5E5108

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5E5108

B. Tech. V Sem. (Main / Back) Exam., Dec. 2014

Computer Science & Engineering

5CS6.3A 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 questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT – I

Q. 1 (a) Explain the concept of information, average information, information rate and redundancy as reffered to information transmission. [4]

(b) Discuss the reason for using logarithmic measure for measuring the amount of information. [4]

(c) A black and white TV picture consists of 525 lines of picture information. Assume that each consists of 525 picture elements and that each element can have 256 brightness levels. Pictures are repeated at the rate of 30/sec. Calculate the average rate of information conveyed by a TV set to a viewer. [8]

OR

(a) Show that the entropy is maximum when source transmits symbols with equal probability. Plot the entropy of this source versus probability p (0<p<1). [8]

(b) The output of an information source consists of 128 symbols, 16 of which occur with probability of 1/32. And remaining 112 occur with a probability of 1/224. The source emits 1000 symbols/sec, assuming that the symbols are chosen independently, find the rate of information of the source. [8]

UNIT-II

Q. 2 (a) Define Noiseless channel and deterministic channel. [4]

(b) A discrete source transmits six messages symbols with probabilities of 0.3, 0.2, 0.2, 0.15, 0.1 and 0.05. Derive suitable Fano and Huffmann codes for the message and determine the average length and efficiency of each code. [8]

(c) A Gaussian channel has 1 MHz bandwidth. Calculate the channel capacity, if its signal power to (two sided) noise spectral density ratio is 5×10^4 Hz. [4]

OR

(a) State Shannon- Hartley Theorem. Give its implications. [6]

(b) A binary channel has the following noise characteristics:

P(Y/X)		Y	
		0	1
X	0	2/3	1/3
	1	1/3	2/3

If the input symbols are transmitted with probabilities ¾ and ¼ respectively, find H(X), H(Y), H(X/Y) and H(Y/X). [10]

UNIT-III

Q. 3 (a) The parity check matrix is given by: [12]

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

(i) Obtain the Generator matrix (G)

(ii) List all the code vectors

(iii) What will be the minimum distance between two code vectors?

(iv) How many errors can be detected? How many errors can be corrected?

(b) Prove that minimum distance of a linear block code is the smallest weight of the non- zero code vector in the code. [4]

OR

(a) Explain the importance of hamming codes and how these can be used for error detection and correction. [8]

(b) The parity check matrix of (7, 4) hamming code is expressed as:

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

Evaluate the syndrome vector for single bit errors for a particular code word transmitted the received code Y = 1000011, whether Y is erroneous? If yes, then in which bit? [8]

UNIT-IV

Q.4 (a) Explain all the basic properties of Galois fields. [8]

(b) Given a (7.4) cyclic code. Draw the general block diagram of syndrome calculation circuit for the cyclic code and explain its operation. [8]

OR

Let C be the n =3 cyclic code over GF (4) = $(0, 1, \propto, \propto^2)$($\propto^3=1$, $\propto^2=1+\propto$) generated by g(x) = $x+\propto$. [16]

(i) Find all codewords of C. Find the minimum distance of C.

(ii) Find the check polynomial of C. Find the generator polynomial of C^1.

(iii) Find all cyclic subcodes of C i.e. cyclic codes that are contained in C.

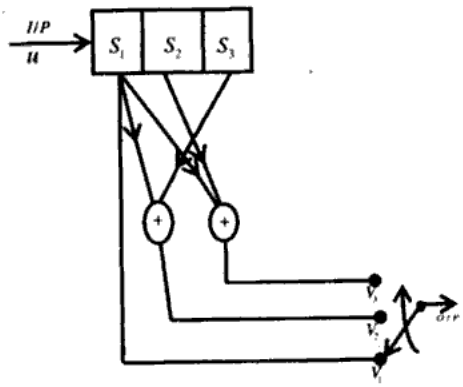
UNIT-V

Q. 5 (a) For the convolution encoder shown below: - [12]

(i) Draw the state diagram.

(ii) Draw the trellis diagram.

(iii) Determine the o/p sequence for the i/p data u =11011011

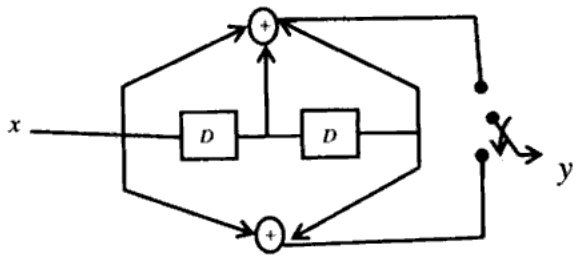


(b) Explain Viterbi Algorithm. [4]

OR

(a) What are convolution codes? How is it different from block codes? [4]

(b) Use Viterbi algorithm to decode the received sequence Z = [1110 10 1 0 01]



Draw the state diagram and trellis diagram. [12]
