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 elements: ");
q=input("Enter the matrix p(y/x): ");        %matrix P(y|x)
disp(q);
disp(");

N=1:n;
p=input("Enter the 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 h(x)
Hx=0;
for i=1:n
  Hx=Hx+(-(p(i)*log2(p(i))));
end
disp('H(x): ');
disp(Hx);
disp(");

                                             % H(y)
Hy=0;
for i=1:n
  Hy=Hy+(-(py(i)*log2(py(i))));
```

```
end
disp('H(y): ');
disp(Hy);
disp('');

                                        % 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('');

                                        % H(y/x)
h1= hxy - Hx;
disp('H(x/y): ');
disp(h1);
disp('');

                                        % H(x/y)
h2= hxy - Hy;
disp('H(y/x): ');
disp(h2);
disp('');

                                        % 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 elements: 2
Enter the matrix p(y/x): [0.1,0.9;0.9,0.1]
   0.10000   0.90000
   0.90000   0.10000

Enter the probability: [0.5,0.5]
P(x) :
Diagonal Matrix

   0.50000         0
         0   0.50000

P(x,y) :
   0.050000   0.450000
   0.450000   0.050000

P(y):
   0.50000   0.50000

H(x):
 1

H(y):
 1

hxy = 0
H(x,y):
 1.4690

H(x/y):
 0.46900

H(y/x):
 0.46900

I(x,y):
 0.53100
```