Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Assignment-I

B.Tech. / Semester: III/V **Branch: CSE**
Subject: Information Theory & Coding **Subject Code: 5CS3-01**
Date of submission: 6-9-25 **MM: 10**

SET-12

Q1.The second order extension of a DMS X, denoted by X^2, is formed by taking the source symbols two at a time. The coding of this extension has been shown in Table 1. Find the efficiency η and the redundancy **γ** of this extension code. **[CO2, BL3]**

a_i	$P(a_i)$	Code
a_1=x_1x_1	0.81	0
a_2=x_1x_2	0.09	10
a_3=x_2x_1	0.09	110
$a_{4=x_2x_2}$	0.01	111

Q2.Prove that the upper bound on Entropy is given as $H_{max} \leq \log_2 m$. Here m is the number of messages emitted by the source.

[CO1, BL3]

Q3.Consider a BSC with P(x1) = α.Show that the mutual information I(X;Y) is given by:

I(X;Y) = H(Y) + p log2p +(1-p)$\log_2$(1-p).

Also calculate I(X;Y) for α=0.5 and p = 0.1

[CO2, BL3]

Q4. A DMS X has five symbols x_1, x_2, x_3, x_4 and x_5 with $P(x_1)=0.2$, $P(x_2)=0.15$, $P(x_3)=0.05$, $P(x_4)=0.10$ and $P(x_5)=0.50$

(a)Construct a Shannon Fano code for X, and calculate the efficiency of the code.

(b)Repeat for the Huffman code and compare the results. **[CO2, BL3]**