5E3258

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B. Tech. (Sem. V) (Main/Back) Examination, December - 2013
Computer Science
5CS6.3 Information Theory & Coding

Time : **3** Hours] [Total Marks : **80**
[Min. Passing Marks : **24**

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

1 (a) Give the different properties of Entropies. **10**

(b) A discrete source emits one of six symbols once every m-sec. The symbol probabilities are $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}$ and $\frac{1}{32}$ respectively. Find the source entropy and information rate. **6**

OR

1 (a) Define an entropy and show that $H(S)_{max} = \log_2 9$ bits/message-symbols. **10**

(b) A black and white TV picture consists of 525 lines of picture information. Assume that each line consists of 525 picture elements and that each element can have 256 brightness levels. Pictures have repeated at the rate of 30 frames/sec. Calculate the average rate of information conveyed a set of TV set to a viewer. **6**

UNIT - II

2 (a) Consider a source S = [S_1, S_2] with probabilities ¾ and ¼ respectively. Obtain Shannon-Fano code for source S, its 2nd and 3rd extensions. Calculate efficiency for each case. **10**

(b) Write short note : (any one)
(i) Noise Free channel
(ii) Shannon's theorem **6**

OR

2 (a) Show that :
H (X, Y) = H (X/Y) + H (Y) **8**

(b) For the JPM given below, compute individually H(X), H(Y), H(X,Y) and I (X,Y). **8**

UNIT - III

3 (a) Explain the types of errors and classification of codes. **8**

(b) Design a single error correcting code with a message block of size 11 and show that by an example that it can correct single error. **8**

OR

3 (a) What is coding efficiency ? Show that the coding efficiency is maximum when P(0) = P (1). **8**

(b) Design (n,k) hamming code with a minimum distance of d_{min} = 3 and message length of 4 bits. **8**

UNIT - IV

4 (a) The parity 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 the message bits.
(a) Find the G matrix and parity check matrix
(b) Find the minimum weight of this code. **10**

(b) Write short note on :
(i) BCH code
(ii) RS code. **6**

OR

4 Design a (4, 2) LBC :
(i) Find the generator matrix for the code vector set.
(ii) Find the parity check matrix.
(iii) Make an encoding ckt.
(iv) Draw the encoding ckt.
(v) Draw the syndrome calculation ckt. **16**

UNIT - V

5 (a) Design an encoder for the (7, 4) binary cyclic code generated by $g(x) = 1 + x + x^3$ and verify its operation using the message vectors (1001) and (1011). **10**

(b) Define : (any two)
(i) Brust error
(ii) Transfer function
(iii) Standard array **6**

OR

5 (a) For a (7,4) cyclic code, the received vector Z (X) is 1110101 and $g(x) = 1+x+x^3$. Draw the syndrome calculation ckt and correct the single error in the received vector. **10**

(b) Write short note on : (any two)
(i) Sequential coding
(ii) Viterbi Decoding
(iii) Trellies codes. **2×3=6**