Documentation: Assignment 7

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[Q 1] Generate 50 randam numbers from geometric distribution of the form : f(x; p) = pqi1 i = 1, 2, 0 ¡ p ¡ 1. Draw the probability mass function

Code: R

```
sample<-c()
pmf<-c()
pmf_data<-c()
p<-runif(1)
x<-c()
cat("Randomly generated probabilities \"p\" and \"q\" are: ",p," ",1-p,"
    respectively !!\n")
q<-1-p
count<-50
for(i in 1:count){
    u<-runif(1)
    sample[i]<-floor(log(u)/log(q))+1
    pmf[i]<-q**(i-1)-q**i
    pmf_data[i]<-p*(q**(sample[i]-1))
    x[i]<-i
}
png("question1-pmf--perfect.png")
plot(x,pmf,col="red",main=paste("p = ", toString(p)))
png("question1-pmf-based_on_data.png")
plot(sample,pmf_data,col="green",main=paste("p = ", toString(p)))
cat("Mean is: ",mean(sample),"\n")
cat("Variance is: ",var(sample),"\n")
```

Output: Randomly generated probabilities ”p” and ”q” are: 0.2086162 0.7913838 respectively !!

Mean is: 4.1

Variance is: 14.62245

Observation: Note that the cumulative probability

$$P(Xj1) = 1q^{(j1)} \tag{1}$$

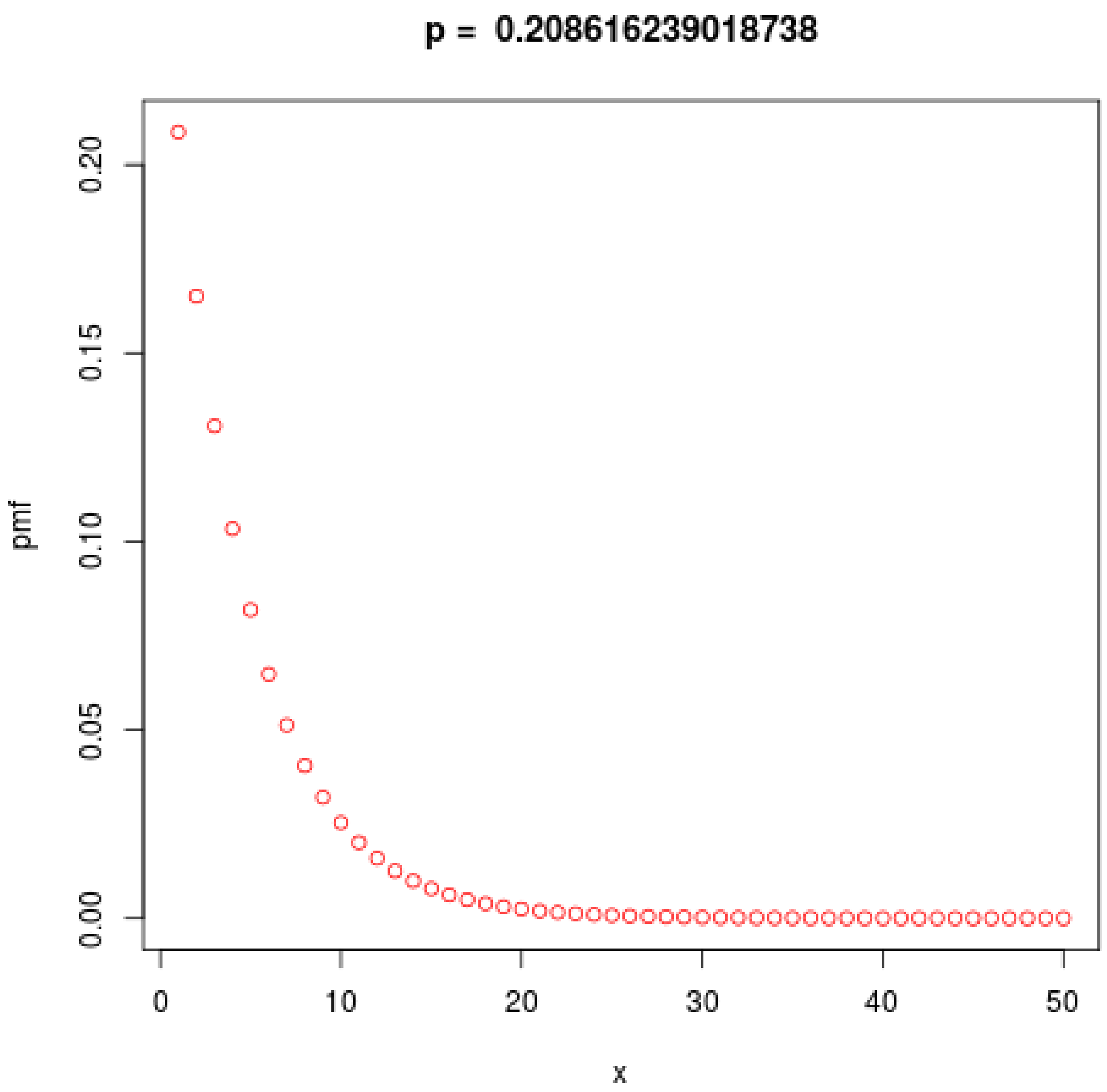
Random Number Generated **X=Int(log(U)/log(q)) + 1**.

p: 0.2086162

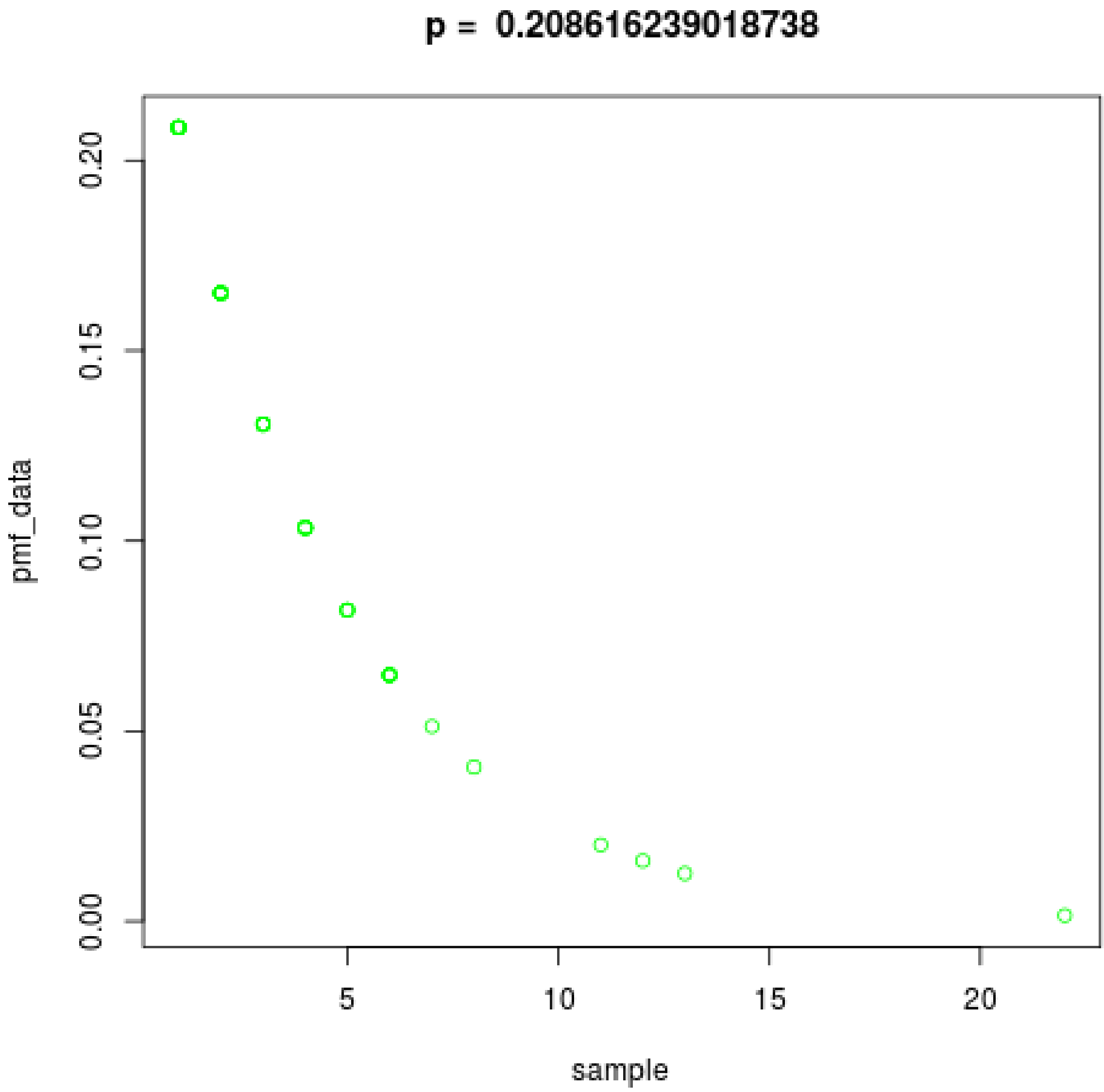
Mean: 4.1

Variance: 14.62245

Graph:



(a) *pmf-Perfect Graph- Theoretical*



(b) *pmf-Graph Based on Data - Observed*

[Q 2] Generate 50 random numbers from poisson distribution with mean 2. Draw the probability mass function and the cumulative distribution function.

Code: R

```
sample<-c()
pmf<-c()
pmf_data<-c()
mean<-2
x<-c()
count<-50
for(i in 1:count){
```

```
    j<-0
    p<-exp(-1*mean)
    F<-p
    while(1){
        u<-runif(1)
        if(u<F){
            sample[i]<-j
            break
        }
        p<-(mean*p)/(j+1)
        F<-F+p
        j<-j+1
    }
    pmf[i]<-(exp(-1*mean)*(mean**(i-1)))/factorial(i-1)
    pmf_data[i]<-(exp(-1*mean)*(mean**(sample[i])))/factorial(sample[i])
    x[i]<-i
}
png("question2-pmf-perfect.png")
plot(x,pmf,col="red",main="pmf-perfect")
png("question2-pmf-based_on_data.png")
plot(sample,pmf_data,col="red",main="pmf-based_on_data")
png("question2-cdf.png")
plot(ecdf(sample),col="red")
cat("Mean is: ",mean(sample),"\n")
cat("Variance is: ",var(sample),"\n")
```

Output: Theoretical Mean: 2

Observed Mean is: 1.6

Variance is: 0.9795918

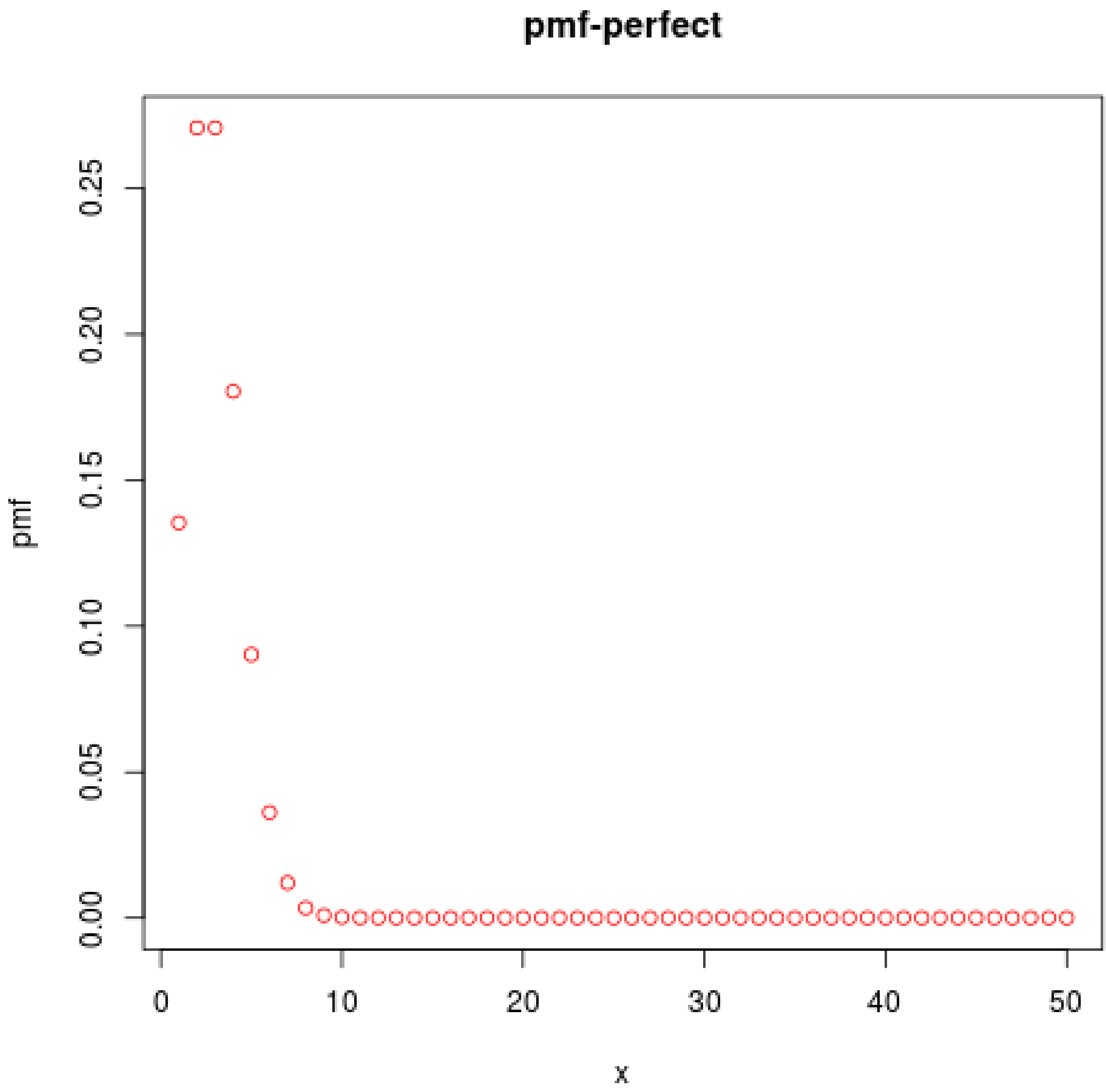
Observation:

$$p_{i+1} = *p_i/(i+1) \tag{2}$$

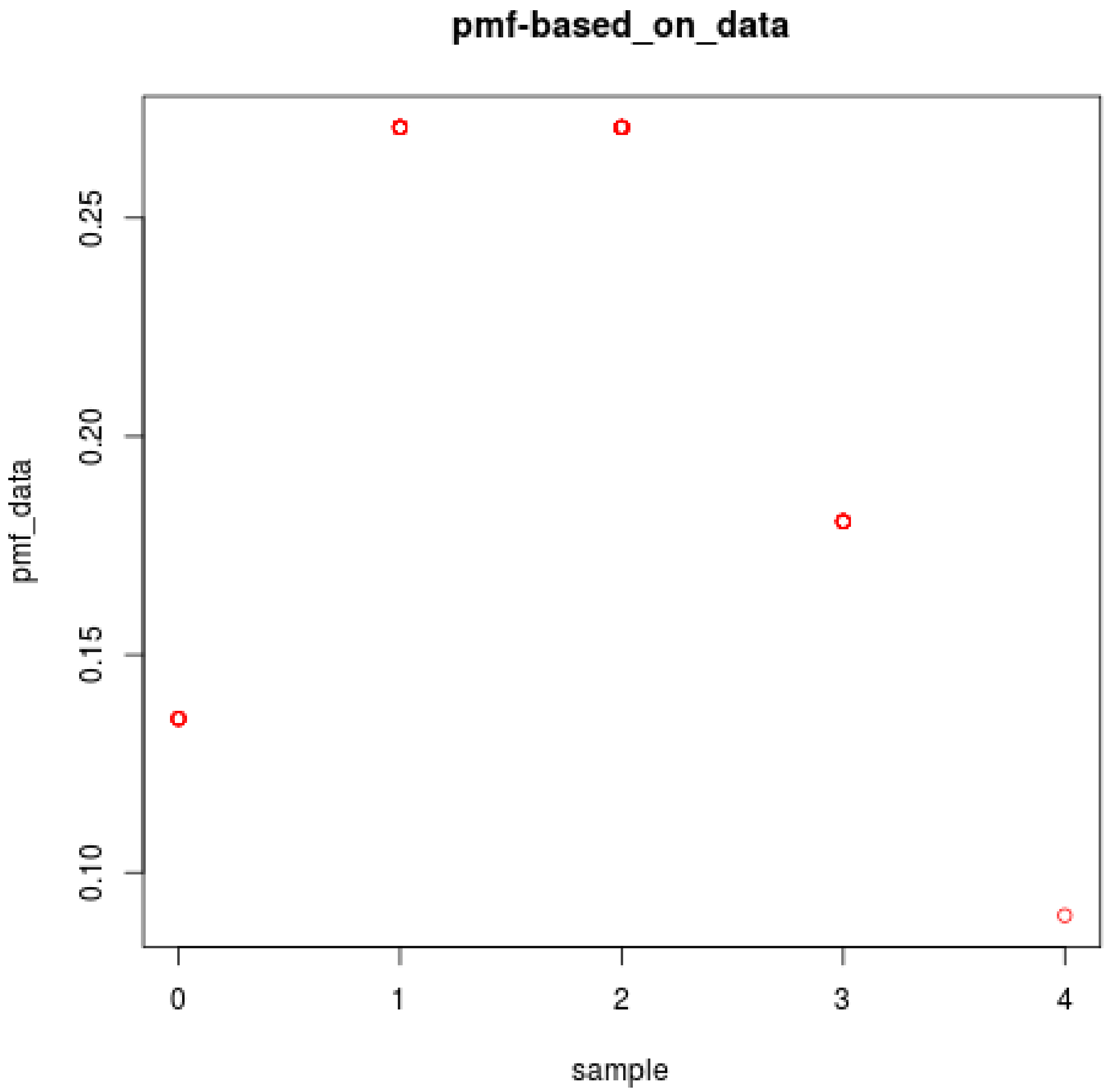
Observed Mean: 1.6

Variance: 0.9795918

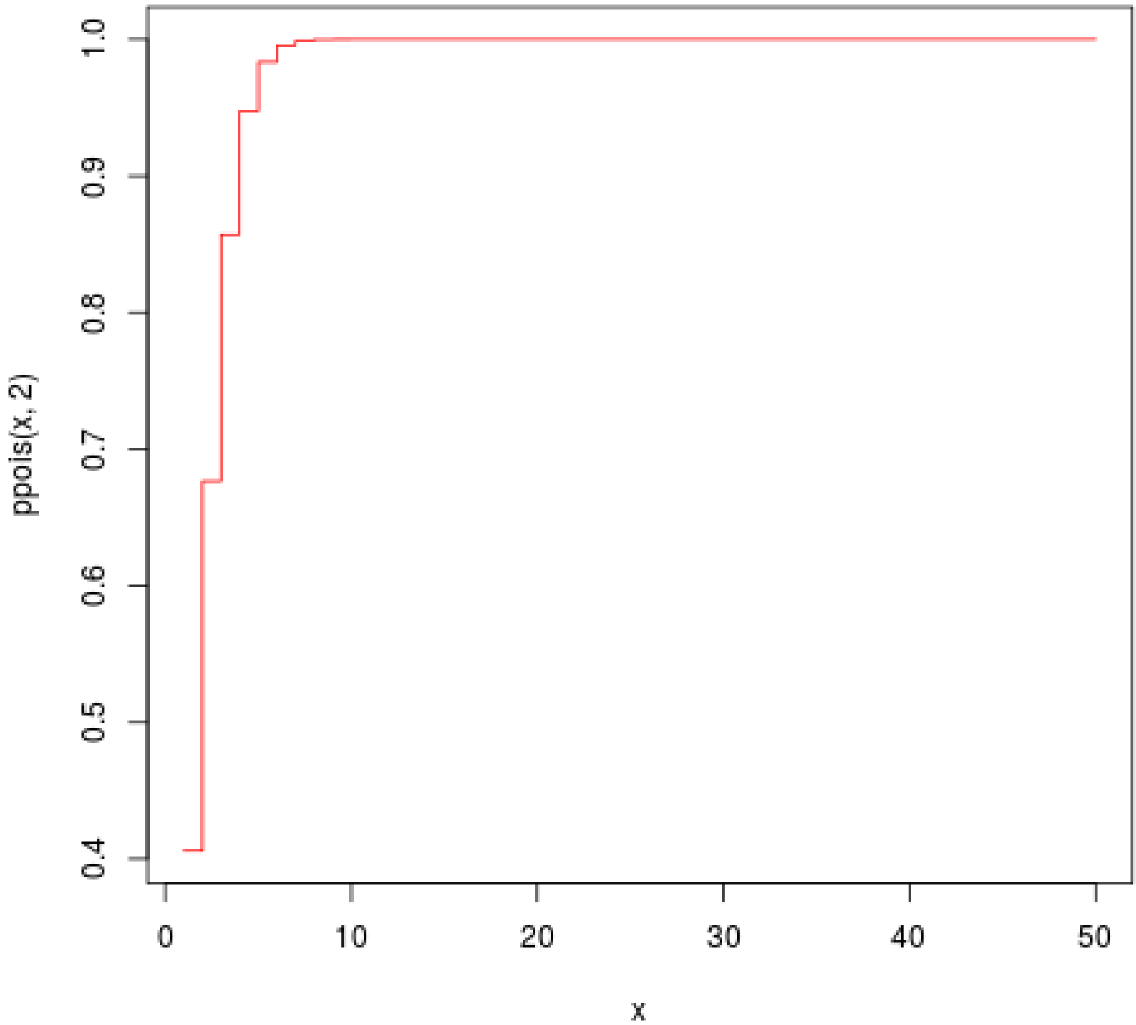
Graph:



(c) *pmf-Perfect Graph- Theoretical*



(d) *pmf-Graph Based on data- Observed*



(e) *CFD*

[Q 3] Draw the histogram based 50 generated random numbers from the mixture of two Weibull distributions : f(x; 1, 1, 2, 2, p) = pf1(x; 1, 1) + (1 p)f2(x; 2, 2) where f1() and f2() are two Weibull distributions of the form : f(x; ,) = x 1 e (x) where, 1 = 2, 1 = 1, 2 = 1.5, 2 = 1, p = 0.4

Code R:

```
theta1<-1
theta2<-1
beta1<-2
beta2<-1.5
p<-0.4
```

```
q<-0.6
first<-function(u){
    return (((-1*log(u))**(1/beta1))/theta1)
}
second<-function(u){
    return (((-1*log(u))**(1/beta2))/theta2)
}
count<-50
sample<-c()
for(i in 1:count){
    u1<-runif(1)
    x1<-first(u1)
    x2<-second(u1)
    u2<-runif(1)
    if(u2<p)
        sample[i]<-x1
    else
        sample[i]<-x2
    cat(sample[i],"\n")
}
hist(sample)
cat("Mean is: ",mean(sample),"\n")
cat("Variance is: ",var(sample),"\n")
```

Output:

Mean: 0.8324047

Variance: 0.2156945

Observation: CDF of Weibull Distribution:

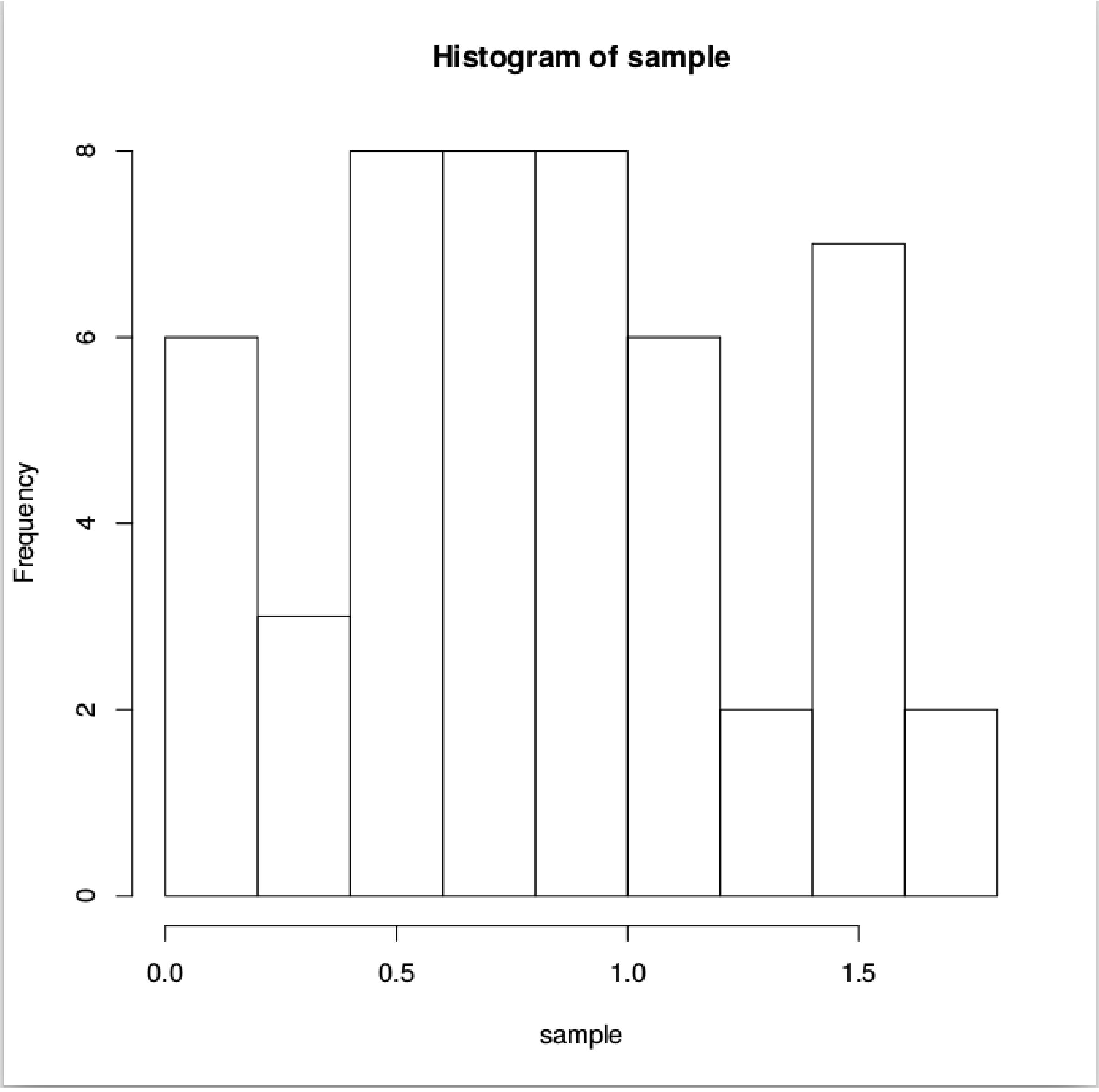
$$F(x) = 1 - e^{-(theta*x)^{beta}} \tag{3}$$

step 1: genrate a random number U1 step 2: generate X1 and X2 from weibull distributions given. step 3: if U2 ¡ p, set X = X1. step 4: else if U ¿ p , set X = X2.

Observed Mean: 0.8324047

Variance: 0.2156945

Graph:



(f) *Histogram of mixed distribution*