

5E3258

B.Tech. V Sem.(Main/Back) Exam Dec. 2012

Computer Science

5CS6.3 Information Theory & Coding

Time : 3 Hours

Maximum Marks: 80

Min. Passing Marks: 24

Instructions to Candidates:

Attempt any five questions. Selecting one question from each unit. All Question carry equal marks. Schematic diagram must be shown wherever necessary. Any data you feel missing suitable be assumed and stated clearly. Units of quantity used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination.

1. _____ Nil _____

2. _____ Nil _____

UNIT-I

1. (a) Show that for a discrete binding channel :

$$H(X, Y) = H(X/Y) + H(Y)$$

$$H(X, Y) = H(X) + H(Y)$$

- (b) Prove the following properties of mutual information:-

$$I(X;Y) = H(X) - H(X/Y)$$

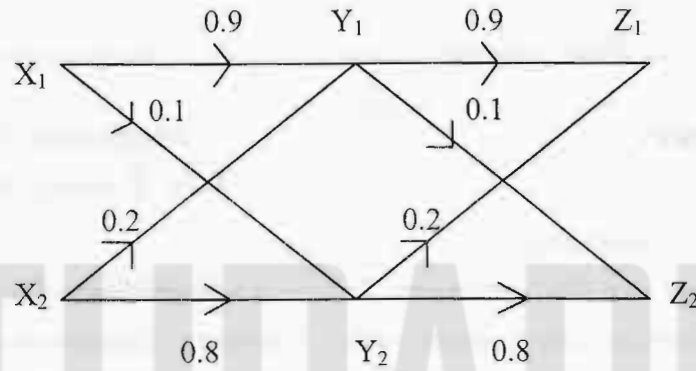
$$I(X;Y) = H(X) + H(Y) - H(X,Y)$$

$$I(X;Y) = H(X) = H(Y) \text{ (for noise free channel)}$$

OR

- (a) Consider a DMS with the alphabet (S_0, S_1, S_2) with probabilities $P_0 = \frac{1}{2}$, $P_1 = \frac{1}{4}$, $P_2 = \frac{1}{2}$. Find out the entropy of the original source and second order extension entropy?

- (b) Two binary channels are connected in cascade as shown in fig.



- (a) Find overall channel matrix and equivalent channel diagram.
 (b) Find $P(z_1)$ and $P(z_2)$ when $P(x_1) = P(x_2) = 0.5$

UNIT-II

2. (a) Apply the Shannon - Fano Coding procedure for the following message.

$$[x] = x_1 \ x_2 \ x_3 \ x_4 \ x_5 \ x_6 \ x_7 \ x_8$$

$$[p] = 1/4 \ 1/8 \ 1/16 \ 1/16 \ 1/16 \ 1/4 \ 1/16 \ 1/8$$

- (b) The given string $S = 001212121021012101221011$

Find the encoding and decoding process.

OR

- (a) Construct Huffman's code to the following set of messages. Also find the efficiency $p(x_1) = 0.49$, $p(x_2) = 0.14$, $p(x_3) = 0.14$, $p(x_4) = 0.07$, $p(x_5) = 0.07$, $p(x_6) = 0.04$, $p(x_7) = 0.02$, $p(x_8) = 0.02$, $p(x_9) = 0.01$

- (b) What is prefix code? Explain with example.

3. Consider (7, 4) linear code whose generator matrix is

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

- (a) Find all the code vectors of this code.
 (b) Find the parity check matrix for this code.
 (c) Find the minimum weight of this code.
 (d) Prove equation $CH^T = 0$

OR

3. Consider a (7, 4) block code generated by

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

Find out the error vector and suppose that the received vector R is 1001001.

UNIT-IV

- 4 (a) Design an encoder for (7, 4) BCC generated by $g(x) = 1+x+x^3$ and verify its operation using message vector 0101 .
 (b) What is Galois field? Explain properties of Galois fields.

