

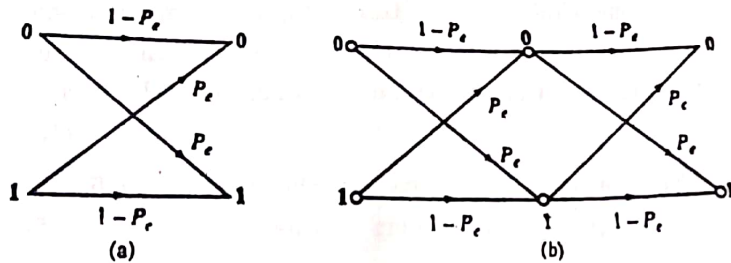
6. (a) Determine the Lempel-ziv code for the given sequence :

AAABABBBBAABABAABAB. (10)

(b) Let channel matrix for figure (a) is M then

(i) Determine the channel matrix for the cascaded channel shown in figure (b) is M^2 .

(ii) Show that the channel matrix for the cascaded of K identical BSCs each with channel matrix M is M^K . (5)



7. (a) Consider a binary sequence of 10 bits with a long sequence of 1s followed by a two 0s and then a sequence of three 1s. Draw the waveform for this sequence, using the following line codes :

- (i) Unipolar NRZ code.
- (ii) Polar NRZ.
- (iii) Bipolar RZ.
- (iv) AMI RZ.
- (v) Split Phase (Manchester) line code. (10)

(b) Among different line codes, which line code/codes has/have better synchronization at the receiver? Justify your answer. (5)

Roll No.

Total Pages : 4

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May, 2023

B.Tech. (ECE) VI SEMESTER

Information Theory & Coding (ECEL-602)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.
2. Answer any four questions from Part-B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.

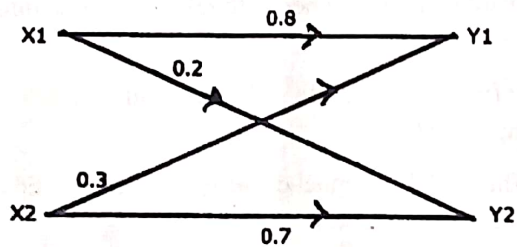
PART-A

1. (a) Differentiate between Mutual and self-information. What are the conditions when both self and mutual information are same? (1.5)
- (b) Define source code efficiency and how can it be improved? (1.5)
- (c) What will the channel capacity of deterministic channel? Justify your answer. (1.5)
- (d) State Shannon-Hartley theorem for channel capacity and from that derive Shannon's theoretical limit. How can this limit be increased? (1.5)
- (e) Differentiate between Fixed length and Variable length coding. Which one is better and why? (1.5)

- (f) How universal coding is differed from Lempel Ziv Coding? Explain with an example. (1.5)
- (g) What do you mean by Bandwidth and Signal to Noise ratio tradeoff. What is it significance? (1.5)
- (h) What do you mean by information rate? What are the various factors affecting it? Give upper and lower bound of information rate. (1.5)
- (i) "Cascading of channels reduce the channel capacity" is it True. Justify your answer. (1.5)
- (j) Differentiate between Polar Quaternary NRZ format and Split Phase Manchester format of line codes. (1.5)

PART-B

2. (a) Find the mutual information and channel capacity of the channel shown Below in figure. Given $P(X1) = 0.6$ and $P(X2) = 0.4$. (10)



- (b) A quaternary source generates information with probabilities $P1 = 0.1$, $P2 = 0.2$, $P3 = 0.3$ and $P4 = 0.4$. Find the entropy of the system. What percentage of maximum possible information is being generated by this source? (5)

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3. (a) Draw a noiseless channel with M inputs and N outputs. Write down channel matrix and prove that mutual information of noiseless channel is $H(X) = H(Y) = H(X,Y)$. Give physical significance of this equation. X and Y are the source and receiver respectively. (8)
- (b) Prove that mutual information of continuous channel is always non-negative. (7)
4. (a) In a certain system the S/N power ratio is 10 and the bandwidth is 10,000 Hz. Find the maximum permissible information rate and channel capacity. What will be the effect on the system if S/N falls to a value of 5? (10)
- (b) State and prove Kraft's inequality. Give its significance in coding and decoding a message. (5)
5. (a) A source transmits eight messages at the frequency of 1 kHz with the probability given below :
- | X1 | X2 | X3 | X4 | X5 | X6 | X7 | X8 |
|------|------|------|------|-----|------|------|----|
| 0.04 | 0.15 | 0.10 | 0.06 | 0.4 | 0.02 | 0.03 | |
- (i) Find entropy and information rate of the source.
- (ii) Using two symbols, construct Huffman Coding for this source by assigning highest priority to the combined message. (10)
- (iii) Find coding efficiency and redundancy. (5)
- (b) "Any irreducible code is always decipherable but the reverse is not true." Justify the statement. (5)

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[P.T.O.]

