

P&S Lab 5

Q1)

Code:

```
#Q1
f=function(k)(7*k + 8*k^2 - 1)
k=uniroot(f,lower=0,upper=1)$root
k

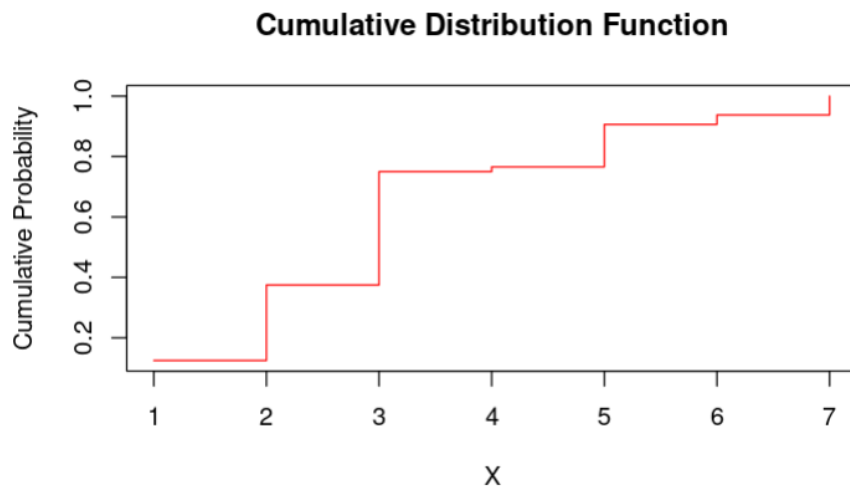
x=c(1,2,3,4,5,6,7)
p=c(k,2*k,3*k,k^2,k^2+k,2*k^2,4*k^2)

pdiscrete(4,p,x)

pdiscrete(5,p,x)

cdf=cumsum(p)
plot(x, cdf, type="s", main="Cumulative Distribution Function",
      xlab="X", ylab="Cumulative Probability", col="red")
```

Output:

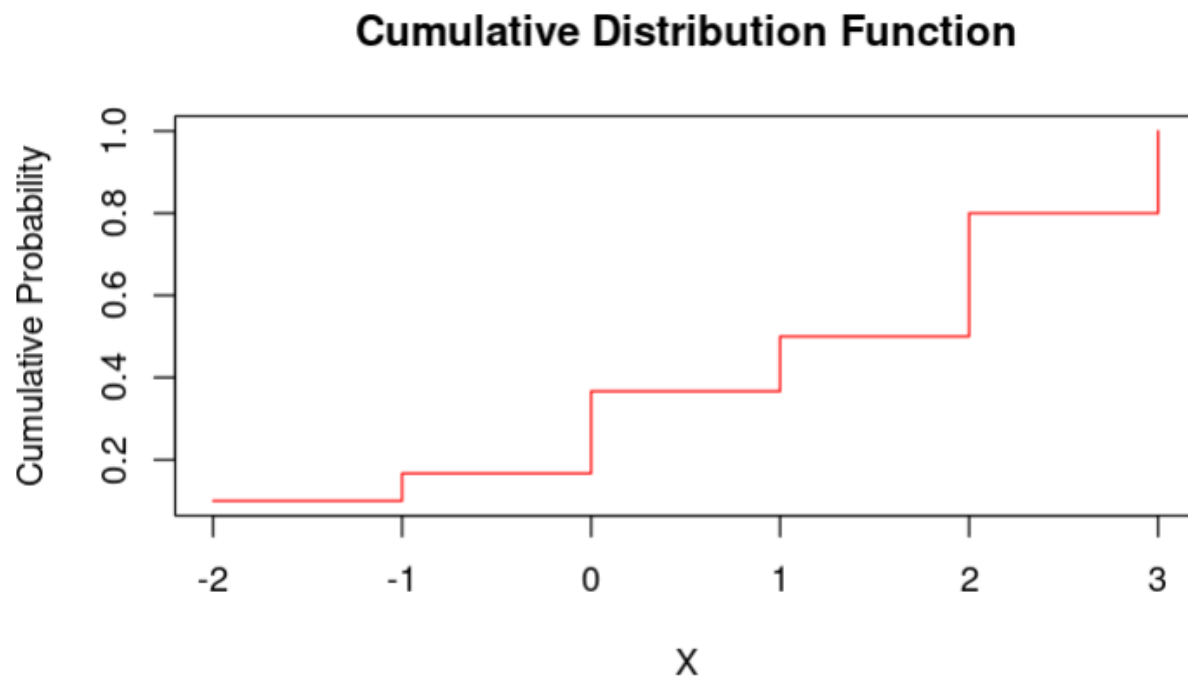


Q2)

Code:

```
#Q2
k=0.0667
x=c(-2,-1,0,1,2,3)
p=c(0.1,k,0.2,2*k,0.3,3*k)
pdiscrete(1,p,x)
cdf = cumsum(p)
plot(x, cdf, type="s", main="Cumulative Distribution Function",
      xlab="X", ylab="Cumulative Probability", col="red")
```

Output:



Q3)

Code:

```
#Q3
x=c(-2,-1,0,1,2)
p=c(1/5,1/5,2/5,2/15,1/15)

v=x^2+1

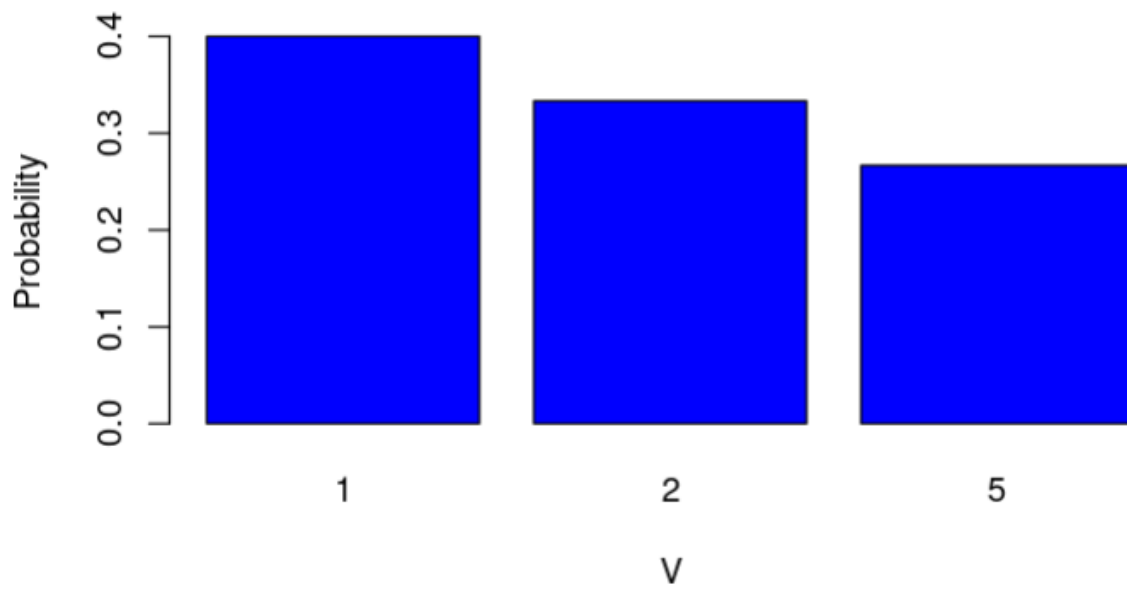
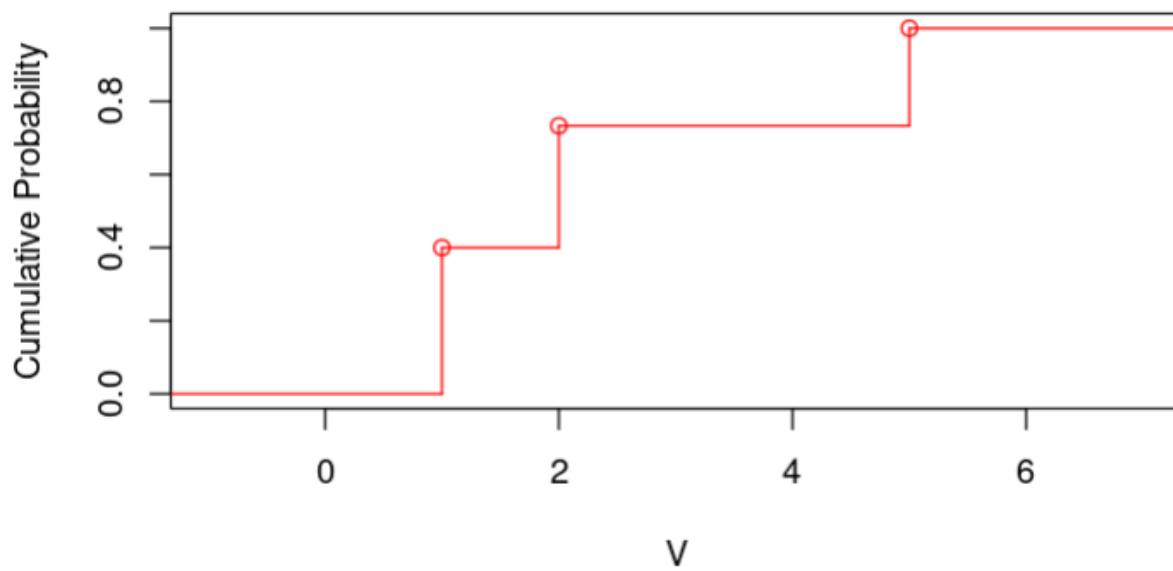
unique_v=unique(v)
prob_v=sapply(unique_v, function(val) sum(p[v==val]))

sorted_idx=order(unique_v)
unique_v_sorted=unique_v[sorted_idx]
prob_v_sorted=prob_v[sorted_idx]

barplot(prob_v_sorted, names.arg=unique_v_sorted,
        main="Probability Distribution of  $V=X^2+1$ ",
        xlab="V", ylab="Probability", col="blue")

cdf=cumsum(prob_v_sorted)
plot(stepfun(unique_v_sorted, c(0,cdf)),
     main="Cumulative Distribution Function of  $V=X^2+1$ ",
     xlab="V", ylab="Cumulative Probability",
     col="red", verticals=FALSE, do.points=TRUE)
```

Output:

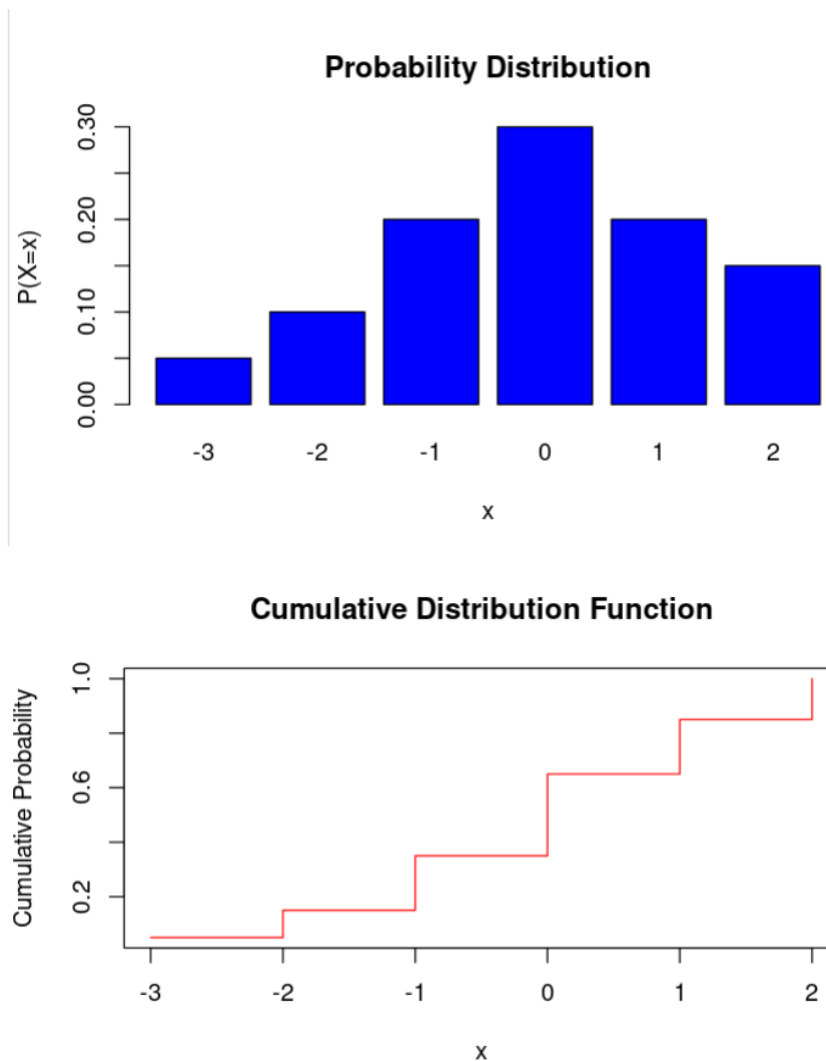
Probability Distribution of $V=X^2+1$ **Cumulative Distribution Function of $V=X^2+1$** 

Q4)

Code:

```
x=c(-3,-2,-1,0,1,2)
p=c(0.05,0.1,0.2,0.3,0.2,0.15)
mean=sum(x*p)
variance=sum(x^2*p)-mean^2
barplot(p,names.arg=x,main="Probability
Distribution",xlab="x",ylab="P(X=x)",col="blue")
cdf=cumsum(p)
plot(x,cdf,type="s",main="Cumulative Distribution
Function",xlab="x",ylab="Cumulative Probability",col="red")
```

Output:



Q5)

Code:

```
f=function(c){3*c^3-10*c^2+9*c-2}  
c=uniroot(f,lower=0,upper=1)$root  
P0=3*c^3  
P1=4*c-10*c^2  
P2=5*c-1  
x=c(0,1,2)  
p=c(P0,P1,P2)  
print(c(prob_less_1=P0,prob_1_to_2=P2,prob_0_to_2=P1+P2))
```

Output:

```
> c=uniroot(f,lower=0,upper=1)$root  
  
> P0=3*c^3  
  
> P1=4*c-10*c^2  
  
> P2=5*c-1  
  
> x=c(0,1,2)  
  
> p=c(P0,P1,P2)  
  
> print(c(prob_less_1=P0,prob_1_to_2=P2,prob_0_to_2=P1+P2))  
prob_less_1 prob_1_to_2 prob_0_to_2  
          3          4          -2  
> |
```