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M. Tech 1st Semester Examination
Information Theory & Random Signals
EC-105

Time : 3 Hours

Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any Five Questions. All the questions carry equal marks. Assume suitable data if necessary.

1. (a) A source generates 5 messages with probability of occurrence as shown below:

Message	m_0	m_1	m_2	m_3	m_4
Probability	0.55	0.15	0.15	0.10	0.05

Apply Huffman coding algorithm and place the combined message as low as possible when its probability is equal to that of another message.

- (i) Calculate the codewords for the messages.
(ii) Calculate average codeword length. (12)
- (b) State and prove the theorems of log sum inequality. (8)
2. (a) State and prove joint channel coding theorem. (10)
(b) Prove that $I(X:Y)=H(X)+H(Y)-H(X,Y)$ (10)

3. (a) Explain the effect of channel capacity when Gaussian channels are used (i) with feedback (ii) without feedback. (10)
- (b) Explain the significance of Hidden Markov Model and how these are different from Markov process? (10)
4. (a) Discuss the various properties of rate distortion function. (10)
- (b) Explain the various types of random variables. (10)
5. (a) Compute the cumulative distribution function of Gaussian random variable. (10)
- (b) State and prove the properties of autocorrelation function of random process. (10)
6. (a) The generator polynomial of a (7,4) cyclic code is $G(p)=p^3+p+1$. Find all the code vectors for code in nonsystematic and systematic form. (12)
- (b) Compare linear block codes, cyclic codes and convolutional codes by giving their advantages and disadvantages. (8)
7. Fig. 1 shows the block diagram of the binary convolutional encoder.

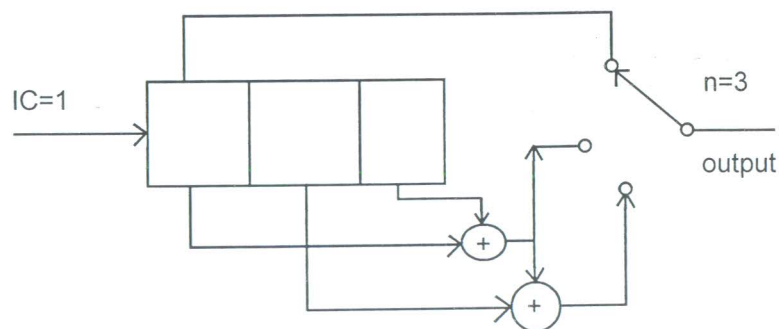


Fig. 1

- (a) Draw the state diagram and code trellis for this encoder.
- (b) Assume that a message has been encoded by this code and transmitted. If the received sequence is $Y=(110, 110, 110, 111, 010, 101, 101)$.
Using Viterbi Algorithm, decode Y and find out the transmitted bit sequence. (20)
8. Discuss the followings:
- (a) Poisson Distribution
- (b) RSA algorithm
- (c) Covariance (20)