Total No. of Questions : 8] [Total No. of Printed Pages : 3

Roll No. 0111EC08MTe

MEDC–301(A)

M. Tech. (Third Semester) EXAMINATION, Feb., 2010

INFORMATION THEORY AND CODING

[MEDC–301(A)]

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : Attempt any *five* questions. All questions carry equal marks.

1. (a) What is Entropy ? Show that the entropy is maximum when all the symbols are equi-probable. Assume M = 3.

(b) A discrete source transmits message x_1, x_2 and x_3 with the probability 0·3, 0·4 and 0·3. The source is connected to the channel given in figure below. Calculate all the entropies :

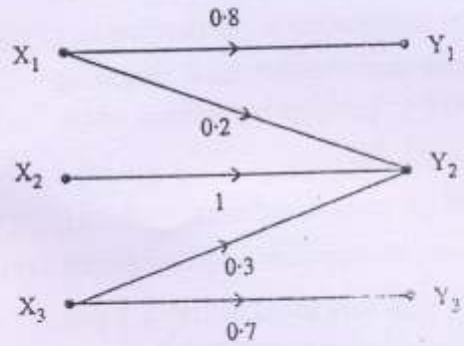

Fig. 1

P. T. O.

2. (a) Give the desired properties of a source code. What is coding efficiency ? Show that the coding efficiency is maximum when P (0) = P (1).

   (b) Apply Huffman coding procedure for determining coding efficiency. [Take M = 3] :

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

   [P] = [0·1 0·25 0·15 0·05 0·15 0·1 0·05 0·15]

3. (a) State and explain Shannon's theorem on capacity. Also discuss bandwidths and S/N trade off.

   (b) Calculate the bandwidth of the picture (video) signal in television. The following are the available data :

   (i) Number of distinguishable brightness levels = 10;

   (ii) The number of enements per frame = 300000

   (iii) Picture frames transmitted per second = 30;

   (iv) S/N required = 30 dB

4. (a) Find the mutual information and channel capacity of the channel shown in figure below. Given P (x_1) = 0·6, P (x_2) = 0·4.

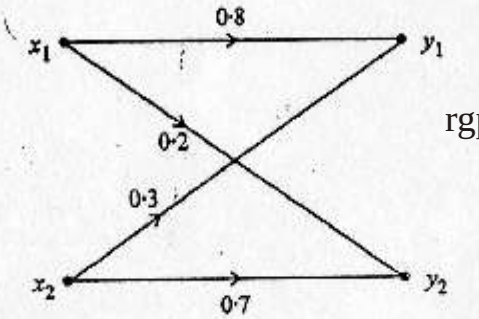

Fig. 2

   (b) Explain and discuss mutual information and its properties.

5. (a) Explain block codes. Discuss Hamming distance minimum distance and error detecting and correcting capabilities of block code.

   (b) Design a block code with a minimum distance of three and a message block size of 3 bits.

6. (a) Explain cyclic codes and its basic properties.

   (b) The generator polynomial of a (7, 4) cyclic code is $g(x) = 1 + x + x^3$. Find the 16 code words of this code.

7. (a) What are BCH codes ? Discuss its encoding and decoding, error location and correction.

   (b) The encoder for a convolution code is shown is figure below. Find all the code words for a 4-bit input data.

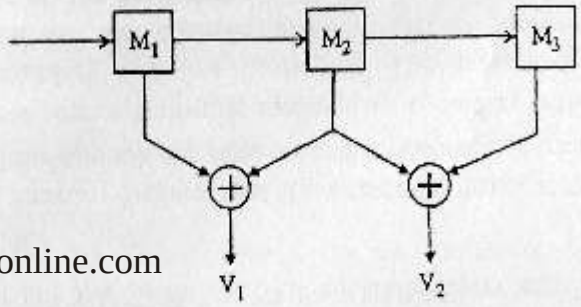

Fig. 3

8. Write short notes on any *two* of the following :

   (i) Binary symmetric channel

   (ii) Hamming code and their application

   (iii) Systematic codes and its encoding circuit

   (iv) Channel coding theorem

   (v) Data compression