Experiment 5

Aim: To study PDF and CDF functions of different Discrete Random Variables and the effect of parametric changes.

Code:

```
clc
clear all

%Bernoulli Random Variable
fprintf('Bernoulli Random Variable\n');
q=input('Success Probability : ');
x_be= -3:1:4;
f_be= zeros(size(x_be));
f_be(x_be==1) = q;
f_be(x_be==0) = 1-q;
F_be = zeros(size(f_be));
for i=1:length(x_be)
    for j=1:i
        F_be(i) = F_be(i)+f_be(j);
    end
end
m_be = sum(x_be.*f_be);
var_be= sum(((x_be-m_be).^2).*f_be);
fprintf('Mean = %3f and Variance =
%3f\n\n',round(m_be,2),round(var_be,2));
figure(1);
subplot(3,2,1)
stem(x_be,f_be,'black');
xlabel('X \rightarrow');
ylabel('f_X(x) \rightarrow');
title(['Bernoulli PDF; p=',num2str(q)]);
subplot(3,2,2);
stairs(x_be,F_be,'black');
xlabel('X \rightarrow');
ylabel('F_X(x) \rightarrow');
title(['Bernoulli CDF; p=',num2str(q)]);
ylim([-0.2 1.2]);

%Binomial Random Variable
fprintf('Binomial Random Variable\n');
n=input('Number of incidents: ');
p=input('Success Probability : ');
x_bi= 0:1:n;
f_bi= zeros(size(x_bi));
for k= 0:n

nCk=factorial(n)/(factorial(k)*factorial
(n-k));
    f_bi(k+1)=nCk*p^k*(1-p)^(n-k);
end
F_bi = zeros(size(f_bi));
for i=1:length(x_bi)
    for j=1:i
        F_bi(i) = F_bi(i)+f_bi(j);
    end
end
m_bi = sum(x_bi.*f_bi);
var_bi= sum(((x_bi-m_bi).^2).*f_bi);
fprintf('Mean = %3f and Variance =
%3f\n\n',round(m_bi,2),round(var_bi,2));
figure(1);
subplot(3,2,3)
stem(x_bi,f_bi,'black');
xlabel('X \rightarrow');
ylabel('f_X(x) \rightarrow');
title(['Binomial PDF; n=',num2str(n),'
p=',num2str(p)]);
subplot(3,2,4);
stairs(x_bi,F_bi,'black');
xlabel('X \rightarrow');
ylabel('F_X(x) \rightarrow');
title(['Binomial CDF; n=',num2str(n),'
p=',num2str(p)]);
ylim([-0.2 1.2]);

%Poisson Random Variable
fprintf('Poisson Random Variable\n');
lam = input('Lambda parameter : ');
x_p= 0:1:20;
f_p= zeros(size(x_p));
for k= 0:n

f_p(k+1)=((lam^k)/factorial(k))*exp(-
lam);
end
F_p = zeros(size(f_p));
for i=1:length(x_p)
    for j=1:i
        F_p(i) = F_p(i)+f_p(j);
    end
end
m_p = sum(x_p.*f_p);
var_p= sum(((x_p-m_p).^2).*f_p);
fprintf('Mean = %3f and Variance =
%3f\n\n',round(m_p,2),round(var_p,2));
figure(1);
subplot(3,2,5)
stem(x_p,f_p,'black');
xlabel('X \rightarrow');
ylabel('f_X(x) \rightarrow');
title(['Poisson PDF;
lambda=',num2str(lam)]);
subplot(3,2,6);
stairs(x_p,F_p,'black');
xlabel('X \rightarrow');
ylabel('F_X(x) \rightarrow');
title(['Poisson CDF;
lambda=',num2str(lam)]);
ylim([-0.2 1.2]);
```

Experiment 6

Aim: To study PDF and CDF functions of different Continuous Random Variables and the effect of parametric changes.

```
clc
clear all
% Uniform Random Variable
fprintf('Uniform Random Variable\n');
a=input('Starting point: ');
b=input('Ending point   : ');
x_u=a-2:0.001:b+2;
inc = x_u(2)-x_u(1);
f_u=zeros(size(x_u));
for i=1:length(x_u)
    if x_u(i)>=a && x_u(i)<=b
        f_u(i)=1/(b-a);
    end
end

F_u=zeros(size(f_u));
for i=1:length(f_u)
    for j=1:i
        F_u(i)=F_u(i)+f_u(j)*inc;
    end
end
m_u=sum(x_u.*f_u)*inc;
var_u=sum(((x_u-m_u).^2).*f_u)*inc;
fprintf('Mean = %3f and Variance =
%3f\n\n',round(m_u,2),round(var_u,2));
figure(2)
subplot(1,2,1)
plot(x_u,f_u,'black')
xlabel('X \rightarrow');
ylabel('f_X(x) \rightarrow');
title('Uniform PDF');
hold on
subplot(1,2,2)
plot(x_u,F_u,'black')
xlabel('X \rightarrow');
ylabel('F_X(x) \rightarrow');
title('Uniform CDF');
ylim([-0.2 1.2]);
hold on

%Gaussian Random Variable
fprintf('Gaussian Random Variable\n');
u= input('Mean of X : ');
var= input('Variance of X : ');
x_g= -10:0.001:10;
inc=x_g(2)-x_g(1);
f_g=(1/sqrt(2*pi*var))*exp(-((x_g-
u).^2)/(2*var));
F_g=zeros(size(f_g));
for i=1:length(f_g)
    for j=1:i
        F_g(i)=F_g(i)+f_g(j)*inc;
    end
end
m_g=sum(x_g.*f_g)*inc;
var_g=sum(((x_g-m_g).^2).*f_g)*inc;
fprintf('Mean = %3f and Variance =
%3f\n\n',round(m_g,2),round(var_g,2));
figure(3)
subplot(1,2,1)
plot(x_g,f_g,'black')
xlabel('X \rightarrow');
ylabel('f_X(x) \rightarrow');
title('Gaussian PDF');
hold on
subplot(1,2,2)
plot(x_g,F_g,'black')
xlabel('X \rightarrow');
ylabel('F_X(x) \rightarrow');
title('Gaussian CDF');
ylim([-0.2 1.2]);
hold on

%Rayleigh Distribution
fprintf('Rayleigh Random Variable\n');
sig=input('Parameter Sigma:');
x_r=0:0.001:10;
inc=x_r(2)-x_r(1);
f_r=(x_r/sig^2).*exp(-
(x_r.^2)/(2*sig^2));
F_r=zeros(size(f_r));
for i=1:length(f_r)
    for j=1:i
        F_r(i)=F_r(i)+f_r(j)*inc;
    end
end

m_r=sum(x_r.*f_r)*inc;
var_r=sum(((x_r-m_r).^2).*f_r)*inc;
fprintf('Mean = %3f and Variance =
%3f\n\n',round(m_r,2),round(var_r,2));
figure(4)
subplot(1,2,1)
plot(x_r,f_r,'black')
xlabel('X \rightarrow');
ylabel('f_X(x) \rightarrow');
title('Rayleigh PDF');
hold on
subplot(1,2,2)
plot(x_r,F_r,'black')
xlabel('X \rightarrow');
ylabel('F_X(x) \rightarrow');
title('Rayleigh CDF');
ylim([-0.2 1.2]);
hold on
```

Display outputs

Discrete RVs

Case 1:

Bernoulli Random Variable
Success Probability : 0.3
Mean = 0.300000 and Variance = 0.210000

Binomial Random Variable
Number of incidents: 20
Success Probability : 0.3
Mean = 6.000000 and Variance = 4.200000

Poisson Random Variable
Lambda parameter : 1
Mean = 1.000000 and Variance = 1.000000

Case 2:

Bernoulli Random Variable
Success Probability : 0.5
Mean = 0.500000 and Variance = 0.250000

Binomial Random Variable
Number of incidents: 20
Success Probability : 0.5
Mean = 10.000000 and Variance = 5.000000

Poisson Random Variable
Lambda parameter : 2
Mean = 2.000000 and Variance = 2.000000

Case 3:

Bernoulli Random Variable
Success Probability : 0.7
Mean = 0.700000 and Variance = 0.210000

Binomial Random Variable
Number of incidents: 20
Success Probability : 0.7
Mean = 14.000000 and Variance = 4.200000

Poisson Random Variable
Lambda parameter : 4
Mean = 4.000000 and Variance = 4.000000

Continuous RVs

Case 1:

Uniform Random Variable
Starting point: -1
Ending point : 1
Mean = 0.000000 and Variance = 0.330000

Gaussian Random Variable
Mean of X : 0
Variance of X : 1
Mean = -0.000000 and Variance = 1.000000

Rayleigh Random Variable
Parameter Sigma:1
Mean = 1.250000 and Variance = 0.430000

Case 2:

Uniform Random Variable
Starting point: -2
Ending point : 2
Mean = 0.000000 and Variance = 1.330000

Gaussian Random Variable
Mean of X : 0
Variance of X : 5
Mean = 0.000000 and Variance = 5.000000

Rayleigh Random Variable
Parameter Sigma:2
Mean = 2.510000 and Variance = 1.720000

Case 3:

Uniform Random Variable
Starting point: -0.5
Ending point : 0.5
Mean = -0.000000 and Variance = 0.080000

Gaussian Random Variable
Mean of X : 0
Variance of X : 10
Mean = 0.000000 and Variance = 9.810000

Rayleigh Random Variable
Parameter Sigma:3
Mean = 3.720000 and Variance = 3.670000