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10EC55

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Information Theory & Coding

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Derive an expression for average information content of long independent messages. **(04 Marks)**

b. Explain Mark off statistical model used to represent dependent information sources. **(04 Marks)**

c. Find H, G_1 and G_2 for the following model **(12 Marks)**

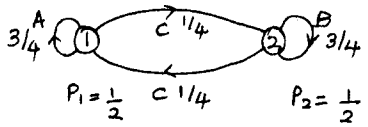
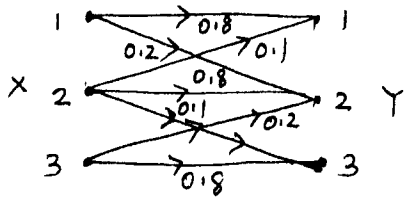


Fig Q1(c)

2 a. Apply Shannon's encoding Algorithm and generate binary codes for the set of messages given in table below. Also find efficiency. **(12 Marks)**

Sym	AA	BB	AC	CB	BC	CA	CC
Prob	9/32	9/32	3/32	3/32	3/32	3/32	2/32

b. Find H[X], H[Y], H[X Y], H[X/Y] and H[Y/X] for the channel shown below **(08 Marks)**



$P[X_1] = \frac{1}{3}$

$P[X_2] = \frac{1}{3}$

$P[X_3] = \frac{1}{3}$

Fig Q2(b)

3 a. A discrete memory less source has an alphabet of sever symbols with probabilities as given in the table below.

Sym	S_0	S_1	S_2	S_3	S_4	S_5	S_6
Prob	0.25	0.25	0.125	0.125	0.125	0.0625	0.0625

Compute Huffman code for this source by moving combined symbol as high as possible and as low as possible. Find efficiency and variance is each case. **(12 Marks)**

b. A non symmetrical binary channel is shown below :

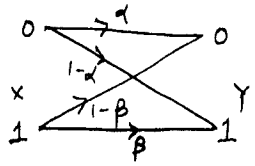


Fig Q3(b)

$P[x = 0] = \frac{1}{4}$

$P[x = 1] = \frac{3}{4}$

i) Find I [X Y] for $\alpha = 0.75$, $\beta = 0.9$

ii) Find C for $\alpha = 0.75$ and $\beta = 0.9$, rs = 1000sym/sec. **(08 Marks)**

4 a. State and prove Shannon's Hartely Law. **(10 Marks)**

b. A CRT terminal is used to enter alpha numeric data into a computer. The CRT is connected through a voice grade telephone line having usable bandwidth of 3KHz and O/P S/N of 10dB. Assume that the terminal has 128 characters which are equiprobable

i) Find channel capacity

ii) Maximum rate at which data can be transmitted without errors from the terminal to the computer. **(10 Marks)**

PART – B

5 a. The parity check bits of (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 and d_4 are message bits

i) Find G and H

ii) Find minimum weight of the code

iii) Find error detecting capacity

iv) Show thorough two examples that this code can detect and correct errors. **(10 Marks)**

b. Design a single error correcting code with a message block size of 11 bits and show by an example that the code can correct single errors. **(10 Marks)**

6 a. The generator polynomial of a (7, 4) cyclic code is $g(x) = 1 + x + x^3$. Find the code words for the following in both systematic and non systematic form, 1010, 1110, 0110, 1101. **(08 Marks)**

b. For a (15,5) binary cyclic code, generator polynomial is $g(x) = 1 + x + x^2 + x^4 + x^5 + x^8 + x^{10}$. Draw the encoder diagram and find the encoded output for a message $D[x] = 1 + x^2 + x^4$. **(12 Marks)**

7 Write short notes on :

a. Golay codes.

b. Shortened cyclic codes

c. Burst error correcting codes

d. Burst and random error correcting codes. **(20 Marks)**

8 For a (3, 1, 2) convolutional encoder with generator sequences $g^{(1)} = 110$, $g^{(2)} = 101$, $g^{(3)} = 111$.

a. Find encoder block diagram **(02 Marks)**

b. Find generator matrix and O/P for 11101. **(02 Marks)**

c. Find code word for 11101 using time domain method. **(06 Marks)**

d. Draw state diagram and tree diagram. **(10 Marks)**

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