CSE 461 Midterm
Winter 2017

Your Name: _____

Student ID: _____

General Information:

This is a closed book/laptop examination. You have **50 minutes** to answer as many questions as possible. The number in parentheses at the end of each question indicates the number of points given to the question. There are **5 questions** on this exam (check to make sure you have all of them), and there are a total of **50 points.** Write all of your answers directly on this paper. Make your answers as concise as possible. If there is something in the question that you believe is open to interpretation, then please go ahead and interpret, but state your assumptions in your answer. Remember to **READ THE ENTIRE QUESTION** before answering, as later questions will build on earlier answers.

Problem 1: Audio PHY (10 points)
This is it, the apocalypse. Despite losing nearly all of our computing resources, we still want to be able to communicate using a physical layer technology. Unfortunately, all we have are megaphones. Remembering that audio waves are very similar to RF waves…

a) Propose a modulation scheme to be able to transmit binary (0s and 1s) from a megaphone that a human can decode on the other side. There are multiple possible answers to this question. (5 Points)

Problem 1, cont.

b) What type of modulation (Amplitude, Frequency, or Phase Shift) is your encoding using and why? (3 Points)

c) Propose a modification of the modulation in order to increase the data rate. (2 Points)

Problem 2: Error Correcting Codes: (10 Points)

Consider the ECC we discussed in class (Hamming Code). The rules for it are as follows:

- Uses $n = 2^k - k - 1$, e.g., n=4, k=3, n=#data bits, k=#check bits
- Detects 2 bit errors, corrects single bit errors
- Put check bits in positions p that are powers of 2, starting with position 1
- Check bit in position p is even parity of positions with a p term in their values

a) Generate the codewords for the following sets of data bits: (4 Points)
    a. 1100 (2 Points)

    b. 0010 (2 Points)

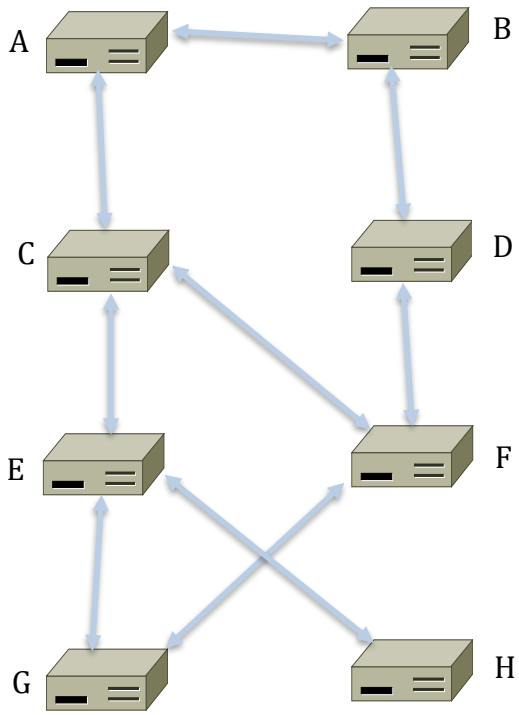
b) For the following codewords, compute the data bits. Remember, there may be errors (and if there are you need to correct them) (4 Points)
    a. 0100101 (2 Points)

    b. 0101011 (2 Points)

c) What's the hamming distance of this coding? (2 Points)

Problem 3: Spanning Tree (10 Points)

For the following network topology, fill out each step of the spanning tree algorithm in a table until it reaches the steady state. Ties broken by lowest address. Use ‘’ if nothing changes in a row between rounds. (7 Points)



	Round 0:
A	(A,A,0)
B	(B,B,0)
C	(C,C,0)
D	(D,D,0)
E	(E,E,0)
F	(F,F,0)
G	(G,G,0)
H	(H,H,0)

	Round 1:
A	
B	
C	
D	
E	
F	
G	
H	

	Round 2:
A	
B	
C	
D	
E	
F	
G	
H	

Problem 3, cont.

	Round 3:
A	
B	
C	
D	
E	
F	
G	
H	

	Round 4:
A	
B	
C	
D	
E	
F	
G	
H	

	Round 5:
A	
B	
C	
D	
E	
F	
G	
H	

	Round 6:
A	
B	
C	
D	
E	
F	
G	
H	

b) Draw the resultant spanning tree on the network shown before. Like, on the actual graph on the page above, not here. (3 Points)

Problem 4: Wireless (10 Points)

a) Draw a wireless topology where the “hidden node” problem is present. Explain which node is transmitting to which node and why a node is “hidden”. (5 Points)

b) Explain how RTS/CTS helps to resolve the hidden node problem. Does it completely resolve the problem? If not, give a counterexample. (5 Points)

Problem 5: Randos (10 Points)

a) What is 'Binary Exponential Backoff' and what is its purpose? (5 Points)

b) Fill in the following table with the following elements matching their network layer: (3 Points)
   a. Switch
   b. Router
   c. Hub

   d. Send packets over multiple networks
   e. Send bits using signals
   f. Send frames over one or more links

Network Layer	Connecting Technology	Layer Purpose
Network		
Link		
Physical		

c) Give an example of a protocol used in the: (2 Points)
   a. Network Layer (1 Point)

   b. Link Layer (1 Point)