Seat no.:_____ Enrollment No.:_____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Sem-I Examination July 2012 (REM.)(Revised)

Subject Code: 712703N **Date: 09/07/12**

Subject Name: Information Theory and Coding

Time: 14.30-17.00 pm **Total marks: 70**

Instruction:

1. **Attempt all question**
2. **Make suitable data wherever necessary**
3. **Figures to right indicate full marks.**

Q-1 (a) Define Source coding and Channel coding **2**

(b) Prove that : $H(X) \leq \overline{R}$ for discrete memoryless source with entropy H(X) and average length of the code is $\overline{R}$. **5**

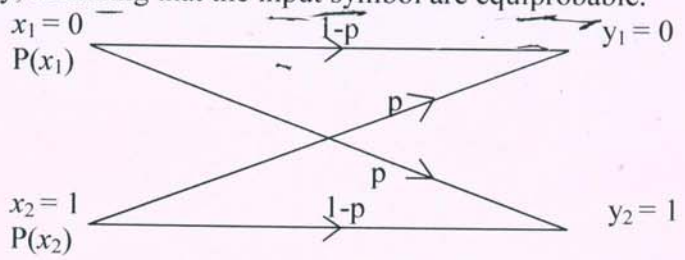
(c) A DMS $X=\{x_1, x_2, \ldots, x_7\}$ has the following probabilities: **7**

x_i	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8
Px_i	$1/8$	$1/16$	$1/16$	$1/4$	$1/16$	$1/4$	$1/8$	$1/16$

Encode the message of X with variable length binary codes using shanon-fano procedure. Find average length, entropy of the binary code and the efficiency.

Q-2 (a) Explain: (i) Entropy (ii) Mutual Information and (iii) Channel Capacity. **6**

(b) For BSC shown in figure find average mutual information and channel capacity, assuming that the input symbol are equiprobable. **8**

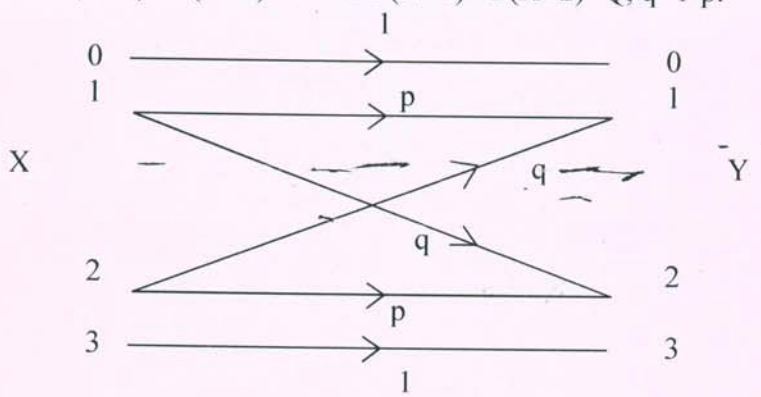


OR

(b) Show that the capacity of discrete memoryless channel shown in figure: **8**

$C = \log_2 \left[\frac{2(1+\beta)}{\beta}\right]$ bps, where $\beta=2^{\alpha}$ and $\alpha= -[\, p \log_2 p + q \log_2 q]$,

Where P(X=0)= P(X=3)= P and P(X=1)= P(X=2)=Q, q=1-p.



Q-3 (a) Explain wozencraft,s sequential decoding algorithm in detail. 7

Q-3 (b) Explain Binary Huffman Coding. Consider a Discrete Memoryless Source $X=\{x_1, x_2, \ldots, x_7\}$ with following message probabilities. Encode this source with variable length binary code using Huffman Algorithm. Find average length and efficiency. 7

x_i	x_1	x_2	x_3	x_4	x_5	x_6	x_7
Px_i	0.4	0.25	0.15	0.1	0.05	0.03	0.02

OR

Q-3 (a) Explain kraft inequality theorem with example. 7

Q-3 (b) Explain Non-binary Huffman Coding. Consider a Discrete Memoryless Source with following message probabilities. Encode this source with Huffman coding using four code symbols 0, 1, 2, and 3. Find average length. 7

mi	m_1	m_2	m_3	m_4	m_5	m_6	m_7	m_8
Pmi	0.24	0.22	0.16	0.13	0.10	0.07	0.05	0.03

Q-4 (a) Write short note: (i) Hamming Codes. (ii) Reed-Solomon Codes 7

Q-4 (b) Find generator polynomial G(x) for (7, 4) cyclic code and find code vector for the following data vector: 1010, 1111, 0001, 1000. 7

OR

Q-4 (a) Explain convolution encoding with different representation. 7

Q-4 (b) For (7, 4) systematic code if the generator matrix is as given below find the code words. 7

$$G = \begin{pmatrix} 1 & 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 1 \end{pmatrix}$$

Q-5 (a) Define the term of cryptography and give difference between public key cryptography and private key cryptography. 7

Q-5 (b) Explain RSA algorithm in detail. 7

OR

Q-5 (a) Explain data encryption standard in detail. 7

Q-5 (b) Compare coded and un-coded system. 7

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