5E3258

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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:-

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

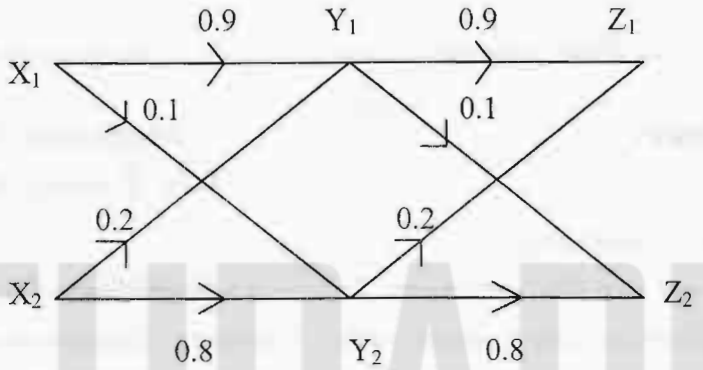
$I(X;Y) = H(X) + H(Y) - H(X,Y)$

$I(X;Y) = H(X) = H(Y)$ (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.

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

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

(b) The given string S = 00121212102101210122101 1

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.

UNIT-III

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.

OR

(a) A (15,5) linear cyclic code has a generator polynomial g(x) =

$1+x+x^2+x^4+x^5+x^8+x^{10}$

(i) Draw block diagram of an encoder and syndrome calculator for this code.

(ii) Find the code polynomial for the message polynomial

$D(x) = 1+x^2+x^4$ (in a Systematic-form) .

(b) The following polynomial f(x) and g (x) are defined over GF(3).

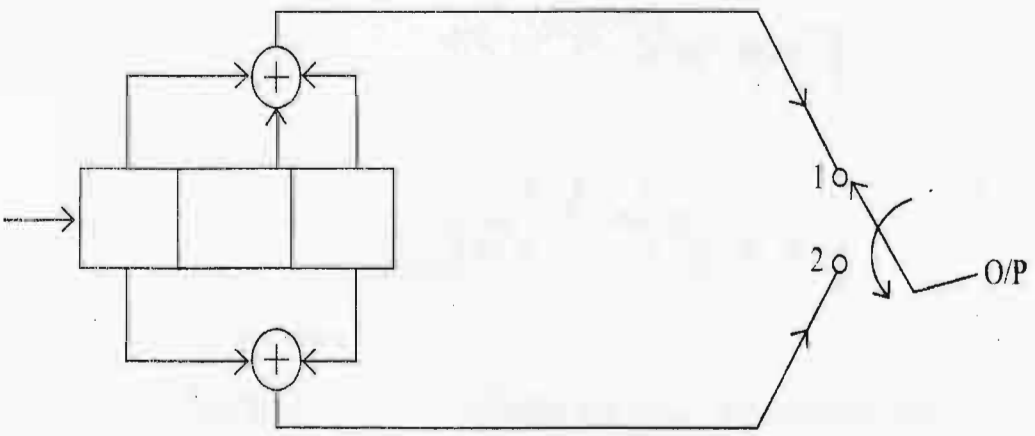
$f(x) = 2+x+x^2+2x^4$

$g(x) = 1+2x^2+2x^4+x^5$

Calculate addition and multiplication of the above two polynomials.

UNIT-V

5. (a) Initially consider that the register contains all zeroes. What will be the code sequence if the i/p data sequence is 100110 ?



OR

5. Write short notes on :

(i) Maximum likelihood decoding of convolution codes

(ii) Describe Viterbi algorithm.