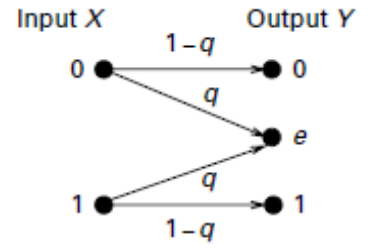
# Department of Electronics & Communication Engineering.
# Bundelkhand Institute of Engineering & Technology, Jhansi.

Assignment Sheet 4

Information Theory and Coding (DC 13)

Instructor: Yogendra Kumar Prajapati
Due Date :
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.