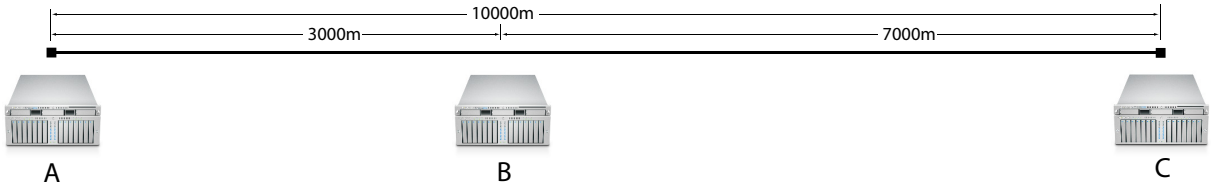
1a. Why is it important for protocols configured on top of Ethernet to have a length field in their header indicating how long the message is? (5 pts)

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? *Note that there are 1000 bits in a kilobit, 1000 kilobits in a megabit, etc.* (10 pts)

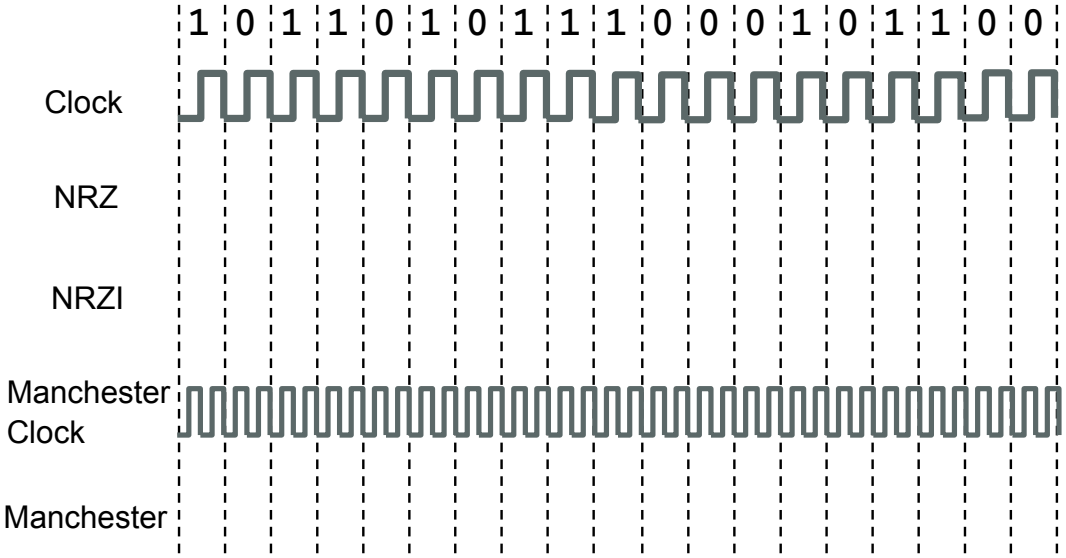
2b. Suppose the layout of our LAN is as shown below.



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 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. .

0101101111111110111111111001

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

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

01111110101111101101111100000111111110

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)

5a. State **two** reasons why broadcast Ethernet, where all hosts on the network share one single wire and CSMA/CD (carrier sense multiple access/collision detect) is used to arbitrate media access among the hosts, cannot support (1) a large number of hosts, or (2) hosts spread across a large geographic area. (10 pts)