Department of Electronics & Communication Engineering

Faculty of Engineering, Integral University, Lucknow

Assignment Sheet 4

Information Theory & Coding (EC-031)

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Due Date : April 02, 2015

Problems : 10

1. Write a short notes of "Extension of zero memory source". Give the example of the same.
2. Prove the following expression

   $I(X;Y) \geq 0$
3. Explain and prove the converse of coding theorem.
4. It is given in the markov process

   $P_1 = ½$ & $P_2 = ½$

   $P_{11} = (3/4)$, $P_{12} = (1/4)$, $P_{21} = (1/4)$ & $P_{22} = (3/4)$

   Find out the following terms.

   (A) Entropy of the source

   (B) Draw the tree diagram

   (C) Probabilities of message of length 1, length 2 & length 3.

   (D) Information of the messages of length 2

   (E) Average information per symbol in message of length 2.
5. In a markov process it is given

   $P_1 = ⅓$, $P_2 = ⅓$ & $P_3 = ⅓$

   $P_{11} = ½$, $P_{22} = ½$, $P_{33} = ½$, $P_{12} = ¼$, $P_{13} = ¼$, $P_{21} = ¼$, $P_{23} = ¼$, $P_{31} = ¼$ & $P_{32} = ¼$

   Draw the graph(state diagram) of the markov source.

   Find out the following parameters.

   (A) Entropy of each state H_i

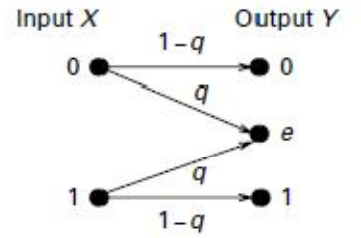
   (B) Entropy of the source

   (C) G_1 & G_2

(D) Verify $G_1 \geq G_2 \geq H$

6. Derive the mathematical expression for the capacity of a binary symmetric channel.
7. Show that

   $H(X, Y) = H(X/Y) + H(Y)$
8. In the Binary Erasure Channel



Channel transition probabilities
$p(y|x)$

Calculate the following :

(A) Average Mutual Information

(B) Channel Capacity

(C) Values of $P(X_1)$ & $P(X_2)$ for maximum mutual information.

9. Consider a binary symmetric channel with the following terms

   $P(X_1) = p$ & $P(X_2) = (1-p)$

   $P(Y_1/X_2) = P(Y_2/X_1) = \alpha$

   $P(Y_2/X_2) = P(Y_1/X_1) = (1-\alpha)$

   Calculate the value of H(X), H(Y), H(Y/X) & I(X ; Y) in terms of p & α.
10. Write down short notes on prefix coding.