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
```