Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
MID TERM EXAMINATION - APR 2023

Semester : Semester VI - 2020
Course Code : ECE3012
Course Name : Sem VI - ECE3012 - Information Theory and Coding
Program : B.Tech. Electronics and Communication Engineering

Date : 12-APR-2023
Time : 9.30AM - 11.00AM
Max Marks : 60
Weightage : 30%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE FIVE QUESTIONS **5 X 2=10M**

1. C.E Shannon is the father of information theory, we have studied Shannon algorithm and Shannon – Fano algorithm. If a person X is interested in getting a compact code with minimum redundancy, which one he or she will prefer..

(CO1) [Knowledge]

2. If you plan a trip to Australia during summer and if you are told that there is a snow flurry: What would be the information conveyed?

(CO1) [Knowledge]

3. Various useful parameters in the domain of ITC are entropy, probability, information rate and symbols etc., Measure of information is inversely proportional to

(CO1) [Knowledge]

4. For the code S={S1, S2, S3} X={ 0, 01, 011}, what is the code word length of the message symbol S2S3

(CO2,CO1) [Knowledge]

5. The output of an information source contains 160 symbols, 128 of which occurs with a probability of 1/256 and remaining occur with a probabilty of 1/64 each. Find the information rate of source if the source emits 10000 symbol/sec:

(CO2) [Knowledge]

PART B

ANSWER ALL THE TWO QUESTIONS **2 X 15 = 30M**

6. a) Shannon's first theorem (binary encoding algorithm), which concerns optimal source coding of an information source which emits messages m1=0.5, m2=0.3 and m3=0.2 and the transmission of these information on a non-perturbed channel, while also giving limits to the compression rate which can be expected. Prove this statement by calculating Efficiency and redundancy of the code using Shannon's binary encoding algorithm by extensing the source to 2nd extension. [10M]

b) Entropy in information theory point of view, is simply the average(expected) amount of the information from the event.How can this be countered for balls in the bin and there are three outcomes possible when you choose the ball, it can be either red, yellow,or green and estimate the information you will get by choosing a ball of all the colours individually from the bin. [5M]

(CO2) [Comprehension]

7. a) Shannon's first theorem or noiseless coding theorem is designed to generate variable length binary code words to the symbol emitted from an information source.Efficiency of shannon's encoding operation can be increased by increasing the extension by making average length of the code words as close to Hr(S),entropy of the nth extension.Verify the same using following messages S={S1,S2,S3} occuring with probabilities P={0.4,0.4,0.2} [8M]

b) Consider a source with alphabets m1 and m2 with respective probabilities of 5/6 and 1/6. Determine the entropy of source S and the entropy of its third extension. Hence show that H(S3) = 3 H(S) [7M]

(CO2) [Comprehension]

PART C

ANSWER THE ONE QUESTION **1 X 20 = 20M**

8. Consider the state diagram of the Markov source with a source S = {A, B, C, D} as shown in Fig. 1.

(i) Compute the state probabilities using state equations. [5M]
(ii) Find the entropy of each state and source entropy. [5M]
(iii) Find the entropy of the adjoint source. [5M]
(iv) Find G1, G2 and Verify that G1>G2>H [5M]

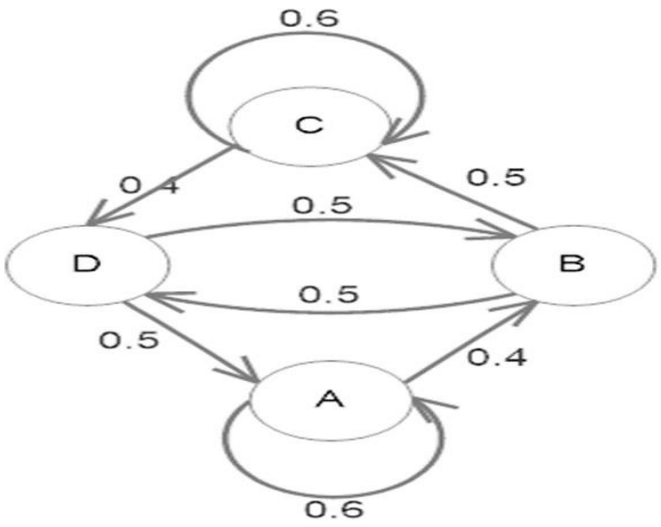

Fig. 1: Markov source

(CO2,CO1) [Application]