EE 710 Coding Theory MINOR 1 MM 25 AUG 29 2016

Note: (i) Answer all parts at the same place (scattered answers will not be graded).
(ii) Write assumptions wherever made. (iii) Show all intermediate steps. Good Luck !

1. Entropy of coin toss [5]

Let X denote the number of tosses required for a coin until the first tail appears.

(a) Assume the coin to be unfair with p being the probability of getting a tail. Find the entropy, $H_u(X)$. [3]

(b) What happens when $p \to 0$? Explain mathematically and intuitively (< 3 sentences). [2]

2. Variable Length Codes [5]

(a) Can we construct a ternary Huffman code with codeword lengths 2, 2, 2, 2, 2, 2, 2, 2, 3, 3 and 3? Explain. [3]

(b) Consider the variable length code $C_1 = \{00, 01, 0\}$. Is it uniquely decodable? Is it an instantaneous code? What about the variable length code $C_2 = \{00, 01, 100, 101, 11\}$? Is it uniquely decodable? Instantaneous? [2]

3. Z Channel [10]

Consider the Z channel shown Fig1.

(a) Find the input probabilities that result in capacity. [5]

(b) If N such channels are cascaded, find the equivalent channel. Also, draw the equivalent channel and show the transition probabilities. [3]

(c) What is the capacity of the combined channel as $N \to \infty$? [2]

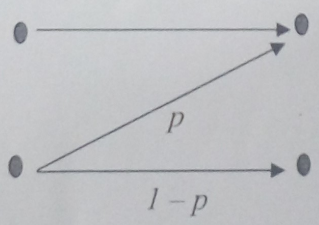

Fig. 1.

4. Linear Codes [5]

(a) Show that if C is a binary linear code, then the code obtained by adding an overall parity check bit to C is also linear. [3]

(b) For the code $C = \{00000, 10101, 01010, 11111\}$ construct the generator matrix. [2]

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