CBCS SCHEME

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17EC54

Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
Information Theory and Coding

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the terms:
i) Self Information
ii) Average Information
iii) Mutual Information
iv) Efficiency
v) Redundancy. **(10 Marks)**

b. Write the block diagram of digital communication system and explain. **(10 Marks)**

OR

2 a. What is Entropy? Explain properties of entropy. **(10 Marks)**

b. Ina binary PCM, if '0' occur with probability 1/4 and '1' occur with probability 3/4, then calculate amount of information conveyed by each bit. **(10 Marks)**

Module-2

3 a. Explain KRAFT INEQUALITY theorem. **(10 Marks)**

b. Explain Shannon's encoding algorithm. **(10 Marks)**

OR

4 a. Apply Shannon's encoding algorithm to the following messages $\{S_1, S_2, S_3\}$ with probabilities {0.5, 0.3, 0.2} to find code-words and also find code-efficiency and redundancy. **(10 Marks)**

b. Explain properties of codes. **(10 Marks)**

Module-3

5 a. Consider a binary channel shown in Fig.Q.5(a) given below.

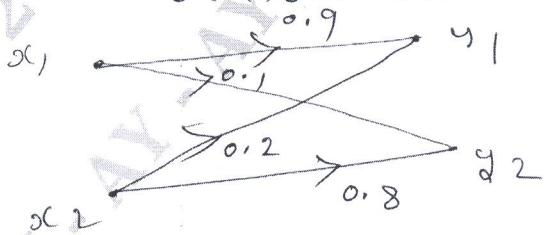

Fig.Q.5(a)

i) Find the channel matrix of the channel.
ii) Find $P(y_1)$ and $P(y_2)$ when $P(x_1) = P(x_2) = 0.5$.
iii) Find the joint probabilities $P(x_1, y_2)$ and $P(x_2, y_1)$ when $P(x_1) = P(x_2) = 0.5$. **(10 Marks)**

b. For a noiseless channel with an input symbols and m output symbols. Prove that $H(X) = H(Y)$ and $H(Y/X) = 0$. **(10 Marks)**

OR

6 a. State and discuss Shannon's theorem on channel capacity. **(10 Marks)**

b. A binary channel has the following characteristics:

$$P(Y/X) = \begin{bmatrix} 2/3 & 1/3 \\ 1/3 & 2/3 \end{bmatrix}$$

If input symbols an transmitted with probabilities 3/4 and 1/4 respectively, find entropies H(X), H(X, Y) and H(Y/X). **(10 Marks)**

Module-4

7 a. With a neat block diagram and a suitable example, explain the error-control based communication system. **(10 Marks)**

b. Distinguish between "block codes" and "convolutional codes". **(10 Marks)**

OR

8 Consider a (6, 3) linear code whose generator matrix is

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

i) Find all code vectors.
ii) Find all Hamming weights and distances.
iii) Find minimum weight parity check matrix.
iv) Draw the encoder circuit for the above codes. **(20 Marks)**

Module-5

9 a. Write a note on: i) Golay codes ii) BCH codes. **(10 Marks)**

b. Discuss the various properties of cyclic codes. **(10 Marks)**

OR

10 Explain encoding of convolution codes using transform-domain approach, with an examples. **(20 Marks)**

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