Subject Code: 10M11EC213

Maximum Marks: 15

Subject Name: Information and Coding Theory

Course Credits: 04

Time: 1Hr.

Attempt all questions. All parts of each question have to be answered in one place. Carrying of mobile phone in examination centre will be treated as unfair means case.

1a. At a town 'A' it is known that the probability of rain after a rainless day is 0.05, while after a rainy day it is 0.2. What is the probability that a day will be rainy after 2 days of rain? Also, what is the probability that there will be exactly three days of rain?

b. In a class of 17 students, the probability that x will comes first is 0.25, the probability that x will come second is 0.22, the probability that y will come first is 0.22 and that y will come second is 0.2. It is also known that if y comes second the probability that x will come first is 0.3. You are told that y has come second, what is the mutual information about x coming first?

c. You have a channel with input ensemble X and output ensemble Z and average mutual information $I(X;Z) = 2.3$ If another channel is connected to the output of the first to give an output ensemble Y, determine the limits of $I(X;Y)$. Prove your answer.

2a. State and prove the necessary condition for the existence of a prefix condition code.

b. State the source coding theorem for fixed length codes.

c. An ensemble has symbols with probabilities
0.15, 0.15, 0.1, 0.08, 0.08, 0.07, 0.07, 0.06, 0.05, 0.05 and 0.02. Encode this using Huffman coding with $D = 4$.

d. Describe encoding using LZW codes.

3a. Draw a block diagram to describe a channel model explain how this can be referred to as either a discrete or a continuous channel.

b. State the requirement for a channel to be a discrete memory less channel. Define for this channel the channel capacity.

c. State and discus the relationship between P_e and $H (U|V)$ for a DMC.

d. Describe the convex cap function and state the conditions required for a point to be a maximum on it.