

```

%      EXPERIMRNT2
% Name: Rathod Chittaranjan
% Roll No: 32457
% Batch: L8
%

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
```

## Command Window:

### Input/Output 1

Enter the no of elements: 3

Enter the matrix  $p(y/x)$ : [0.75 0.25 0 0 0; 0 0 0.33 0.667 0; 0 0 0 0 1]

0.7500 0.2500 0 0 0

0 0 0.3300 0.6670 0

0 0 0 0 1.0000

Enter the probability: [0.2 0.5 0.3]

$P(x)$  :

Diagonal Matrix

0.2000 0 0

0 0.5000 0

0 0 0.3000

$P(x,y)$  :

0.1500 0.0500 0 0 0

0 0 0.1650 0.3335 0

0 0 0 0 0.3000

$P(y)$ :

0.150000 0.050000 0.165000 0.333500 0.300000

$H(x)$ :

1.4855

$H(y)$ :

1.0556

$h_{xy} = 0$

$H(x,y)$ :

1.0556

$H(x/y)$ :

-0.4299

$H(y/x)$ :

0

$I(x,y)$ :

1.4855

This channel is a lossless channel

### Input/Output 2

Enter the no of elements: 2

Enter the matrix  $p(y/x)$ : [0.5 0.5; 0.5 0.5]

0.5000 0.5000

0.5000 0.5000

Enter the probability: [0.5 0.5]

$P(x)$  :

Diagonal Matrix

0.5000 0

0 0.5000

$P(x,y)$  :

0.2500 0.2500

0.2500 0.2500

$P(y)$ :

0.5000 0.5000

H(x):

1

H(y):

1

$h_{xy} = 0$

H(x,y):

2

H(x/y):

1

H(y/x):

1

I(x,y):

0

This channel is a useless channel

### Input/Output 3

Enter the no of elements: 4

Enter the matrix p(y/x): [1 0 0 0; 0 1 0 0; 0 0 1 0; 0 0 0 1]

1 0 0 0

0 1 0 0

0 0 1 0

0 0 0 1

Enter the probability: [0.2 0.3 0.4 0.1]

P(x) :

Diagonal Matrix

0.2000 0 0 0

0 0.3000 0 0

0 0 0.4000 0

0 0 0 0.1000

P(x,y) :

0.2000 0 0 0

0 0.3000 0 0

0 0 0.4000 0

0 0 0 0.1000

P(y):

0.2000 0.3000 0.4000 0.1000

H(x):

1.8464

H(y):

1.8464

$h_{xy} = 0$

H(x,y):

1.8464

H(x/y):

0

H(y/x):

0

I(x,y):

1.8464

This channel is a lossless channel

This channel is a noiseless channel

Conclusion :

Entropy of the matrix was studied by giving different matrix and probability as Input. Conclusion was made based on entropy that whether the channel was useless, lossless or noiseless.