Department of Electronics and Communication Engineering

Digital Communication

Theory Assignment 3 (29/10/2018)

Date of Submission (12/11/2018)

Q1. Given the data stream 1110010100 sketch the transmitted sequence of pulse for each of the following line codes: (a) Uni-polar non-return – to – zero. (b) Polar non-return – to – zero. (c) Uni-polar return – to – zero. (d) Bipolar return – to – zero. (e) Manchester code. [CO.5002.6]

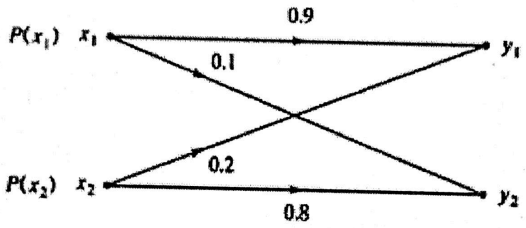
Q2. An analog signal carries four bits in each signal element. If 1000 signal elements are sent per second, find the baud rate and the bit rate. [CO.5002.6]

Q3. A source produces one of the four possible symbols during each interval having probabilities $P(x_1) = 1/2, P(x_2) = 1/4, P(x_3) = P(x_4) = 1/8$. Obtain the information content in each of these symbols.[CO.5002.6]

Q4. If there are M equally likely and independent symbols, then prove that the amount of information carried by each symbol will be $I(x_i) = N$ bits where $M = 2^N$ and N is an integer. [CO.5002.6]

Q5. An analog signal is band-limited to B Hz, sampled at a Nyquist rate and samples are quantized into 4 levels $Q_1, Q_2, Q_3,$ and Q_4 which are independent with probabilities $p_1 = p_4 = \frac{1}{8}$ and $p_2 = p_3 = \frac{3}{8}$. Find the information rate of the source. [CO.5002.6]

Q6. Given a binary channel as shown



(a) Find the channel matrix.
(b) Find $P(y_1)$ and $P(y_2)$ when $P(x_1) = P(x_2) = 0.5$.
(c) Find joint probability $P(x_1, y_2)$ and $P(x_2, y_1)$ when $P(x_1) = P(x_2) = 0.5$. [CO.5002.6]

Q7. Prove the following:
(a) $H(X|Y) = 0$. For a lossless channel
(b) $H(Y|X) = 0$. For a deterministic channel.
(c) $H(X) = H(Y)$ and $H(Y|X) = 0$. For a noise less channel.
(d) $H(X, Y) = H(X|Y) + H(Y)$. [CO.5002.5]

Q8. State and explain Shannon's Hartley law. Show that the channel capacity of an ideal AWGN channel with infinite bandwidth is given by $\lim_{B\to\infty} C = 1.44\frac{S}{N_0}$. [CO.5002.6]

Q9. Five source messages are probable to appear as $m_1 = 0.4, m_2 = 0.15, m_3 = 0.15, m_4 = 0.15, m_5 = 0.15$. Find coding efficiency using (a) Shannon- Fano coding (b) Huffman coding. [CO.5002.6]

Q10. A DMS X has five symbols $x_1, x_2, x_3, x_4 P$ and x_5 $with$ $P(x_1) = 0.4, P(x_2) = 0.19, P(x_3) = 0.16, P(x_4) = 0.15$ and $P(x_5) = 0.1$. (a) Construct Shannon-Fano code for X and calculate the efficiency of the code. (b) Repeat for the Huffman and compare the results.[CO.5002.6]

Prepared by : Dr. Amit Udawat (EC department) Dated: 29/10/2018

Submission date: 12/11/2018

Director
Shivajirao Kadam Institute of Technology & Management - Technical Campus INDORE

Head
Electronics & Communication Dept.
Acropolis Technical Campus
Tillore Khurd, Ralamandal, Indore (M.P.)