ass2.R

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Thu Feb 23 21:22:11 2017

```
#ae13b063
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#assignment-2

#library(knitr)
#library(rmarkdown)
library(prob)
```

```
## Warning: package 'prob' was built under R version 3.3.2
```

```
## Loading required package: combinat
```

```
## Warning: package 'combinat' was built under R version 3.3.2
```

```
##
## Attaching package: 'combinat'
```

```
## The following object is masked from 'package:utils':
##
##     combn
```

```
## Loading required package: fAsianOptions
```

```
## Warning: package 'fAsianOptions' was built under R version 3.3.2
```

```
## Loading required package: timeDate
```

```
## Warning: package 'timeDate' was built under R version 3.3.2
```

```
## Loading required package: timeSeries
```

```
## Warning: package 'timeSeries' was built under R version 3.3.2
```

```
## Loading required package: fBasics
```

```
## Warning: package 'fBasics' was built under R version 3.3.2
```

```
##
```

```
## Rmetrics Package fBasics
```

```
## Analysing Markets and calculating Basic Statistics
```

```
## Copyright (C) 2005-2014 Rmetrics Association Zurich
```

```
## Educational Software for Financial Engineering and Computational Science
```

```
## Rmetrics is free software and comes with ABSOLUTELY NO WARRANTY.
```

```
## https://www.rmetrics.org --- Mail to: info@rmetrics.org
```

```
## Loading required package: fOptions
```

```
## Warning: package 'fOptions' was built under R version 3.3.2
```

```
##
```

```
## Rmetrics Package fOptions
```

```
## Pricing and Evaluating Basic Options
```

```
## Copyright (C) 2005-2014 Rmetrics Association Zurich
```

```
## Educational Software for Financial Engineering and Computational Science
```

```
## Rmetrics is free software and comes with ABSOLUTELY NO WARRANTY.
```

```
## https://www.rmetrics.org --- Mail to: info@rmetrics.org
```

```
##
## Attaching package: 'prob'
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, union
```

```
#Question-1
S= tosscoin(5, makespace = TRUE)
S
```

```
##    toss1 toss2 toss3 toss4 toss5   probs
## 1      H     H     H     H     H 0.03125
## 2      T     H     H     H     H 0.03125
## 3      H     T     H     H     H 0.03125
## 4      T     T     H     H     H 0.03125
## 5      H     H     T     H     H 0.03125
## 6      T     H     T     H     H 0.03125
## 7      H     T     T     H     H 0.03125
## 8      T     T     T     H     H 0.03125
## 9      H     H     H     T     H 0.03125
## 10     T     H     H     T     H 0.03125
## 11     H     T     H     T     H 0.03125
## 12     T     T     H     T     H 0.03125
## 13     H     H     T     T     H 0.03125
## 14     T     H     T     T     H 0.03125
## 15     H     T     T     T     H 0.03125
## 16     T     T     T     T     H 0.03125
## 17     H     H     H     H     T 0.03125
## 18     T     H     H     H     T 0.03125
## 19     H     T     H     H     T 0.03125
## 20     T     T     H     H     T 0.03125
## 21     H     H     T     H     T 0.03125
## 22     T     H     T     H     T 0.03125
## 23     H     T     T     H     T 0.03125
## 24     T     T     T     H     T 0.03125
## 25     H     H     H     T     T 0.03125
## 26     T     H     H     T     T 0.03125
## 27     H     T     H     T     T 0.03125
## 28     T     T     H     T     T 0.03125
## 29     H     H     T     T     T 0.03125
## 30     T     H     T     T     T 0.03125
## 31     H     T     T     T     T 0.03125
## 32     T     T     T     T     T 0.03125
```

```
#adding "number of heads" column to S
headcount <- vector(mode="numeric", length=0) #numeric null vector
for (j in 1:nrow(S)) {
  a=0
  for(i in 1:5){
    if(S[j,i]=="H"){
      a = a + 1
    }
  }
  headcount = c(headcount, a)
}
S$noofheads = headcount
S
```

```
##    toss1 toss2 toss3 toss4 toss5   probs noofheads
## 1      H     H     H     H     H 0.03125         5
## 2      T     H     H     H     H 0.03125         4
## 3      H     T     H     H     H 0.03125         4
## 4      T     T     H     H     H 0.03125         3
## 5      H     H     T     H     H 0.03125         4
## 6      T     H     T     H     H 0.03125         3
## 7      H     T     T     H     H 0.03125         3
## 8      T     T     T     H     H 0.03125         2
## 9      H     H     H     T     H 0.03125         4
## 10     T     H     H     T     H 0.03125         3
## 11     H     T     H     T     H 0.03125         3
## 12     T     T     H     T     H 0.03125         2
## 13     H     H     T     T     H 0.03125         3
## 14     T     H     T     T     H 0.03125         2
## 15     H     T     T     T     H 0.03125         2
## 16     T     T     T     T     H 0.03125         1
## 17     H     H     H     H     T 0.03125         4
## 18     T     H     H     H     T 0.03125         3
## 19     H     T     H     H     T 0.03125         3
## 20     T     T     H     H     T 0.03125         2
## 21     H     H     T     H     T 0.03125         3
## 22     T     H     T     H     T 0.03125         2
## 23     H     T     T     H     T 0.03125         2
## 24     T     T     T     H     T 0.03125         1
## 25     H     H     H     T     T 0.03125         3
## 26     T     H     H     T     T 0.03125         2
## 27     H     T     H     T     T 0.03125         2
## 28     T     T     H     T     T 0.03125         1
## 29     H     H     T     T     T 0.03125         2
## 30     T     H     T     T     T 0.03125         1
## 31     H     T     T     T     T 0.03125         1
## 32     T     T     T     T     T 0.03125         0
```

```
event = subset(S, noofheads >= 3) #more heads than tails
Prob(event)
```

```
## [1] 0.5
```

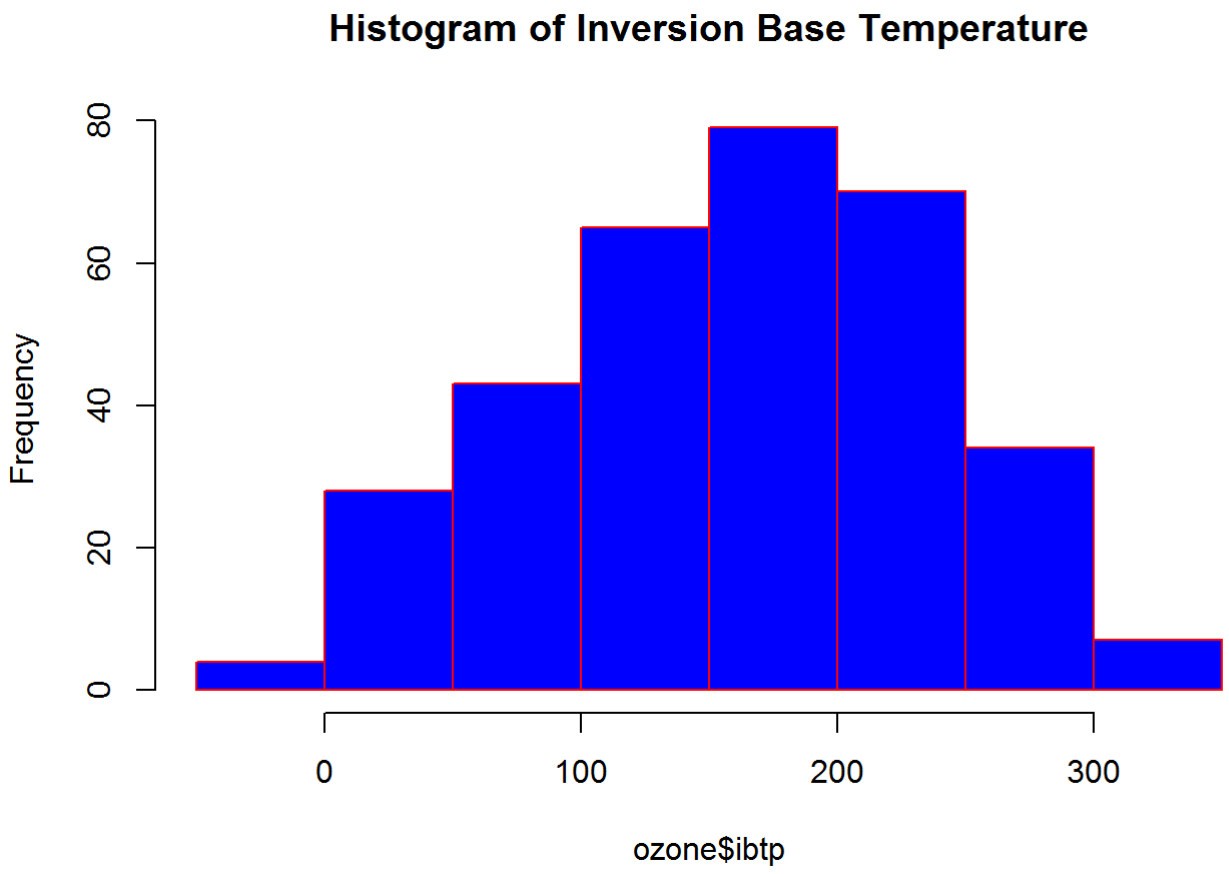
```
#Question-2
#install.packages("gss")
library(gss)
```

```
## Warning: package 'gss' was built under R version 3.3.2
```

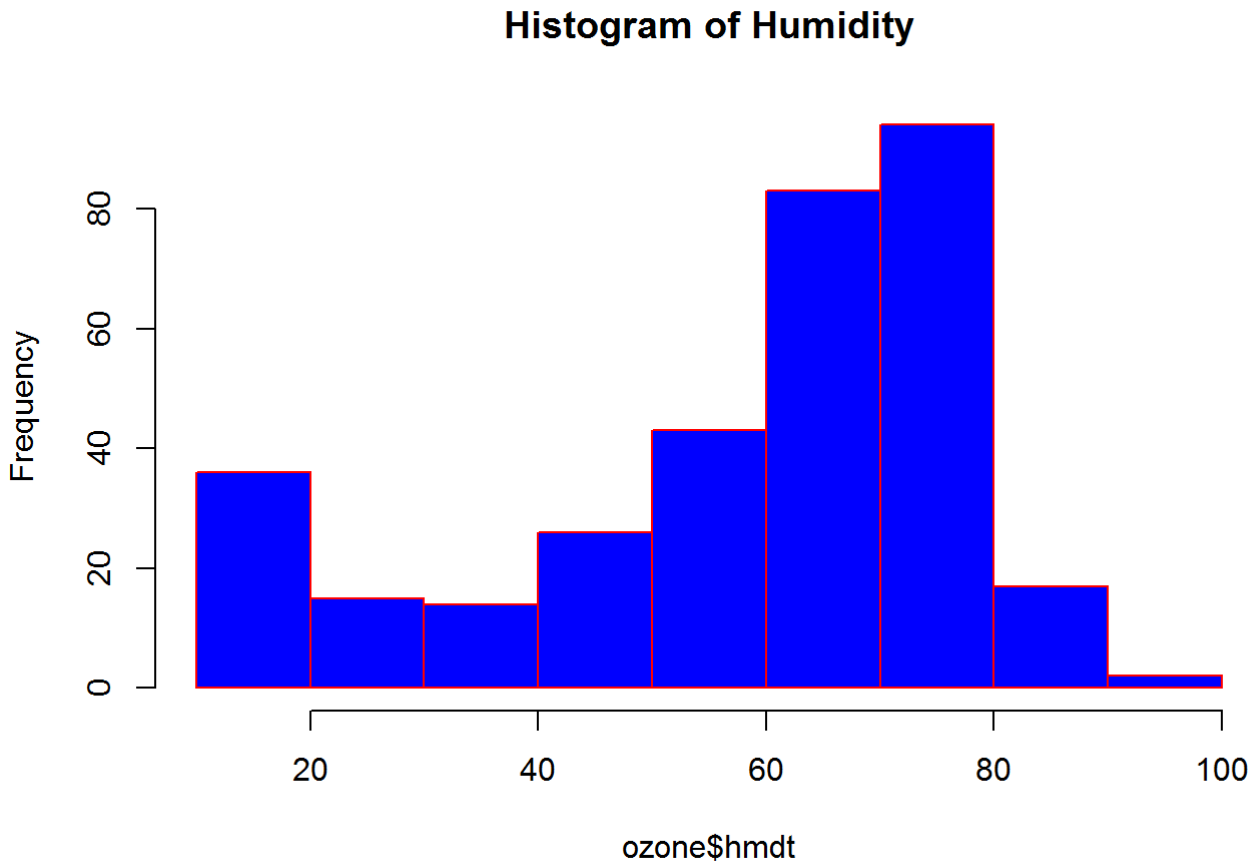
```
data(ozone)
summary(ozone)
```

```
##       upo3            vdht           wdsp            hmdt      
##  Min.   : 1.00   Min.   :5320   Min.   : 0.000   Min.   :19.00  
##  1st Qu.: 5.00   1st Qu.:5690   1st Qu.: 3.000   1st Qu.:47.00  
##  Median :10.00   Median :5760   Median : 5.000   Median :64.00  
##  Mean   :11.78   Mean   :5750   Mean   : 4.891   Mean   :58.13  
##  3rd Qu.:17.00   3rd Qu.:5830   3rd Qu.: 6.000   3rd Qu.:73.00  
##  Max.   :38.00   Max.   :5950   Max.   :21.000   Max.   :93.00  
##       sbtp            ibht            dgpg            ibtp       
##  Min.   :25.00   Min.   : 111.0   Min.   :-69.00   Min.   :-25.0  
##  1st Qu.:51.00   1st Qu.: 877.5   1st Qu.: -9.00   1st Qu.:107.0  
##  Median :62.00   Median :2112.5   Median : 24.00   Median :167.5  
##  Mean   :61.75   Mean   :2572.9   Mean   : 17.37   Mean   :161.2  
##  3rd Qu.:72.00   3rd Qu.:5000.0   3rd Qu.: 44.75   3rd Qu.:214.0  
##  Max.   :93.00   Max.   :5000.0   Max.   :107.00   Max.   :332.0  
##       vsty            day       
##  Min.   :  0.0   Min.   :  3.00  
##  1st Qu.: 70.0   1st Qu.: 90.25  
##  Median :120.0   Median :177.50  
##  Mean   :124.5   Mean   :181.73  
##  3rd Qu.:150.0   3rd Qu.:275.75  
##  Max.   :350.0   Max.   :365.00
```

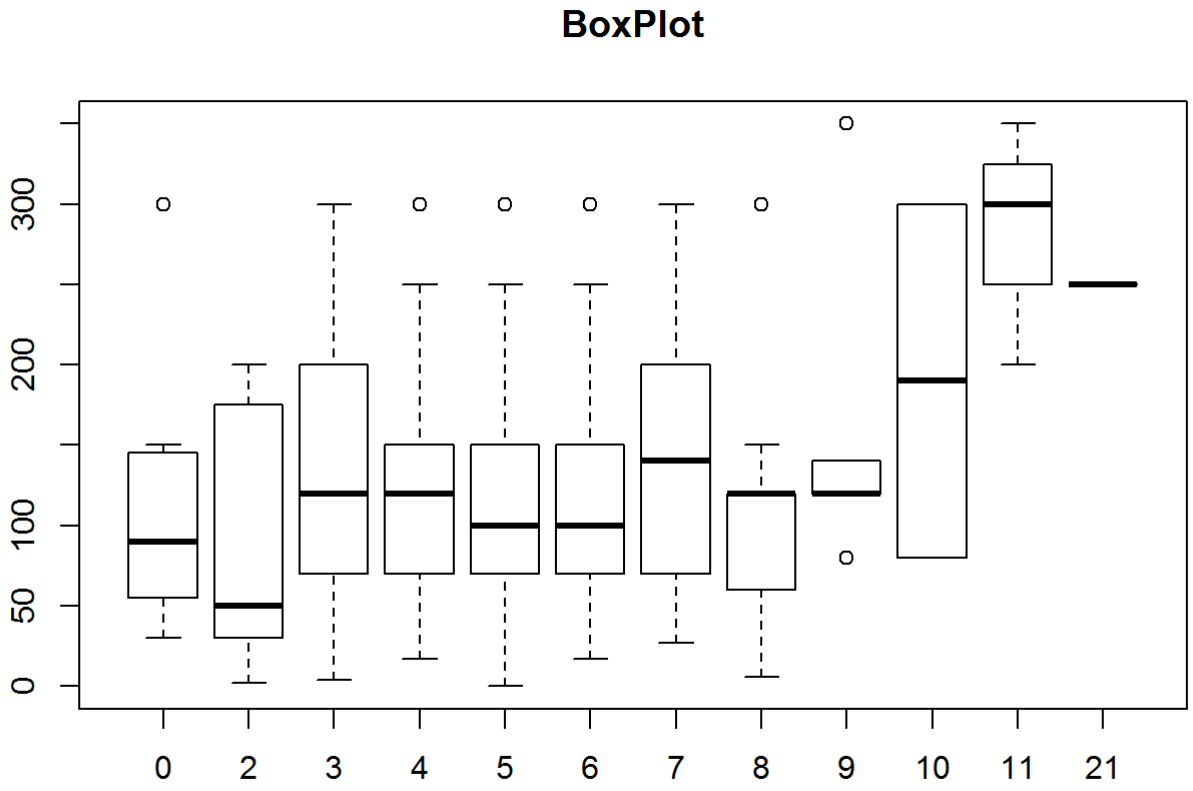
```
hist(ozone$ibtp,main = "Histogram of Inversion Base Temperature",border = "red",col = "blue")
```



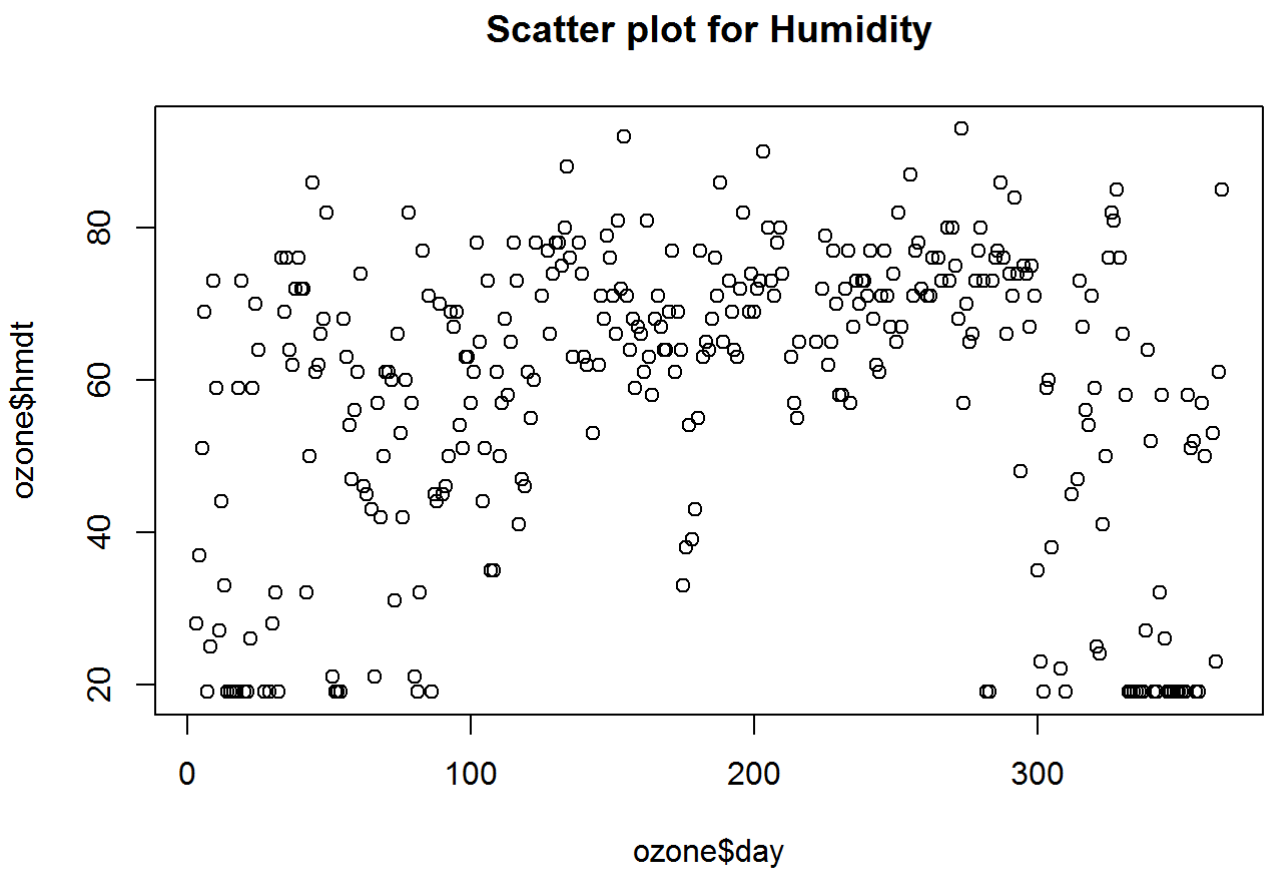

```
hist(ozone$hmdt,main = "Histogram of Humidity",border = "red",col = "blue")
```



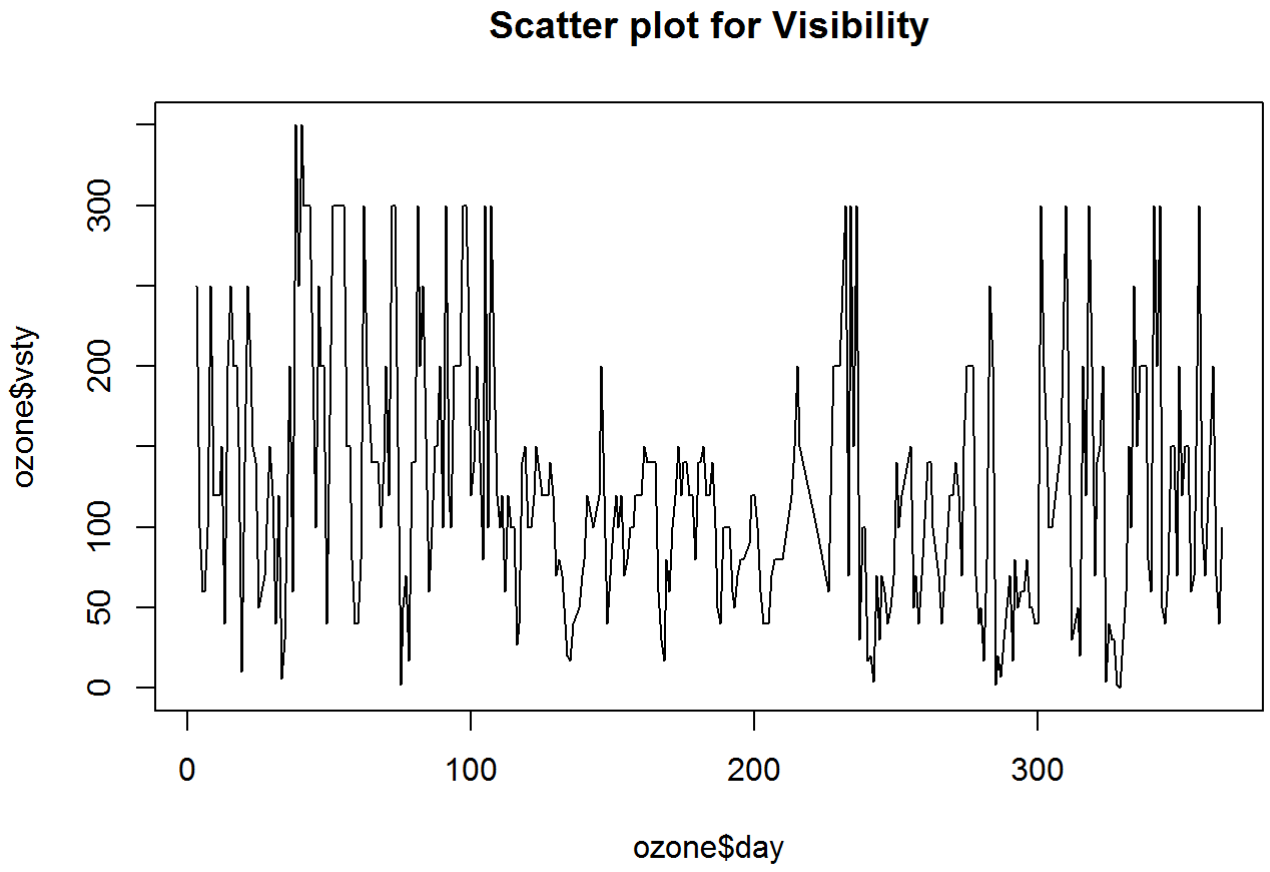

```
boxplot(ozone$vsty ~ ozone$wdsp, main="BoxPlot")
```



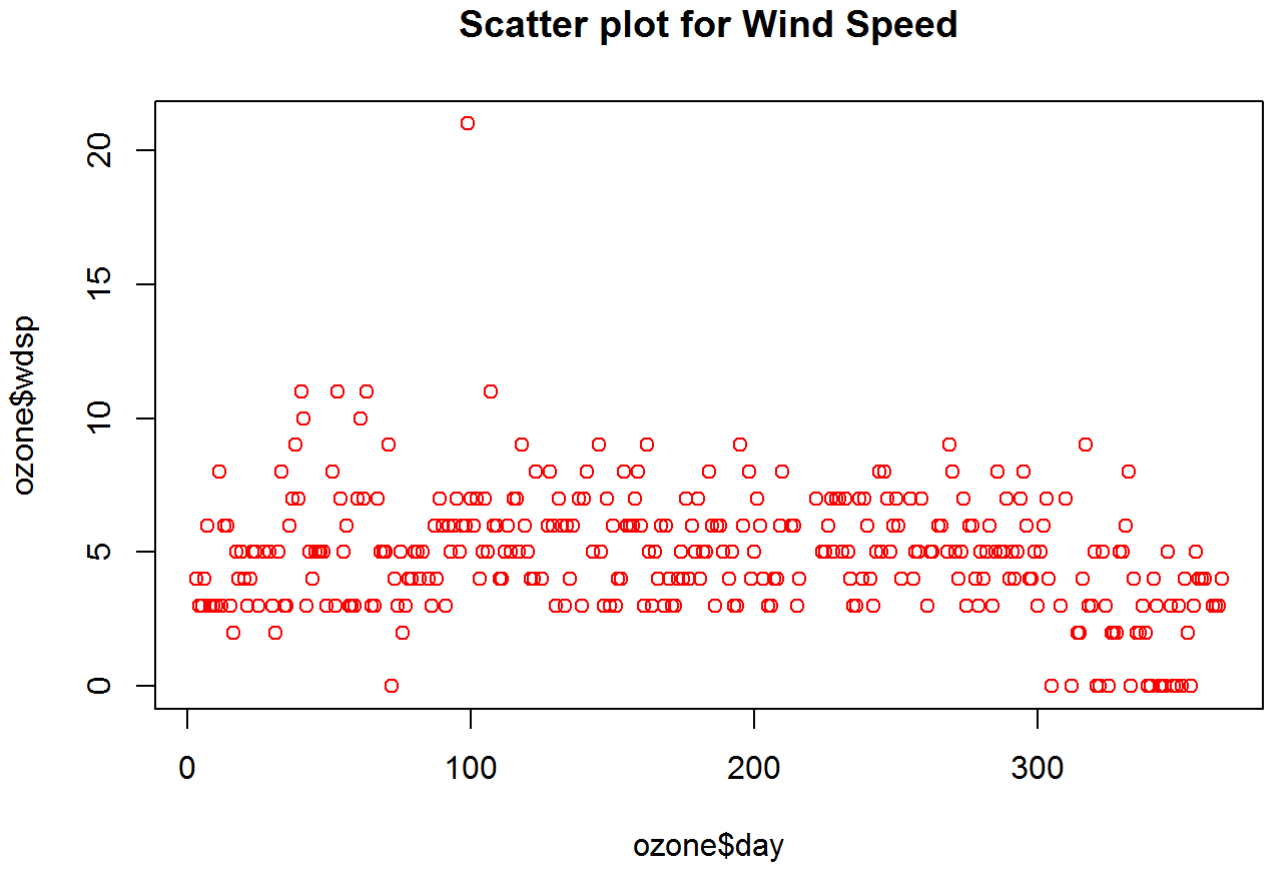
```
plot(x=ozone$day,y=ozone$hmdt, main = "Scatter plot for Humidity")
```



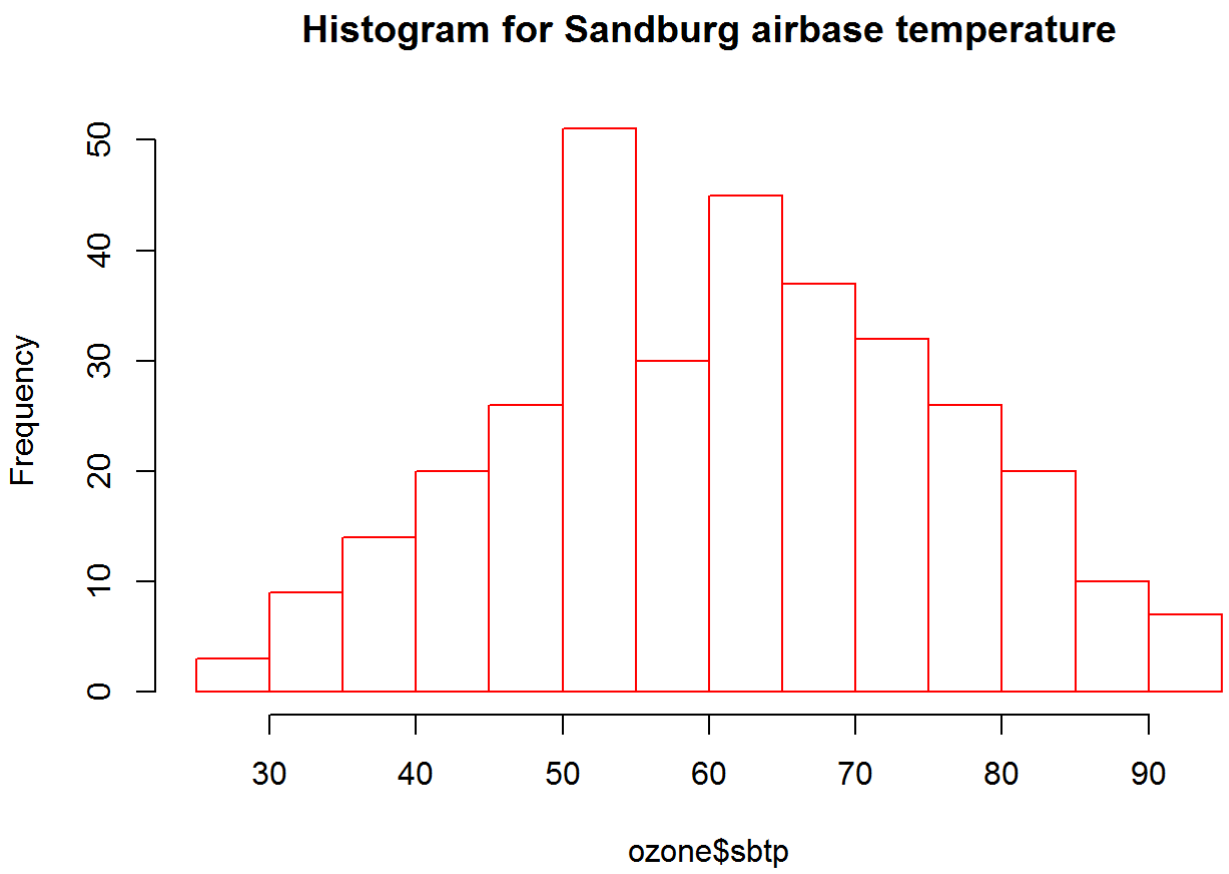

```
plot(x=ozone$day,y=ozone$vsty, main = "Scatter plot for Visibility", "l")
```



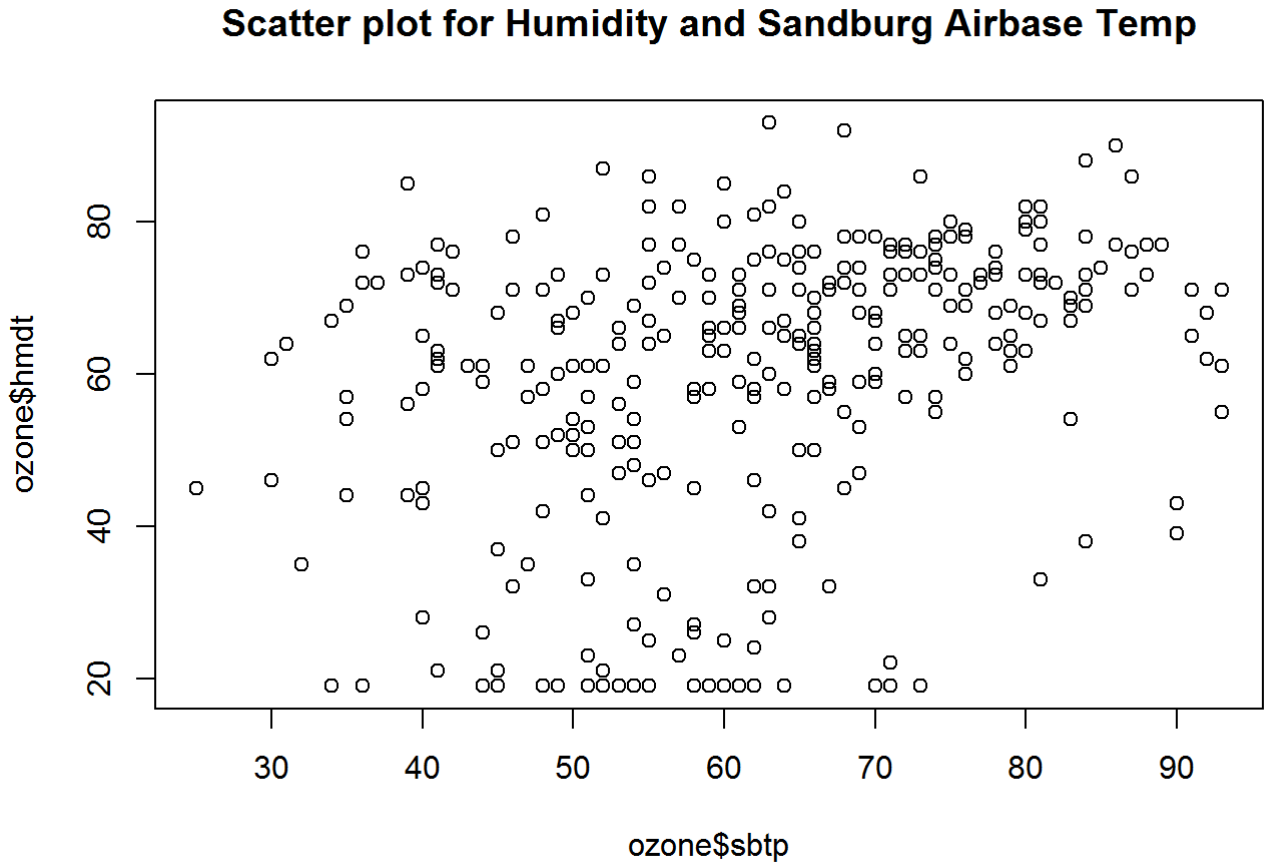

```
plot(x=ozone$day,y=ozone$wdsp, main = "Scatter plot for Wind Speed", col="Red")
```



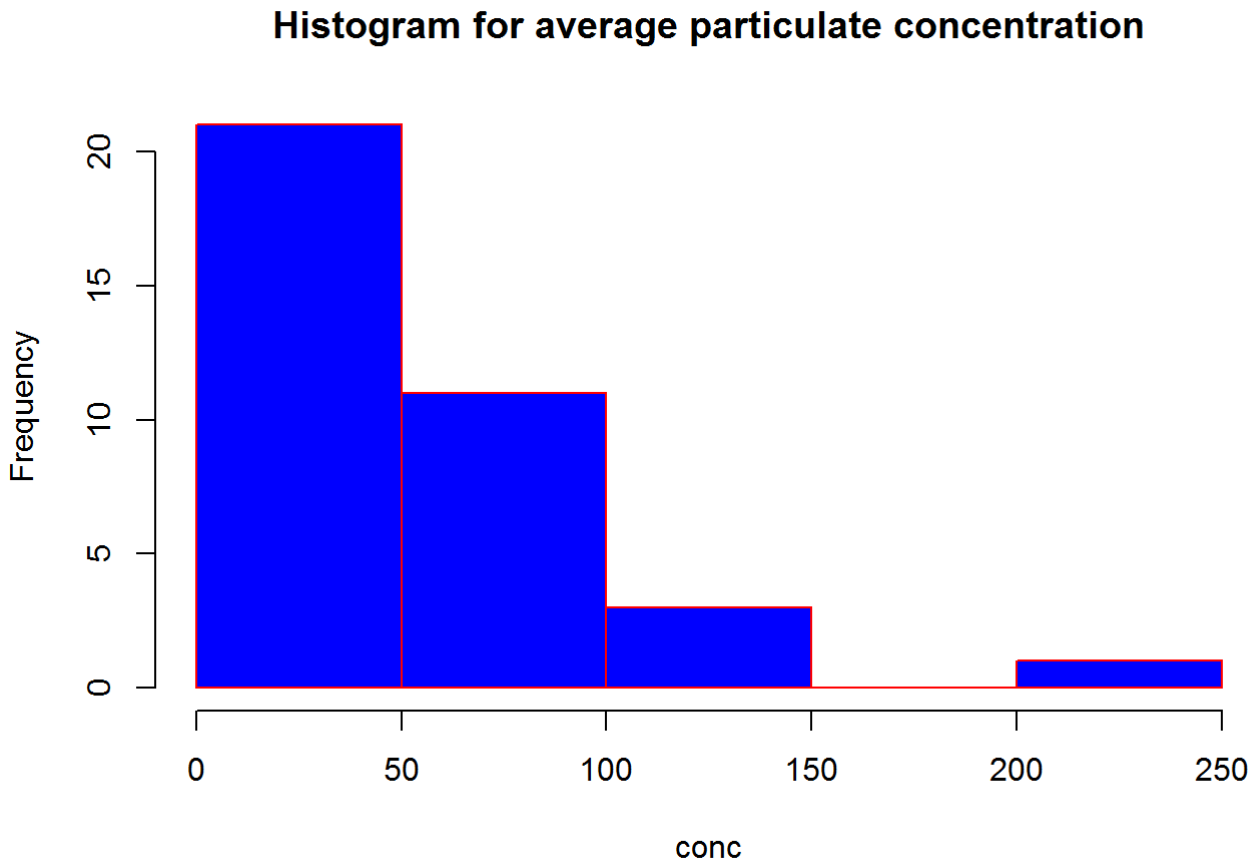
```
#humidity and sandburg airbase temperature
hist(ozone$sbtp, main="Histogram for Sandburg airbase temperature", border="red")
```



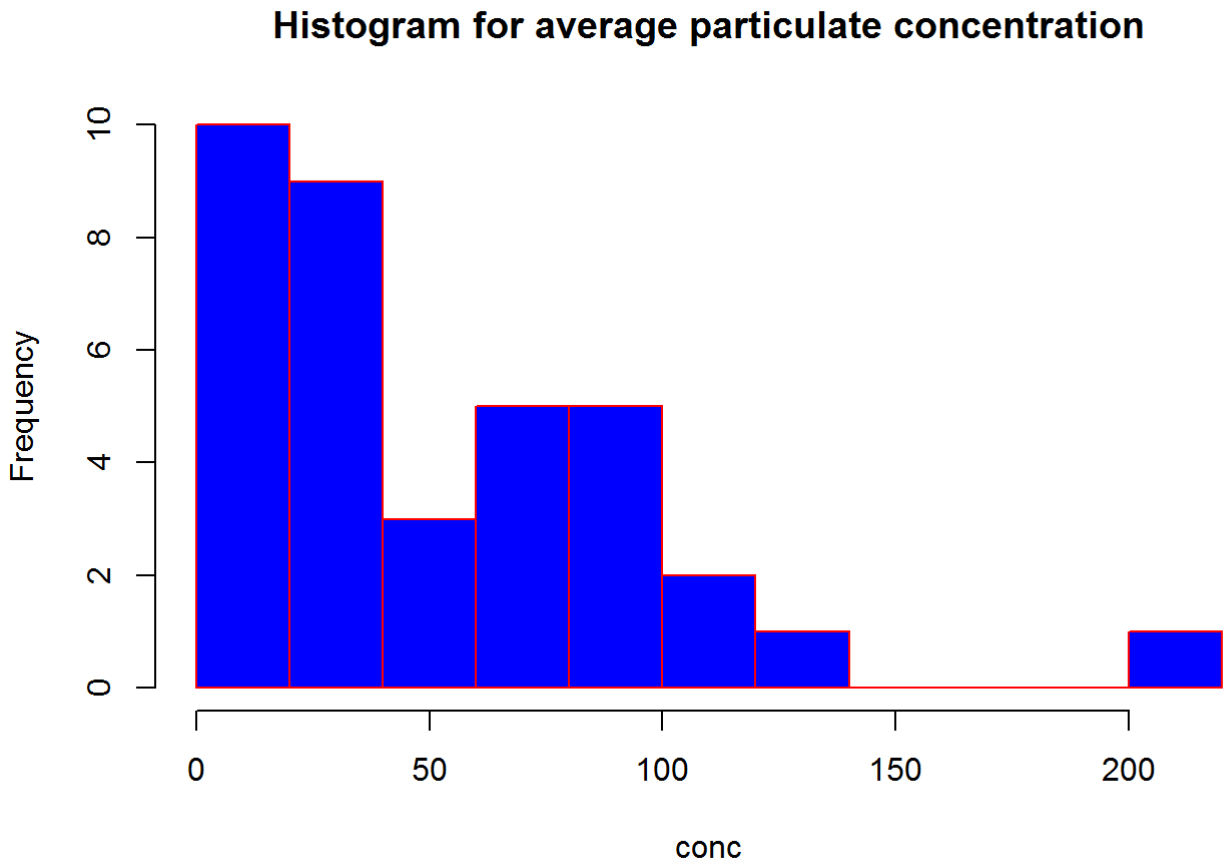

```
plot(x=ozone$sbtp,y=ozone$hmdt, main = "Scatter plot for Humidity and Sandburg Airbase Temp")
```




```
#Question-3
conc <- c( 5, 18, 15, 7, 23, 220, 130, 85, 103, 25, 80, 7, 24, 6, 13, 65, 37, 25,24, 65, 82,
95, 77, 15, 70, 110, 44, 28, 33, 81, 29, 14, 45, 92, 17, 53)
hist(conc, main="Histogram for average particulate concentration", border="red", col="blue")
```



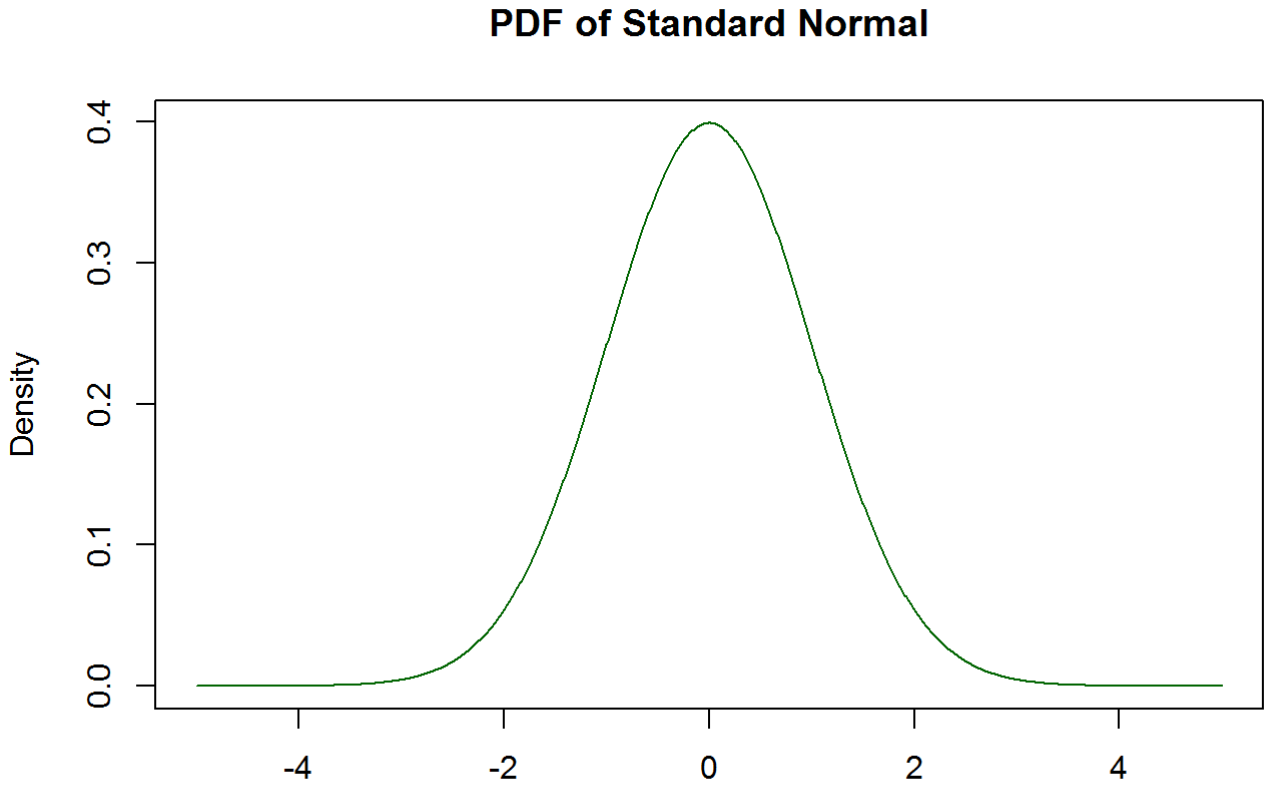

```
#From the below graph, we can see that histogram is approximately normal
hist(conc, main="Histogram for average particulate concentration", border="red", col="blue",
breaks = 10)
```



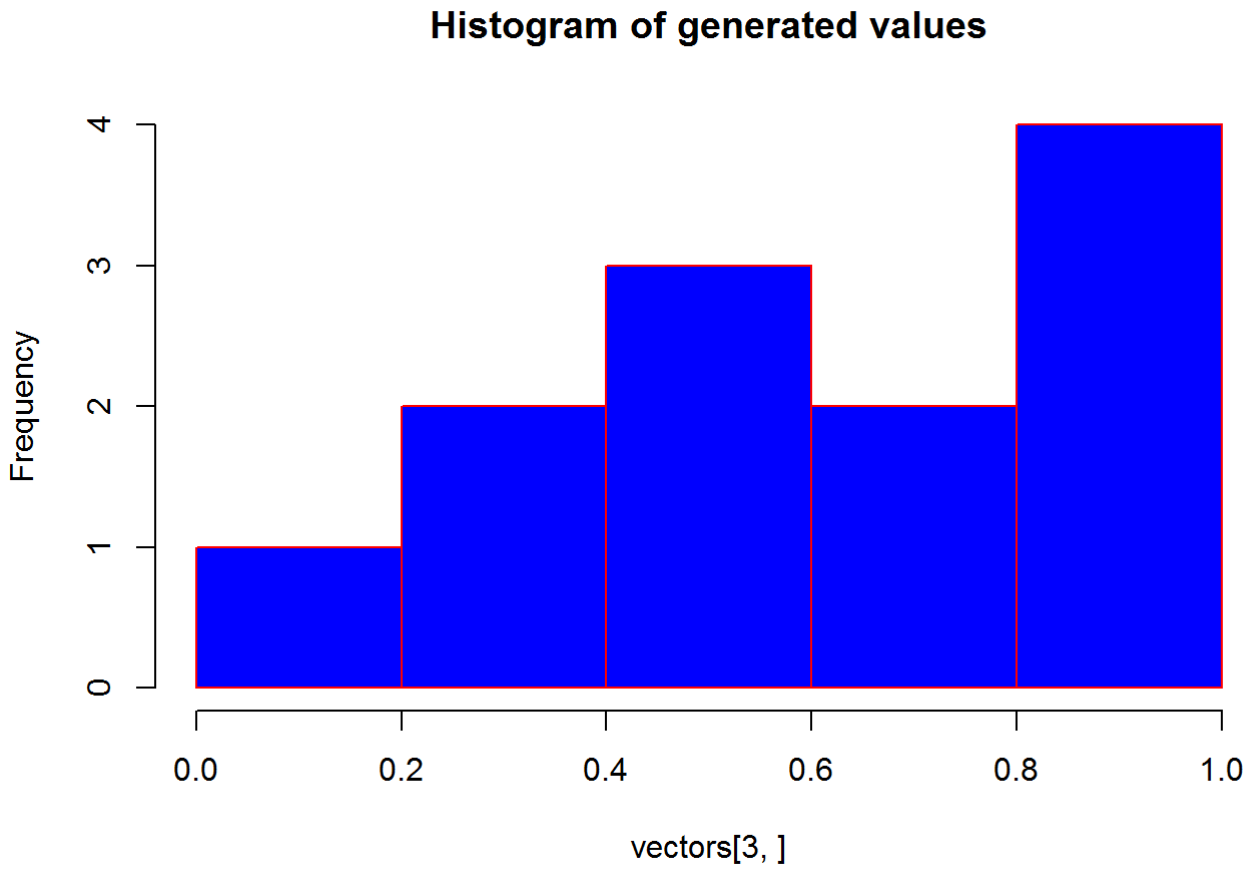

```
#Question-4
#Label 1-5:defective, 6-15:partially defective, 16-40:Acceptable transistors
S = urnsamples(1:40, size=1)
p = rep(1, times=nrow(S))
S = probspace(S, probs = p) #equally likely
#EventA : does not fail immediately
A = subset(S, out>5)
#EventB : acceptable
B = subset(S, out>15)
Prob(B, given = A) #Answer
```

```
## [1] 0.7142857
```

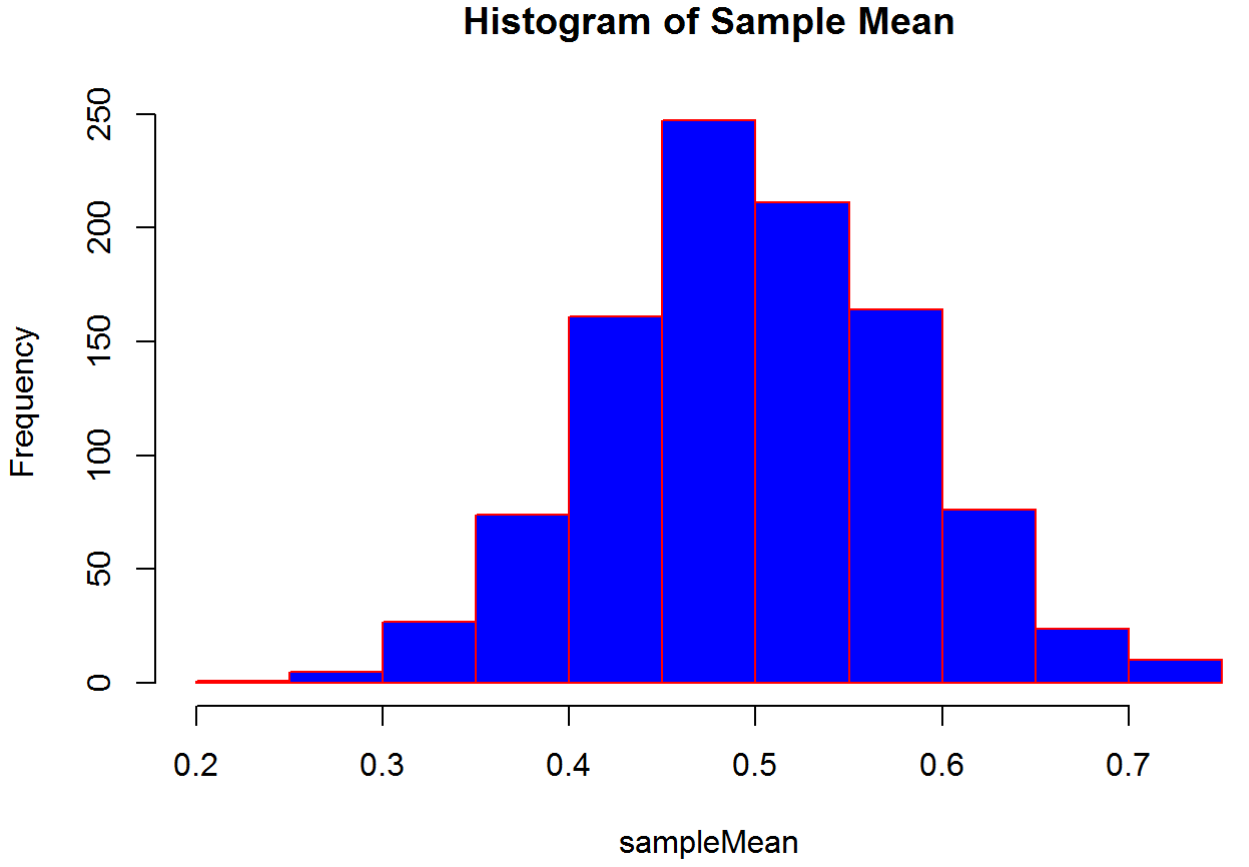
```
#Question-5
x <-seq(-5,5,.01)
densities <-dnorm(x, 0,1) #density calculation
plot(x, densities, col="darkgreen",xlab="", ylab="Density", type="l", main="PDF of Standard N
ormal") #Plot
```



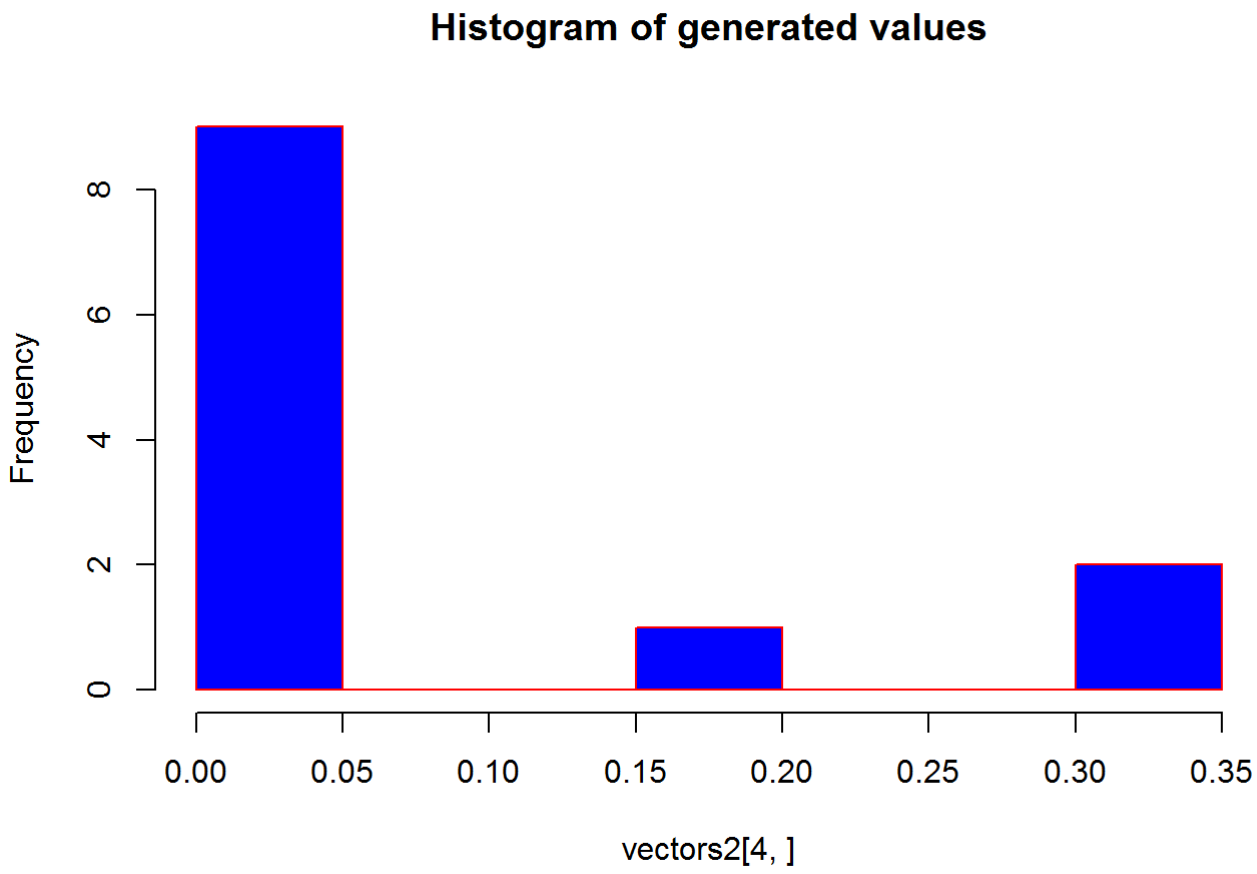

```
#Question-6
set.seed(100)
#Part1(Uniform Law)
vectors <- matrix(ncol = 12, nrow = 1000)
for(i in 1:1000){
  vec = runif(12,0,1)
  vectors[i,]=vec
}
hist(vectors[3,],main = "Histogram of generated values",border = "red",col = "blue") #hist of
 generated values
```



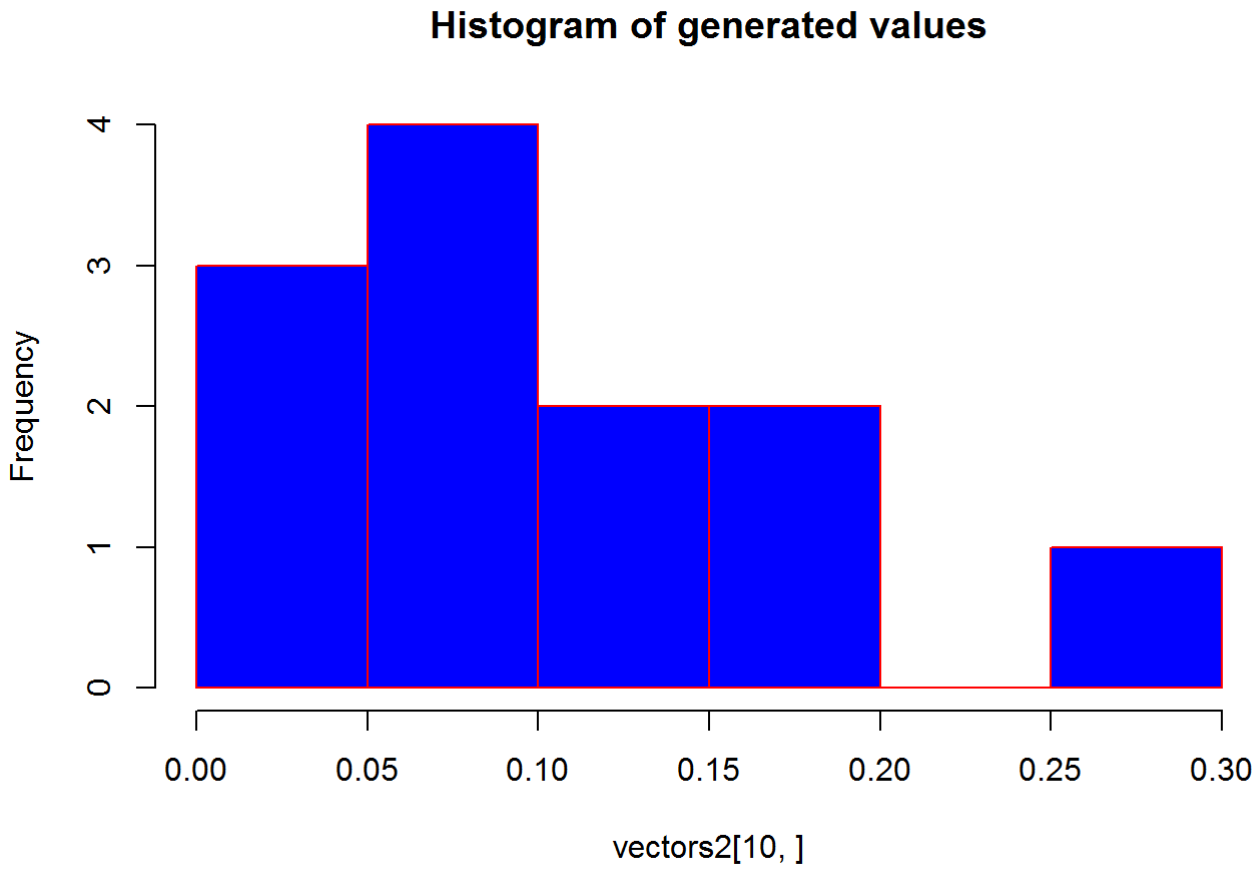

```
sampleMean = apply(vectors,1,mean)
hist(sampleMean,main = "Histogram of Sample Mean",border = "red",col = "blue")
```



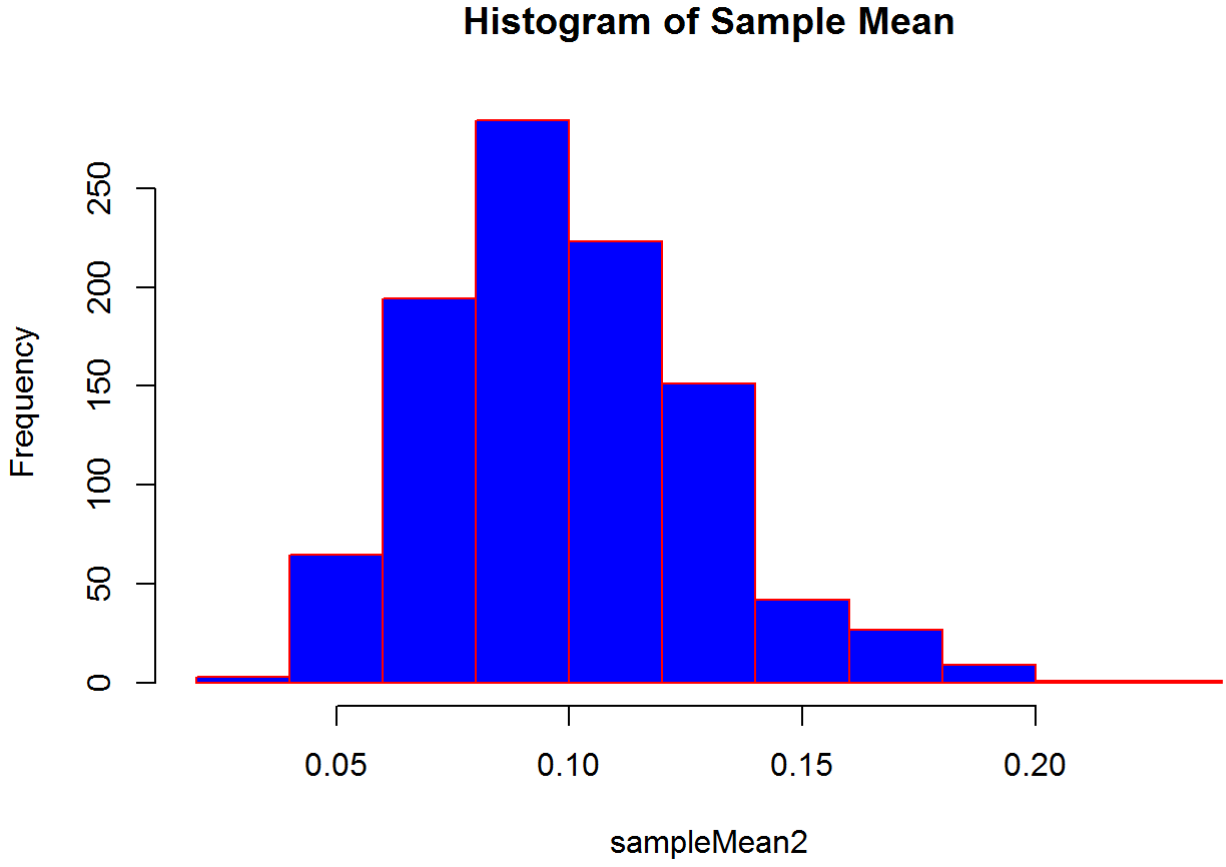
```
#Part-2(Exponential Law)
vectors2 <- matrix(ncol = 12, nrow = 1000)
for(i in 1:1000){
  vec = rexp(12,10)
  vectors2[i,]=vec
}
hist(vectors2[4,],main = "Histogram of generated values",border = "red",col = "blue")
```




```
hist(vectors2[10,],main = "Histogram of generated values",border = "red",col = "blue")
```




```
sampleMean2 = apply(vectors2,1,mean)
hist(sampleMean2,main = "Histogram of Sample Mean",border = "red",col = "blue")
```



```
##Exercise Problems from lab session-3
#Exercise-1
S = rolldie(2, makespace = TRUE)
S
```

```
##    X1 X2      probs
## 1   1  1 0.02777778
## 2   2  1 0.02777778
## 3   3  1 0.02777778
## 4   4  1 0.02777778
## 5   5  1 0.02777778
## 6   6  1 0.02777778
## 7   1  2 0.02777778
## 8   2  2 0.02777778
## 9   3  2 0.02777778
## 10  4  2 0.02777778
## 11  5  2 0.02777778
## 12  6  2 0.02777778
## 13  1  3 0.02777778
## 14  2  3 0.02777778
## 15  3  3 0.02777778
## 16  4  3 0.02777778
## 17  5  3 0.02777778
## 18  6  3 0.02777778
## 19  1  4 0.02777778
## 20  2  4 0.02777778
## 21  3  4 0.02777778
## 22  4  4 0.02777778
## 23  5  4 0.02777778
## 24  6  4 0.02777778
## 25  1  5 0.02777778
## 26  2  5 0.02777778
## 27  3  5 0.02777778
## 28  4  5 0.02777778
## 29  5  5 0.02777778
## 30  6  5 0.02777778
## 31  1  6 0.02777778
## 32  2  6 0.02777778
## 33  3  6 0.02777778
## 34  4  6 0.02777778
## 35  5  6 0.02777778
## 36  6  6 0.02777778
```

```
A = subset(S, X1 == X2) #outcomes match
A
```

```
##    X1 X2      probs
## 1   1  1 0.02777778
## 8   2  2 0.02777778
## 15  3  3 0.02777778
## 22  4  4 0.02777778
## 29  5  5 0.02777778
## 36  6  6 0.02777778
```

```
B = subset(S, X1 + X2 >= 8) #sum of outcomes atleast 8
B
```

```
##    X1 X2      probs
## 12  6  2 0.02777778
## 17  5  3 0.02777778
## 18  6  3 0.02777778
## 22  4  4 0.02777778
## 23  5  4 0.02777778
## 24  6  4 0.02777778
## 27  3  5 0.02777778
## 28  4  5 0.02777778
## 29  5  5 0.02777778
## 30  6  5 0.02777778
## 32  2  6 0.02777778
## 33  3  6 0.02777778
## 34  4  6 0.02777778
## 35  5  6 0.02777778
## 36  6  6 0.02777778
```

```
Prob(A, given = B)
```

```
## [1] 0.2
```

```
Prob(B, given = A)
```

```
## [1] 0.5
```

```
#Exercise-2
x1 = c("A",2:10,"J","Q","K")
x1
```

```
##  [1] "A"  "2"  "3"  "4"  "5"  "6"  "7"  "8"  "9"  "10" "J"  "Q"  "K"
```

```
x1 = rep(x1, 4) #as we have 4 suits
S = urnsamples(x1, size=2, replace = FALSE, ordered = TRUE)
p = rep(1, times=nrow(S))
S = probspace(S, probs = p) #equally likely
A = subset(S, X1=="A")
B = subset(S, X2=="A")
S2 = subset(S, X1=="A"& X2=="A") #both aces
Prob(S2)
```

```
## [1] 0.004524887
```

```
#Exercise-3
#Label balls 1-7: Red, balls 8-10: Green
S = urnsamples(1:10, size=3, replace=FALSE, ordered=TRUE)
p = rep(1, times=nrow(S))
S = probspace(S, probs = p) #equally likely

A= subset(S, X1<8 & X2<8 & X3<8) #all 3 balls are red
Prob(A)
```

```
## [1] 0.2916667
```

```
B= subset(S, X1<8 & X2<8 & X3>7| X1<8 & X2>7 & X3<8 | X1>7 & X2<8 & X3<8) #2 balls are red
Prob(B)
```

```
## [1] 0.525
```

```
#Exercise-4
S = tosscoin(10, makespace = TRUE)
#We will find probability of no head and then subtract it from 1
nohead = S
for(i in 1:10){
  nohead = subset(nohead, nohead[,i]=="T")
}
ans = 1-Prob(nohead)
ans
```

```
## [1] 0.9990234
```