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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Electronics and Communication Engineering

Semester End Examination; Dec. - 2014

Information Theory and Coding

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer any **FIVE** full questions selecting at least **TWO** full questions from each part.*
ii) Assume suitable missing data if any.

PART - A

1. a. Find an expression for average information content in long independent sequence. 6

   b. Find the relationship between Hartley's, Nats and Bits. 6

   c. State and prove Kraft inequality. 8

2 a. Consider a DMS with seven possible Symbols x; I = 1,2, ……7 and the corresponding probabilities $P(x_1) = 0.42$, $P(x_2) = 0.30$, $P(x_3) = 0.15$ $\{x_4) = 0.07$, $P(x_5) = 0.03$, $P(x_6) = 0.02$ and $P(x_7) = 0.01$

   (i)Determine Huffman code for the source

   (ii) Determine the average number of binary digits per symbol. 10

   (iii) Find the efficiency of this code place the composite symbol as Low as possible.

   b. Briefly describe JPEG standard for lossless compression. 4

   c. Determine Lempel-zir code for the following bit stream 101011011010101011 6

3 a. Derive an expression for channel capacity of a Binary symmetric channel. 4

   b. Obtain a expression $c = w\log_2\left[1+\frac{P}{Now}\right]$ bits per second. 8

   c. Consider a binary channel with

   $P\left(\frac{y_1}{x_1}\right) = \frac{3}{4}$ $P\left(\frac{y_2}{x_1}\right) = \frac{1}{4}$, $P\left(\frac{y_1}{x_2}\right) = \frac{1}{4}$, $P\left(\frac{y_2}{x_2}\right) = \frac{3}{4}$

   (i) Find the channel matrix of the channel

   (ii) Find $p(y_1)$ *and* $p(y_2)$ *when* $p(x_1) = \frac{2}{3}$ *and* $P\left(\frac{y_2}{x_2}\right) = \frac{1}{3}$ 8

   (iii) Find the joint probabilities $p(x_1y_2)$ *and* $p(x_2y_1)$ *when* $p(x_1) = \frac{2}{3}$ *and* $P(x_2) = \frac{1}{3}$

4 a. Define the following:

   (i) Hamming Weight

   (ii) Hamming Distance 3

   (iii) Code rate

Contd…2

b. The party check bits of a (8,4) block code are generated by

$C_5 = d_1 + d_2 + d_4$
$C_6 = d_1 + d_2 + d_3$
$C_7 = d_1 + d_3 + d_4$
$C_8 = d_2 + d_3 + d_4$

where d_1,d_2,d_3,& d_4 are message bits 8

(i) Find generator matrix and parity check matrix for this code

(ii) Prove that $GH^T=0$

c. Define fields and list its properties. 9

PART - B

5 a. Derive the expression for probability of error correction. 10

b. Construct the standard array for the (6, 3) code, the parity matrix $P = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ 10

6 a. Explain the matrix Description of cyclic codes. 10

b. Explain the following codes:

(i) Quasi cyclic codes and shortened cyclic codes

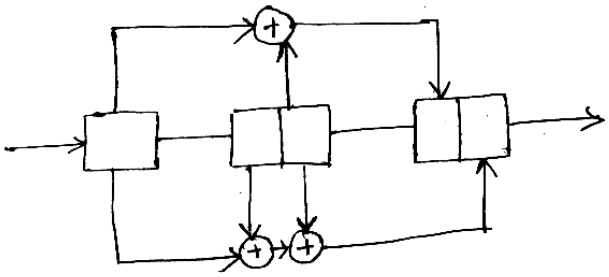
(ii) Burst error correction 10

(iii) Fire codes

(iv) Golay code.

7. a. Find the matrix description of convolution Encoder. 10

b. Consider the convolution encoder given in figure.



10

(i) Write the incoming and outgoing bits of convolutional encoder

(ii) Write the state diagram for the encoder

(iii) Draw the trellis diagram

(iv) Obtain the encoded output for the message 1001101

8 a. Explain the concept of coded modulation. 10

b. Draw and explain the general structure of TCM encoder that processes 'M' input bits. 10

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