CENG 3331 Intro to Telecommunication and networks

Homework 4

Due at the beginning of class, 10/12/2022

Q1: (20) A source sends A, B, C, D 4 symbols. Each symbol uses binary code to represent. Such as 00->A, 01->B, 10->C, and 11->D. Each binary bit lasts 5ms.

a. **If they are equally likely to be send, what is the bit rate?**

b. **If the probability of sending these 4 symbols are 1/5, 1/4, 1/4, 3/10, please give the bit rate?**

Q2: (40) Given the source $\begin{bmatrix} X \\ P(X) \end{bmatrix} = \begin{bmatrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 & x_7 \\ 0.2 & 0.19 & 0.18 & 0.17 & 0.15 & 0.1 & 0.01 \end{bmatrix}$

a) **Find the** $H(X)$

b) **Do Huffman Coding, calculate the codeword length and coding efficiency**

Q3: (40) Consider messages made up entirely of vowels (A, E, I, O, U). Here is the table of probabilities for each of the vowels.

$$\begin{bmatrix} Vowels \\ P \end{bmatrix} = \begin{bmatrix} A & E & I & O & U \\ 0.22 & 0.34 & 0.17 & 0.19 & 0.08 \end{bmatrix}$$

a) **Given an expression for the number of bits of information you receive when learning that a particular vowel is either I or U.**

b) **Using Huffman coding, construct a variable-length code (assuming that each vowel is encoded individually). Please draw a diagram of the Huffman code tree and give the encoding for each of the vowels**

Q4: (Extra 10) Join the discussion of Cyber-physical Systems on Blackboard. Attach only the screenshot of your answer from Blackboard.