Exponential Distribution

A continuous random variable X is said to follow exponential distribution if its probability density function is given by,

$$f(x) = \begin{cases} \alpha e^{-\alpha x}, & x > 0 \\ 0, & otherwise \end{cases}$$

Procedure:

- Generating the data set
- Determine the probabilities of the random variable using Exponential distribution in R

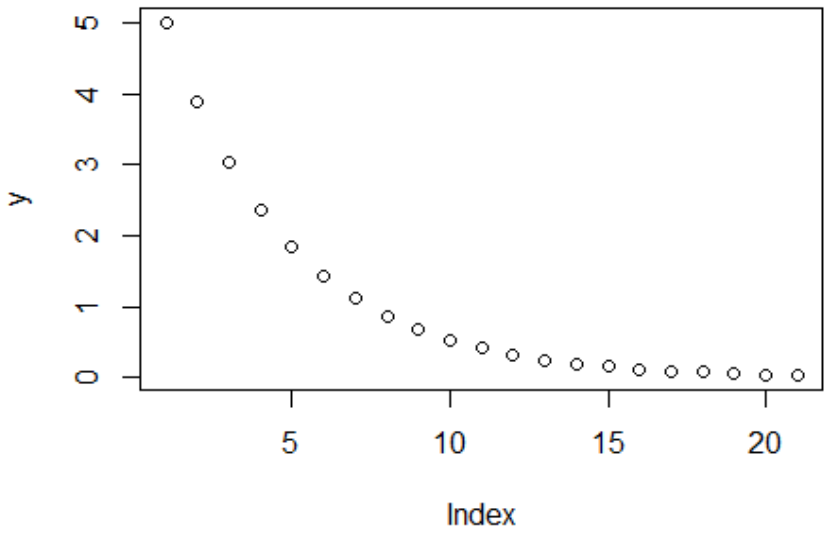
Problem -1

Exponential Density:

For a quantile input vector, the dexp R function returns the appropriate values of the exponential density.

Code and Results:

```
#programno:1
x<-seq(0,1,by=0.05)  #Specifying value of x for exp function
#applying dexp function with a rate of 5
y<-dexp(x,rate=5)  #Apply exp function
plot(y)  # Ploting the dexp values
```



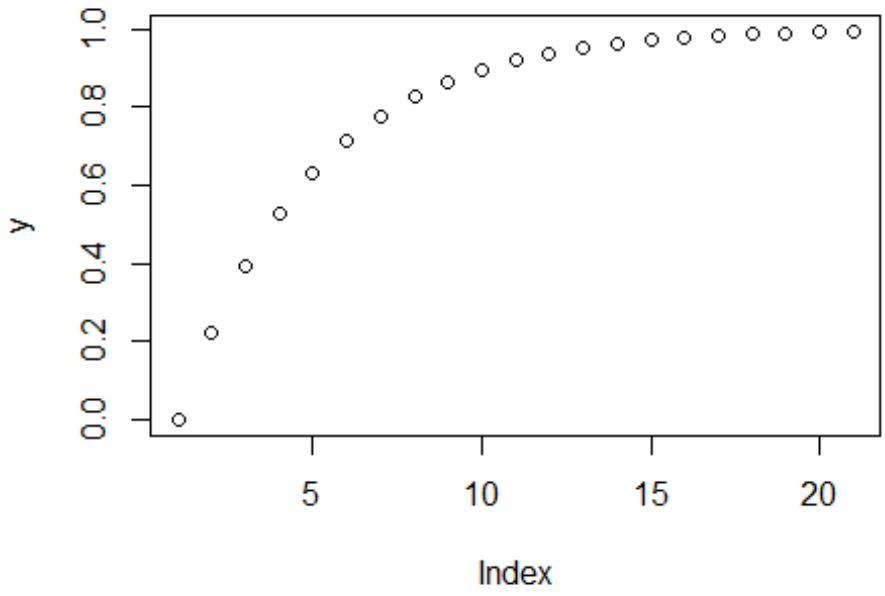
Problem no:2

Exponential Cumulative Distribution Function

pexp function is used to get the values of the exponential cumulative distribution function.

Code and Results:

```
x<-seq(0,1,by=0.05) #Specifying the value of x for pexp function
#useing  pexp function to get the values of the exponential cumulative
distribution function.
y<-pexp(x,rate=5)# Apply pexp function
plot(y) # Ploting the  pexp values
```



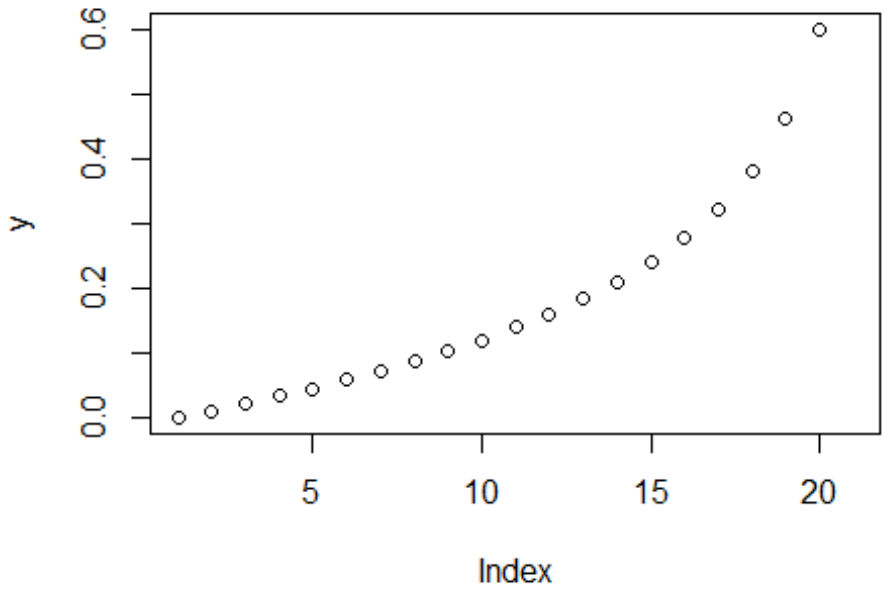
Problem no:3

Exponential Quantile Function:

qexp functionis used to return the corresponding values of the quantile function.

Code and Results:

```
x<-seq(0,1,by=0.05) #Specifying the values of x for qexp function
y<-qexp(x,rate=5) # Applying the  qexp function
plot(y)  #Ploting the  qexp values
```



Problem no:4

Random Number Generation

Drawing random values from the exponential distribution using rexp function.

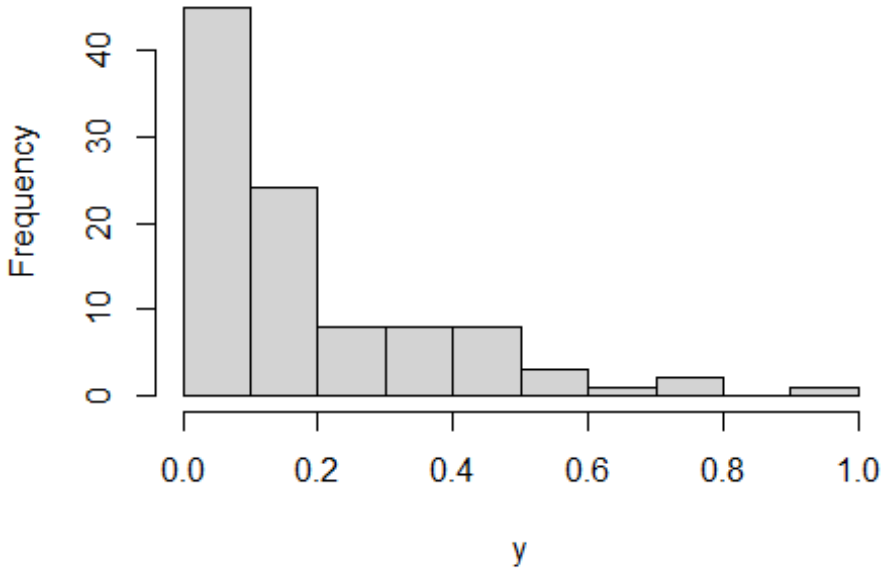
Code and Results:

```
 #specifying a seed and the sample size
set.seed(1000) # Set seed for reproducibility
n<-100 #Specifying the sample size
```

```r
y<-rexp(n,rate=5)#Drawing n exponential  distributed values
y# Printing the values to Rthe console
```

```
##   [1] 0.200932404 0.103538594 0.487476883 0.432649780 0.095485943 0.033414
018
##   [7] 0.312764976 0.102184632 0.192296835 0.010103988 0.150393235 0.337970
170
##  [13] 0.121979737 0.170327213 0.445563408 0.019322176 0.070621309 0.151212
543
##  [19] 0.422779566 0.070693436 0.753619508 0.113427614 0.033758647 0.192463
691
##  [25] 0.015236524 0.085195912 0.081133988 0.025133099 0.145727527 0.002774
974
##  [31] 0.090719716 0.072822357 0.592754532 0.007241551 0.052466256 0.074128
822
##  [37] 0.085037181 0.019515043 0.057706814 0.790180249 0.103143271 0.033265
284
##  [43] 0.195358781 0.005362362 0.030026673 0.084926641 0.224321542 0.274703
509
##  [49] 0.020055878 0.390322635 0.499957010 0.337015742 0.180606341 0.359582
650
##  [55] 0.008750660 0.288696043 0.176578975 0.252978874 0.036329836 0.917208
741
##  [61] 0.017141150 0.051810615 0.484962900 0.101450095 0.343621307 0.262757
079
##  [67] 0.039747167 0.157597467 0.061821305 0.138493009 0.332541618 0.080354
275
##  [73] 0.016022911 0.179260775 0.131950899 0.087233484 0.589404158 0.038329
073
##  [79] 0.048946480 0.498623575 0.003025558 0.179160386 0.216552821 0.056417
165
##  [85] 0.122571792 0.088825946 0.186658634 0.523034412 0.246028305 0.014055
709
##  [91] 0.165152601 0.659685485 0.023470224 0.135405428 0.006578628 0.317771
515
##  [97] 0.430372476 0.003307302 0.098272298 0.040132140
```

```r
hist(y,breaks=10,main="")# Ploting the randomly drawn exponential density
```



Problem no:5

Example for Applications of the Exponential Distributions:

Consider a scenario in which a system comprises a specific sort of component, whose time s in years, to failure is shown by T. With a mean time to failure of β = 5, the exponential distribution effectively models the random variable T. what will be the probability that at least 2 are still working at the end of 8 years if 5 of these components are installed in different systems.

Code and Results:

```
y<-5
#finding the probability of the component functioning after 8 years
a<-pexp(8,rate=1/y,lower.tail=F)
#now finding the total probability
cat("The probability that atleast 2 are still functioning",1-pbinom(1,5,a))

## The probability that atleast 2 are still functioning 0.2666086
```