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C028631(028)

B. Tech. (Sixth Semester) Examination, April-May 2022

(AICTE Scheme)

(Electronics & Telecommunication Engg. Branch)

INFORMATION THEORY and CODING

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Part (a) of each question is compulsory and carries 4 marks each. Attempt any two parts from (b), (c) and (d) of each question. Part (b), (c) and (d) carry 8 marks each.*

Unit-I

1. (a) How uncertainty is related to information? What is the unit of information?

(b) Consider a DMS with source probabilities (0·20, 0·20, 0·15, 0·15, 0·10, 0·10, 0·05, 0·05) :

(i) Determine an efficient fixed length code for the source.

(ii) Determine the Huffman code for this source

(iii) Compare the two Codes and Comment

(c) Encode the string using Lempel-Ziv algorithm and write the steps for the coding 101011011010101011.

(d) Explain in detail the lossless and lossy compression techniques.

Unit-II

2. (a) What are the different types of channel? Explain Binary Schematic Channel in detail.

(b) Explain Information Capacity Theorem in detail.

(c) Define Mutual Information and prove the following :

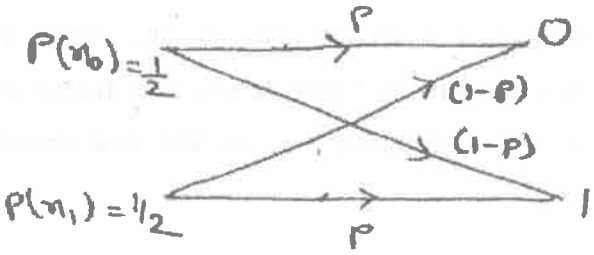
(i) $I(x;y) = I(y;x)$

(ii) $I(x;y) = H(x) - H\left(\frac{x}{y}\right)$

(iii) $I(x;y) = H(y) - H\left(\frac{y}{x}\right)$

(d) In the given figure of Binary Symmetric Channel find the rate of Information Transmission across this channel for $P = 0{\cdot}8$. The symbols are generated at the rate of 1000 per second $P(X_0) = P(X_1) = \frac{1}{2}$.

Also determine channel input information rate.



Unit-III

3. (a) Define Linear Codes. What are the different properties of linear codes?

(b) Design the encoder for (7, 3) cyclic code generated by $h(p) = (p^3 + p + 1)$ and verify its operation by

any message vector.

(c) A (6, 3) code is generated according to the generator matrix. The receiver receives $Y = 100011$. Determine the corresponding data word if the channel is a binary symmetric channel and maximum likelihood decision is used :

$$G = \begin{bmatrix} 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$

(d) Write the features of Hamming Codes. Determine if the code generated from the generator matrix of (6, 3) code is Hamming code or Not. Find encoding table.

$$G = \begin{bmatrix} 1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

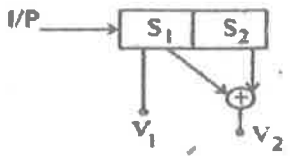
Unit-IV

4. (a) How convolution codes are differ from block Codes?

(b) Write the algorithm for Viterbi Decoding and explain it with the help of Trellis diagram.

(c) Obtain the codeword for the convolutional encoder (2, 1, 2) using Transform domain approach. The impulse response of input top adder output path is (1, 1, 1) and input bottom adder output path is (1, 0, 1) and also message signal is 10011.

(d) Sketch the code tree for the convolution coder shown with $k = 1, n = 2$. Write the step also.



Unit-V

5. (a) What is Euclidean Distance?

(b) Explain the process of mapping by set partitioning. Why it is done?

(c) Draw the General structure of TCM Encoder and write TCM design rule.

(d) Explain in brief about BCH codes and what is the importance of minimal polynomial? How BCH codes are decoded.