

Roll No .....

EC-7005 (1) (CBGS)

B.E. VII Semester

Examination, November 2018

Choice Based Grading System (CBGS)

Information Theory and Coding

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.
ii) All questions carry equal marks.

1. a) Define information. State all various units of information and find relationship between them.
   b) What is entropy? Show that entropy is maximum when all messages are equi-probable. Assume M = 2.

2. a) What is mutual information? Explain the concept of average mutual information. Also discuss the relationship between entropy and mutual information.
   b) Find mutual information for the following.
      i) Noise free channel
      ii) Channel with independent input/output

3. a) State and explain Shannon's source coding theorem with examples.
   b) What is coding efficiency? With the help of suitable examples show that coding efficiency improves as symbol probabilities become more and more equal.

4. a) Apply Huffman coding procedure to find coding efficiency of the following. [Take M = 2]

$[x] = [x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5 \quad x_6 \quad x_7 \quad x_8]$
$[p] = [.1 \quad .25 \quad 0.15 \quad 0.05 \quad 0.15 \quad 0.1 \quad .05 \quad .15]$

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   b) Apply Shannon fano coding procedure for finding coding efficiency of the following [Take M = 2]

$[x] = [x_1 \quad x_2 \quad x_3 \quad x_4 \quad x_5 \quad x_6 \quad x_7 \quad x_8]$
$[p] = [1/4 \quad 1/8 \quad 1/16 \quad 1/16 \quad 1/16 \quad 1/4 \quad 1/16 \quad 1/8]$

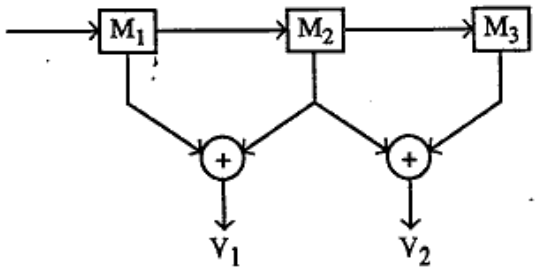
5. a) Explain the concept of block codes. Differentiate between Hamming distance and minimum distance.
   b) Describe a single error correction with linear block code.

6. a) Design a block code with a minimum distance of three and a message block size of eight bits.
   b) The generator matrix for a (6,3) block code is given below. Find all code vectors of this code.

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

7. a) What are cyclic codes? Explain. Also give properties of cyclic codes.
   b) The generator polynomial of a (7, 4) cyclic code is $g(x) = 1 + x + x^3$. Find all the code words of this code.

8. a) What are convolution codes? Explain encoding and decoding for convolution codes.
   b) The encoder for a convolutional code is as below. Find all the code words for a 4-bit input data.



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