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Applied Data Science

IST687 Intro to Data Science, Spring 2019
Due Date: 05/1/2019
Homework: 4

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#R Code - unexecuted

```
# Clear objects from Memory
rm(list=ls())
# Clear Console:
cat("\014")

# Homework Week 4: Exploration of Sampling

# Step 1: Write a summarizing function to understand the distribution of a vector
# ---------------------------------------------------------------------------
## 1.1: The summarizing function: printVecInfo
printVecInfo <- function(vec){
  if(!require("moments")){install.packages("moments")}

  cat("MEAN: ",round(mean(vec),2), "\nMEDIAN: ",round(median(vec),2), "\nMAX: ",max(vec),
"\nMIN: ",min(vec),
      "\nSD: ",round(sd(vec),2), "\nSKEWNESS: ",round(skewness(vec),2), "\nQUANTILE .05:
",quantile(vec,0.05), "\nQUANTILE .95: ",quantile(vec,0.95),"\n", sep = "")
}

## 1.2: Test printVecInfo function
v <- c(1,2,3,4,5,6,7,8,9,10,50)
printVecInfo(v)


# Step 2: Creating Samples in a Jar
# ---------------------------------------------------------------------------
## 2.1 Functions:
### Create jar Container Object
createJarMarbles <- function(){
  if(!require("stringr")){install.packages("stringr")}

  #creating a container objec that holds 50 'red' and 50 'blue' -- marbles
  jarMarbles <- c(replicate(50,"red"),replicate(50,"blue"))

  return(jarMarbles)
}
```

```
### Jar Sampling Function - Return mean value of samples
sampleJarOfMarbles <- function(X,n,marble.type='red',rep=TRUE){

  samp <- sample(X,n,replace=rep)
  m <- length(samp[samp[]==marble.type])/length(X)
  #return mean of sample set
  return(m)
}
### Jar Replicate Sampling Function - Return list of mean values of samples
replicateSampleJarOfMarbles <- function(X,n=1,k=1){

  sampMeans <- replicate(k,sampleJarOfMarbles(X,n))

  return(sampMeans)
}

## 2.1(4) Create jar container object
jar <- createJarMarbles()

## 2.2(5) Confirm there are 50 reds
red.count <- length(jar[jar[] == 'red'])
red.count

## 2.3(6) Sample 10 'marbles' from the jar.
samp10 <- sample(jar,10,replace=TRUE)

### How many are red?
length(samp10[samp10=='red'])

### What is the percentage of red marbles?
cat(length(samp10[samp10=='red'])/length(samp10)*100,"%","\n", sep="")

## 2.4(7) Do sampling 20 times - Generate list of 20 numbers - Each number is the mean of how
many reds there were in 10 samples
##       printVecInfo to see information of the samples
##       generate histogram of the samples
#set.seed(42)
samp10.rep20 <- replicateSampleJarOfMarbles(jar,n=10,k=20)
length(samp10.rep20)
hist(samp10.rep20)
printVecInfo(samp10.rep20)

## 2.5(8) Repeat 2.4(7), with sampling at 100 times - Get 20 numbers, each represents the mean of
reds there were in the 100 samples
samp100.rep20 <- replicateSampleJarOfMarbles(jar,n=100,k=20)
length(samp100.rep20)
hist(samp100.rep20)
printVecInfo(samp100.rep20)

## 2.5(9) Repeat 2.5(8), with sampling at 100 times - Get 100 numbers, each represents the mean
of reds there were in the 100 samples.
samp100.rep100 <- replicateSampleJarOfMarbles(jar,n=100,k=100)
length(samp100.rep100)
```

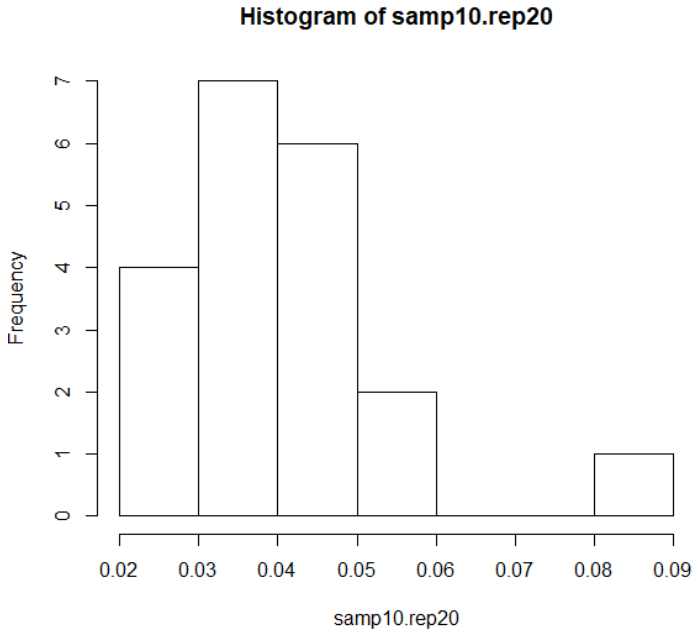
```
hist(samp100.rep100)
printVecInfo(samp100.rep100)

# Step 3: Explore the airquality dataset
# ------------------------------------------------------------
## 3.1(10) Store the 'airquality' dataset into a temp variable
airQ <- airquality

## 3.2(11) Clean the dataset (i.e. remove the NAs) - replace with column means
na.2.mean <- function(x){
  replace(x, is.na(x), mean(x, na.rm = TRUE))
}
airQ.clean <- replace(airQ, TRUE, lapply(airQ, na.2.mean))

## 3.3(12) Explore Ozone, Wind, and Temp by doing a 'printVecInfo' on each as well as generate
historgram for each
## Ozone
printVecInfo(airQ.clean$Ozone)
hist(airQ.clean$Ozone)

## Wind
printVecInfo(airQ.clean$Wind)
hist(airQ.clean$Wind)

## Temp
printVecInfo(airQ.clean$Temp)
hist(airQ.clean$Temp)
```

#R Code – executed

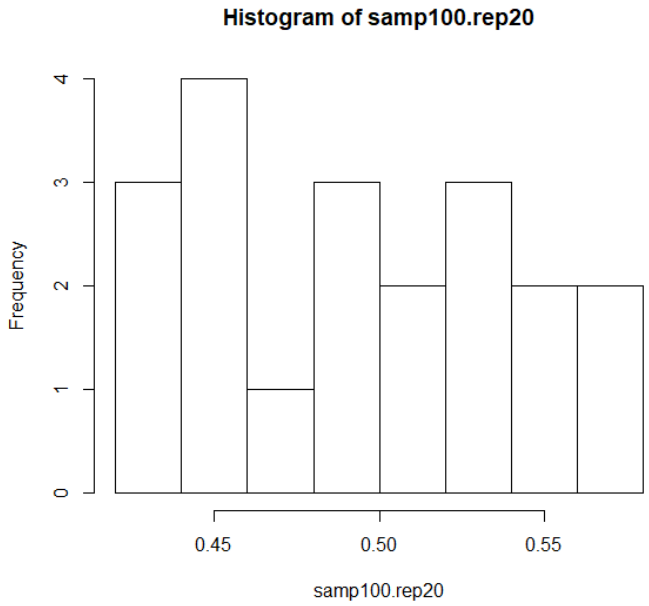
```
> # Homework Week 4: Exploration of Sampling
>
> # Step 1: Write a summarizing function to understand the distribution of a
vector
> # ------------------------------------------------------------------------
--------
> ## 1.1: The summarizing function: printVecInfo
> printVecInfo <- function(vec){
+   if(!require("moments")){install.packages("moments")}
+
+   cat("MEAN: ",round(mean(vec),2), "\nMEDIAN: ",round(median(vec),2), "\nMA
X: ",max(vec), "\nMIN: ",min(vec),
+       "\nSD: ",round(sd(vec),2), "\nSKEWNESS: ",round(skewness(vec),2), "\n
QUANTILE .05: ",quantile(vec,0.05), "\nQUANTILE .95: ",quantile(vec,0.95),"\n
", sep = "")
+ }
>
> ## 1.2: Test printVecInfo function
> v <- c(1,2,3,4,5,6,7,8,9,10,50)
> printVecInfo(v)
MEAN: 9.55
MEDIAN: 6
MAX: 50
MIN: 1
```

```
SD: 13.72
SKEWNESS: 2.62
QUANTILE .05: 1.5
QUANTILE .95: 30
>
>
> # Step 2: Creating Samples in a Jar
> # ------------------------------------------------------------------------
--------
> ## 2.1 Functions:
> ### Create jar Container Object
> createJarMarbles <- function(){
+   if(!require("stringr")){install.packages("stringr")}
+
+   #creating a container objec that holds 50 'red' and 50 'blue' -- marbles
+   jarMarbles <- c(replicate(50,"red"),replicate(50,"blue"))
+
+   return(jarMarbles)
+ }
>
> ### Jar Sampling Function - Return mean value of samples
> sampleJarOfMarbles <- function(X,n,marble.type='red',rep=TRUE){
+
+   samp <- sample(X,n,replace=rep)
+   m <- length(samp[samp[]==marble.type])/length(X)
+   #return mean of sample set
+   return(m)
+ }
> ### Jar Replicate Sampling Function - Return list of mean values of samples
> replicateSampleJarOfMarbles <- function(X,n=1,k=1){
+
+   sampMeans <- replicate(k,sampleJarOfMarbles(X,n))
+
+   return(sampMeans)
+ }
>
> ## 2.1(4) Create jar container object
> jar <- createJarMarbles()
>
> ## 2.2(5) Confirm there are 50 reds
> red.count <- length(jar[jar[] == 'red'])
> red.count
[1] 50
>
> ## 2.3(6) Sample 10 'marbles' from the jar.
> samp10 <- sample(jar,10,replace=TRUE)
>
> ### How many are red?
> length(samp10[samp10=='red'])
[1] 3
>
> ### What is the percentage of red marbles?
> cat(length(samp10[samp10=='red'])/length(samp10)*100,"%","\n", sep="")
30%
>
> ## 2.4(7) Do sampling 20 times - Generate list of 20 numbers - Each number
is the mean of how many reds there were in 10 samples
```

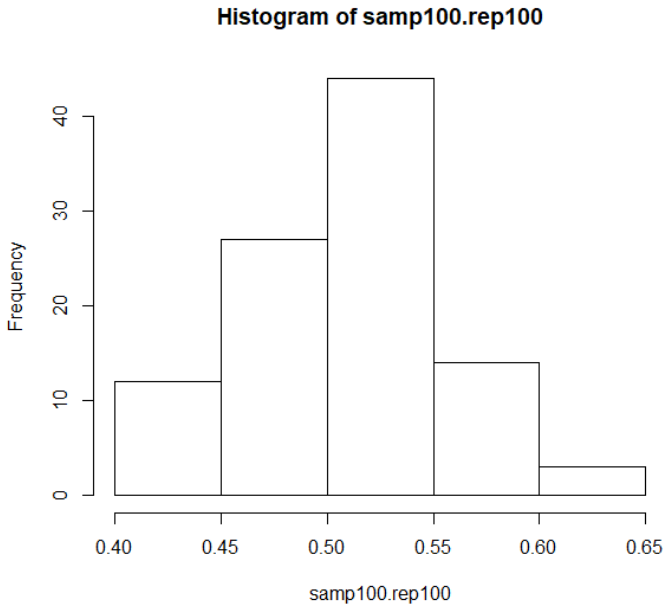
```
> ##        printVecInfo to see information of the samples
> ##        generate histogram of the samples
> #set.seed(42)
> samp10.rep20 <- replicateSampleJarOfMarbles(jar,n=10,k=20)
> length(samp10.rep20)
[1] 20
> hist(samp10.rep20)
```



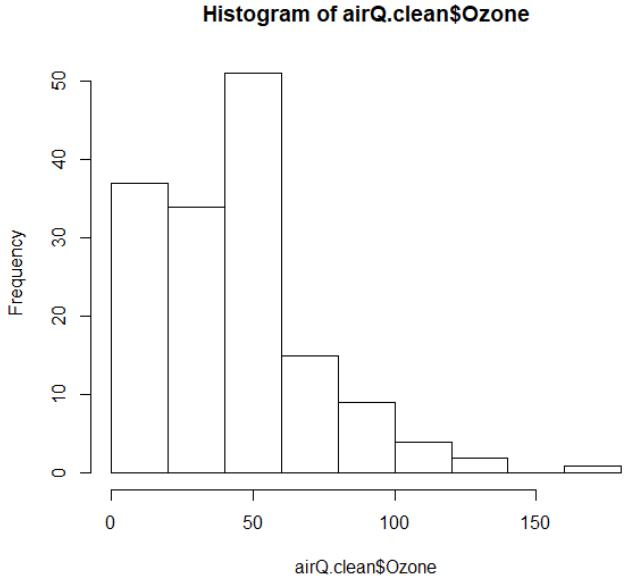

```
> printVecInfo(samp10.rep20)
MEAN: 0.04
MEDIAN: 0.04
MAX: 0.09
MIN: 0.02
SD: 0.02
SKEWNESS: 0.99
QUANTILE .05: 0.02
QUANTILE .95: 0.0615
>
> ## 2.5(8) Repeat 2.4(7), with sampling at 100 times - Get 20 numbers, each
represents the mean of reds there were in the 100 samples
> samp100.rep20 <- replicateSampleJarOfMarbles(jar,n=100,k=20)
> length(samp100.rep20)
[1] 20
> hist(samp100.rep20)
```




```
> printVecInfo(samp100.rep20)
MEAN: 0.5
MEDIAN: 0.5
MAX: 0.58
MIN: 0.42
SD: 0.05
SKEWNESS: 0.09
QUANTILE .05: 0.439
QUANTILE .95: 0.5705
>
> ## 2.5(9) Repeat 2.5(8), with sampling at 100 times - Get 100 numbers, each
represents the mean of reds there were in the 100 samples.
> samp100.rep100 <- replicateSampleJarOfMarbles(jar,n=100,k=100)
> length(samp100.rep100)
[1] 100
> hist(samp100.rep100)
```

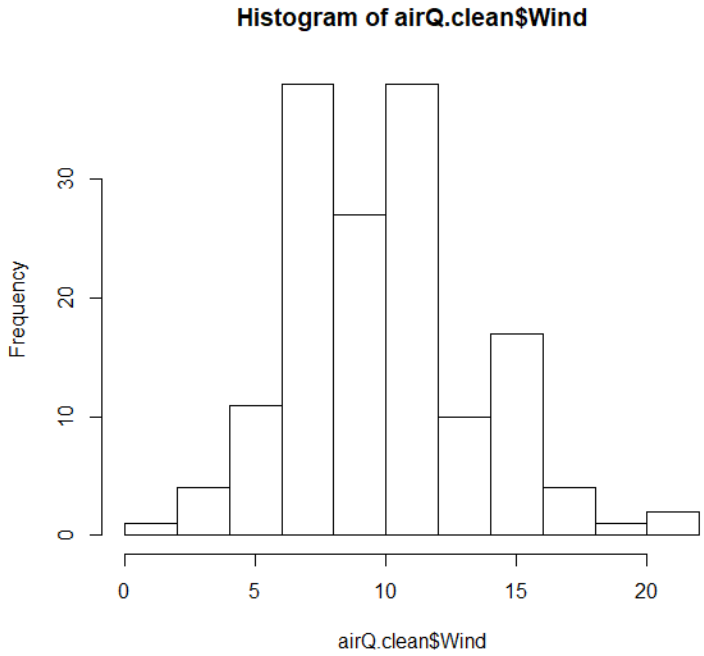


```
> printVecInfo(samp100.rep100)
MEAN: 0.51
MEDIAN: 0.51
MAX: 0.63
MIN: 0.4
SD: 0.05
SKEWNESS: -0.02
QUANTILE .05: 0.4295
QUANTILE .95: 0.5805
>
> # Step 3: Explore the airquality dataset
> # ------------------------------------------------------------
> ## 3.1(10) Store the 'airquality' dataset into a temp variable
> airQ <- airquality
>
> ## 3.2(11) Clean the dataset (i.e. remove the NAs) - replace with column me
ans
> na.2.mean <- function(x){
+   replace(x, is.na(x), mean(x, na.rm = TRUE))
+ }
> airQ.clean <- replace(airQ, TRUE, lapply(airQ, na.2.mean))
>
> ## 3.3(12) Explore Ozone, Wind, and Temp by doing a 'printVecInfo' on each
as well as generate historgram for each
> ## Ozone
> printVecInfo(airQ.clean$Ozone)
MEAN: 42.13
MEDIAN: 42.13
MAX: 168
MIN: 1
SD: 28.69
SKEWNESS: 1.41
QUANTILE .05: 9
QUANTILE .95: 97
> hist(airQ.clean$Ozone)
```

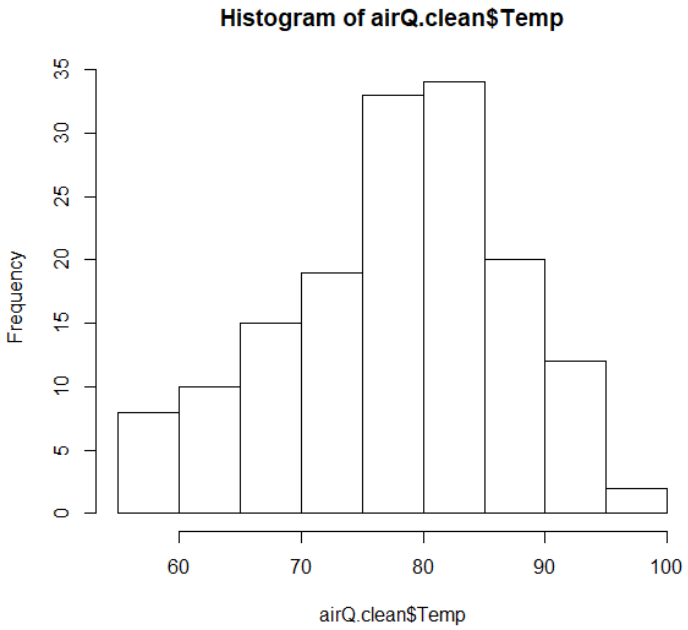



```
>
> ## Wind
> printVecInfo(airQ.clean$Wind)
```

```
MEAN: 9.96
MEDIAN: 9.7
MAX: 20.7
MIN: 1.7
SD: 3.52
SKEWNESS: 0.34
QUANTILE .05: 4.6
QUANTILE .95: 15.5
> hist(airQ.clean$Wind)
```




```
>
> ## Temp
> printVecInfo(airQ.clean$Temp)
MEAN: 77.88
MEDIAN: 79
MAX: 97
MIN: 56
SD: 9.47
SKEWNESS: -0.37
QUANTILE .05: 60.2
QUANTILE .95: 92
> hist(airQ.clean$Temp)
```


Histogram of airQ.clean$Temp
Frequency
0
5
10
15
20
25
30
35
60
70
80
90
100
airQ.clean$Temp