**Laboratory Experiment No. 02**

**Problem Statement:**

**Simulate** Discrete memoryless channel (DMC) for a given source probabilities and channel matrix. **Calculate** various Entropies and mutual information for given channel.

clc;

clear;

close all;

n=input("Enter the no of source elements: ");

q=input("Enter the channel matrix P(Y/X): "); %matrix P(Y|X)

disp(q);

disp('');

N=1:n;

p=input("Enter the source probability: "); %probabilities for X

px=diag(p,n,n); %matrix P(X)

disp("P(X) : ");

disp(px);

disp('');

pxy=px\*q; % P(X,Y)=P(X)\*P(Y|X)

disp("P(X,Y) : ");

disp(pxy);

disp('');

py=p\*q; % P(Y))

disp('P(Y):');

disp(py);

disp('');

%Entropy of source h(x)

Hx=0;

for i=1:n

Hx=Hx+(-(p(i)\*log2(p(i))));

end

disp('H(x): ');

disp(Hx);

disp('');

% Entropy of destination H(y)

Hy=0;

for i=1:n

Hy=Hy+(-(py(i)\*log2(py(i))));

end

disp('H(y): ');

disp(Hy);

disp('');

% Mutual Entropy H(x,y)

hxy=0

for i=1:n

for j=1:n

hxy=hxy+(-pxy(i,j)\*log2(pxy(i,j)));

end

end

disp('H(x,y): ');

disp(hxy);

disp('');

% Conditional Entropy H(y/x)

h1= hxy - Hx;

disp('H(x/y): ');

disp(h1);

disp('');

% Conditional Entropy H(x/y)

h2= hxy - Hy;

disp('H(y/x): ');

disp(h2);

disp('');

% Mutual Information I(x,y)

Ixy= Hx - h2;

disp('I(x,y): ');

disp(Ixy);

disp('');

if h2==0

disp("This channel is a lossless channel ");

end

if Ixy==0

disp ("This channel is a useless channel ");

end

if Hx==Hy

if h1==0

disp("This channel is a noiseless channel ");

end

endif

**Output**:

Enter the no of source elements: 2

Enter the channel matrix P(Y/X): [0.2,0.8;0.3,0.7]

0.20000 0.80000

0.30000 0.70000

Enter the source probability: [0.2,0.8]

P(X) :

Diagonal Matrix

0.20000 0

0 0.80000

P(X,Y) :

0.040000 0.160000

0.240000 0.560000

P(Y):

0.28000 0.72000

H(x):

0.72193

H(y):

0.85545

hxy = 0

H(x,y):

1.5713

H(x/y):

0.84942

H(y/x):

0.71590

I(x,y):

0.0060325