

ECE (435/535a) Spring 2016 Quiz #2  
February 18

Name: \_\_\_\_\_ Student Number: \_\_\_\_\_

Signature: \_\_\_\_\_

**Instructions:** Answer all questions and show all work. Answers which are not justified with appropriate work will receive 0 points. Students who cheat will receive zero points on the exam and will be subject to the university's disciplinary procedure for academic dishonesty. Cheating includes, but is not limited to, collaborating or conferring in any way with anyone. Use of the internet is strictly forbidden. Your signature above attests that you are in compliance with these rules.

Problem	Points	Student's Score
1	40	
2	60	
Total:	100	

1. Which of the following codes are
  - (a) (20 points) Uniquely decodable?
  - (b) (20 points) Instantaneous?

$$\mathcal{C}_1 = \{0, 01\}$$

$$\mathcal{C}_2 = \{00, 01, 100, 101, 11\}$$

2. (a) (40 points) Find the binary Huffman code for the random variable  $X$  with probabilities

$$\mathbf{p} = \left( \frac{1}{21}, \frac{2}{21}, \frac{3}{21}, \frac{4}{21}, \frac{5}{21}, \frac{6}{21} \right).$$

- (b) (10 points) Find the entropy of  $X$ . (Hint:  $H(X) = -\sum p_i \log_2 p_i$ )  
(c) (10 points) Calculate the average length of the Huffman code. (Hint:  $\bar{L} = \sum p_i l_i$ )