

BACHELOR OF TECHNOLOGY (C.B.C.S.) (2020 COURSE)
 B.Tech.Sem - V Electronic & Communication : WINTER- 2022
 SUBJECT : INFORMATION THEORY & CODING

Day : Tuesday

Time : 02:30 PM-05:30 PM

Date : 06-12-2022

W-24610-2022

Max. Marks : 60

N.B.

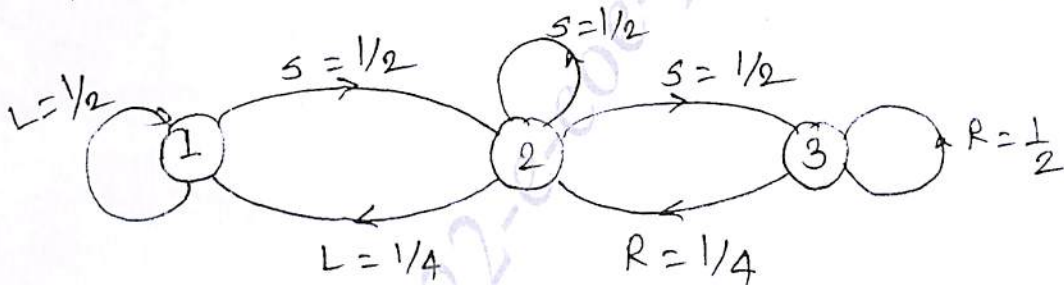
- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Use of non-programmable calculator is allowed.
- 4) Assume suitable data if necessary.

Q.1 a) Explain the concept of information, average information rate and redundancy (05)
 code efficiency as referred to information transmission.

- b) A pair of dice are tossed simultaneously. The outcome of 1 dice is recorded (05)
 as X_1 and that of the 2nd dice as X_2 . Events are defined as follows:
 $A = (X_1, X_2)$ such that $(X_1, X_2) \leq 7$
 $B = (X_1, X_2)$ such that $(X_1 > X_2)$
 Which event conveys more information?

OR

Q.1 a) For markov source shown, calculate the information rate if $r = 1$ bits/sec. (05)



$$P_1 = 1/4, P_2 = 1/2, P_3 = 1/4.$$

- b) The collector voltage of certain circuit is to lie between -5 and -12 V, the (05)
 voltage can take only these values -5, -6, -7, -9, -11, -12 with respective
 probabilities $1/6, 1/3, 1/12, 1/12, 1/6, 1/6$. This voltage is recorded in a pen
 recorder. Determine the average self information.

Q.2 State the steps of Huffman coding. In discrete memoryless source content (10)
 $(X_1 = 0.4, X_2 = 0.2, X_3 = 0.05, X_4 = 0.3, X_5 = 0.05)$. Calculate code words,
 average code word length, code efficiency, entropy and information rate if
 Nyquist rate is 1000 samples/sec using Huffman coding.

OR

Q.2 State the steps of Shannon – Fano coding. In DMS content $(X_1 = 0.4, X_2 = 0.3,$ (10)
 $X_3 = 0.05, X_4 = 0.2, X_5 = 0.05)$. Calculate codewords, average code word
 length, code efficiency, entropy and information rate if Nyquist rate is 1000
 samples/sec using Shannon – Fano coding.

P.T.O.

- Q.3 a)** A BSC has following noise matrix with source probability as $P(X_1) = 2/3$, $P(X_2) = 1/3$. $P(Y/X) = \begin{bmatrix} 1/4 & 3/4 \\ 3/4 & 1/4 \end{bmatrix}$. Determine $H(X)$, $H(Y)$, channel capacity. (05)
- b)** Explain Muroga's Theorem, with mathematical expressions on Channel Capacity. (05)

OR

- Q.3** State Muroga's Theorem and find mutual information, channel capacity of discrete channel as shown if information rate is 1 symbol/sec, also determine $H(X, Y)$, $H(X/Y)$, $H(X)$, $H(Y)$. (10)

$$p(Y/X) = \begin{bmatrix} 0.4 & 0.6 & 0 \\ 0.5 & 0 & 0.5 \\ 0 & 0.6 & 0.4 \end{bmatrix}$$

- Q.4** Consider (6,3) linear block code defined by the generator matrix. (10)

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

- Determine if the code is Hamming Code.
- Find the parity check matrix H .
- Find all the code words.
- What is the minimum distance d_{min} of the code.
- How many errors can be detected and corrected?

OR

- Q.4** Consider the generator polynomial for a (7,4) cyclic code defined by $g(p) = P^3 + P^2 + 1$ (10)

- Find the encoding table for the cyclic code.
- What is the minimum distance d_{min}
- Find the systematic output codeword for input $C = 1111$.

- Q.5** With the help of diagram identify the five main stages associated with the baseline mode of operation of JPEG. Explain. (10)

OR

- Q.5** Give brief note on GIF or TIFF formats. With necessary diagram if applicable. (10)

- Q.6** Give a brief note on H 263 video compression standard. (10)

OR

- Q.6** Describe the principle of MPEG4 with suitable diagrams of encoder and decoder. (10)

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