Assignment 1

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9/9/2019

Part I

1

S1

```
sum(1:2019)
```

```
## [1] 2039190
```

S2

```
x <- 1:2019
sum(x^3)
```

```
## [1] 4.158296e+12
```

S3

```
sum(x^x)
```

```
## [1] Inf
```

S4

```
y <- c(1, -1)
z <- x*y
```

```
## Warning in x * y: longer object length is not a multiple of shorter object
## length
```

```
sum(z^x)
```

```
## [1] Inf
```

S5

```
sum(1/(x^2))
```

```
## [1] 1.644439
```

S6

```
sum(1/x)
```

```
## [1] 8.187821
```

S7

```
sum(1/(x^3))
```

```
## [1] 1.202057
```

S8

```
sum(1/z)
```

```
## [1] 0.6933948
```

2

a

```
x <- rnorm(1000, 10,1)
mean(x)
```

```
## [1] 10.03742
```

```
sd(x)
```

```
## [1] 1.017602
```

b

```
'50% of the sample should be greater than 10'
```

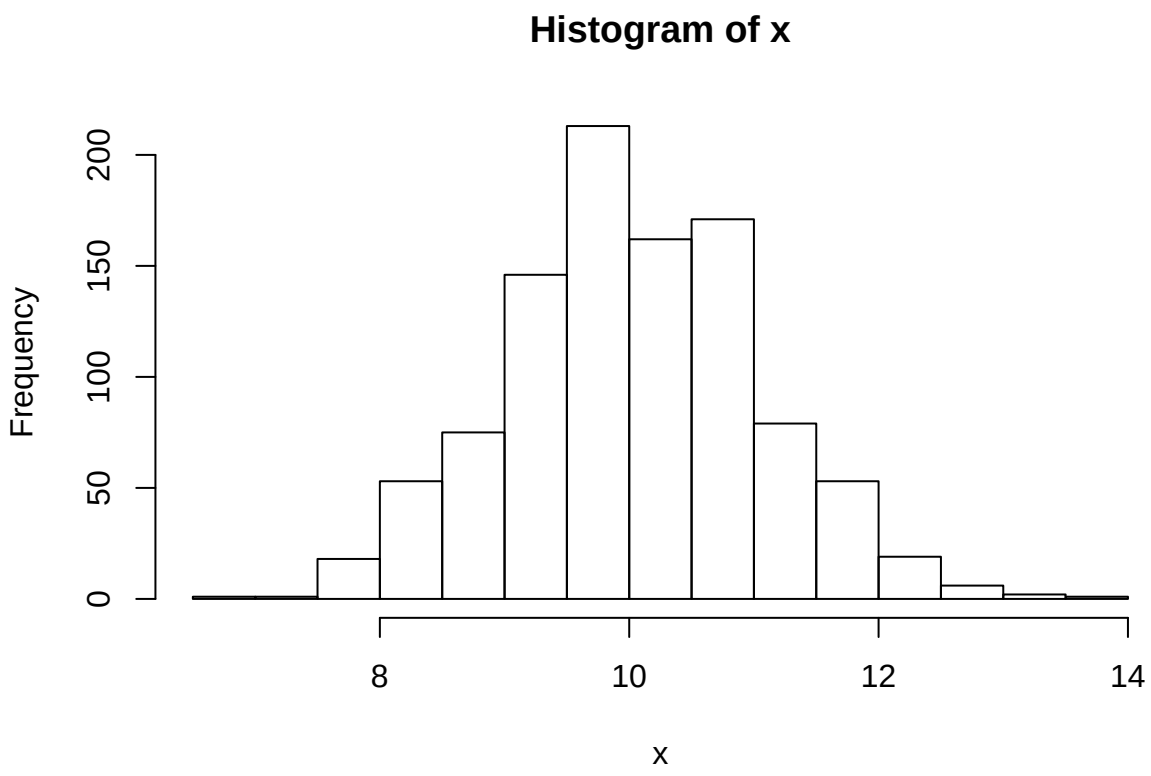
```
## [1] "50% of the sample should be greater than 10"
```

```r
sum(x>10)
```

```
## [1] 493
```

c

```r
hist(x)
```



d

```r
x <- rnorm(1000, 2,1)
sum(x>1) / 1000
```

```
## [1] 0.825
```

3

a

```
x <- sample(1:6, 1000, replace = TRUE)
```

b

```
mean(x)
```

```
## [1] 3.49
```

```
sd(x)
```

```
## [1] 1.74727
```

c

```
sum(x==6)
```

```
## [1] 173
```

d

```
table(x, dnn = "Dice Frequency")
```

```
## Dice Frequency
##   1   2   3   4   5   6
## 188 148 165 157 169 173
```

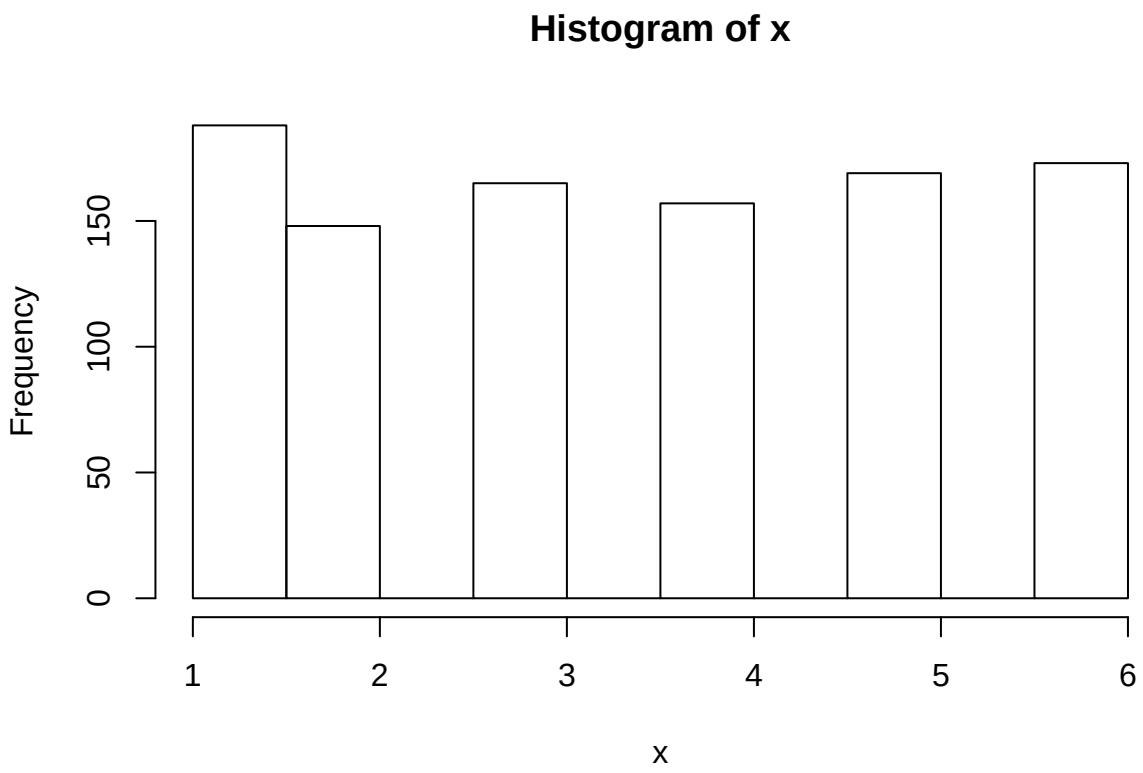
e

```
prop.table(table(x, dnn = "Dice Relative Frequency"))
```

```
## Dice Relative Frequency
##     1     2     3     4     5     6
## 0.188 0.148 0.165 0.157 0.169 0.173
```

f

```r
hist(x)
```



4

a

```r
x_1 <- sample(1:6, 1000, replace = TRUE)
x_2 <- sample(1:6, 1000, replace = TRUE)
x_3 <- sample(1:6, 1000, replace = TRUE)

sum(x_1 > x_2 + x_3) / 1000
```

```
## [1] 0.086
```

b

```r
x_1 <- sample(1:6, 1000, replace = TRUE)
x_2 <- sample(1:6, 1000, replace = TRUE)
x_3 <- sample(1:6, 1000, replace = TRUE)
```

```r
sum((x_1)^2 > (x_2)^2 + (x_3)^2) / 1000
```

```
## [1] 0.209
```

5

```r
'tail = 0, head = 1'
```

```
## [1] "tail = 0, head = 1"
```

```r
x_1 <- sample(0:1, 1000, replace = TRUE)
x_2 <- sample(0:1, 1000, replace = TRUE)
x_3 <- sample(0:1, 1000, replace = TRUE)

sum(x_1 == 0 & x_2 == 0 & x_3 == 0) / 1000
```

```
## [1] 0.129
```

6

```r
'tail = 0, head = 1'
```

```
## [1] "tail = 0, head = 1"
```

```r
count <- 0
for (i in 1:1000) {
  x <- 0
  x <- sample(0:1, 10, replace = TRUE)

    for (j in 1:8) {
      if (x[j] == 0 & x[j+1] == 0 & x[j+2] == 0) {
          count <- count +1
          break
      }
      }

    }

count
```

```
## [1] 507
```

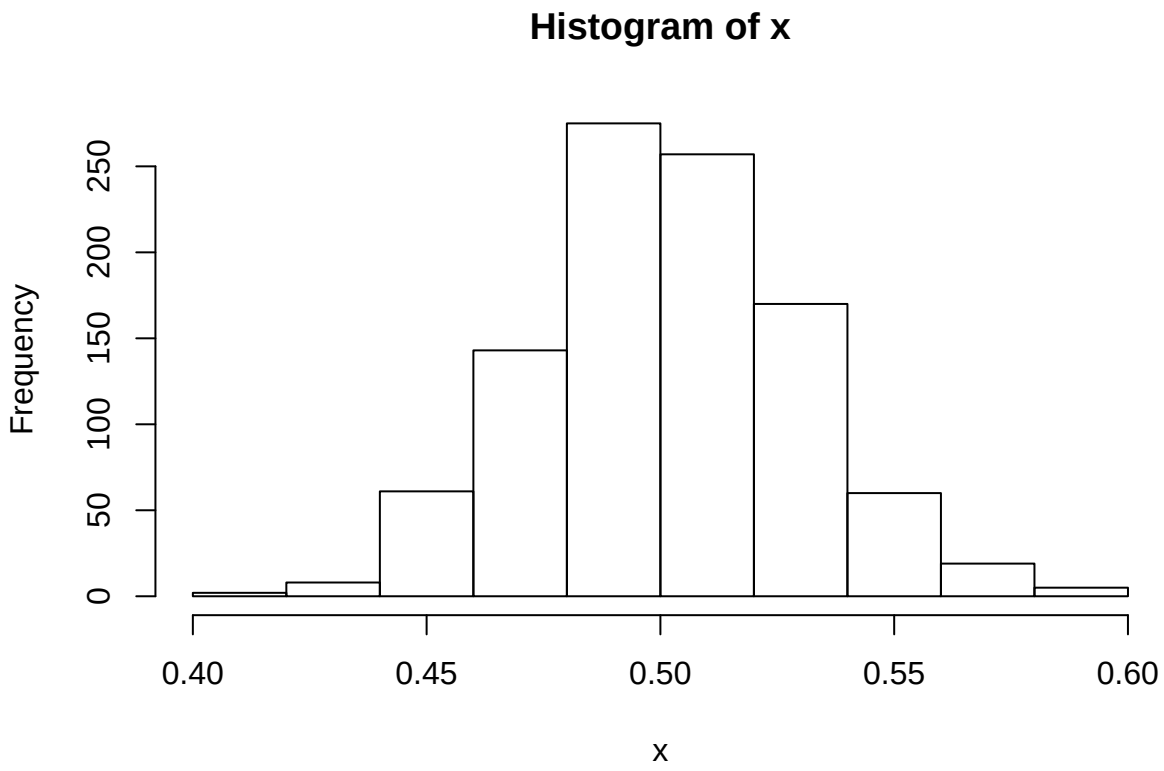
7

Normal Distribution

```
y <- matrix(runif(100000, min=0, max=1), nrow = 1000)

x <- rowMeans(y)

'X looks like normal distribution'
```

```
## [1] "X looks like normal distribution"
```

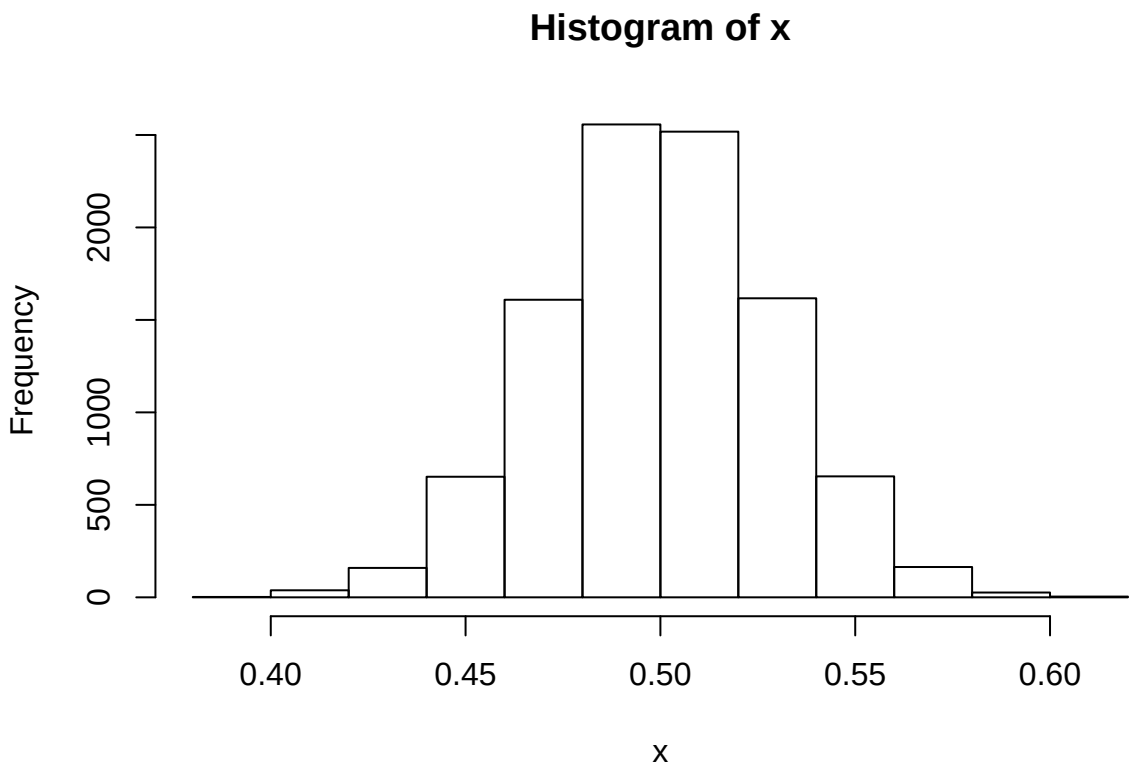
```
hist(x)
```




```
#Increased Iteration

y <- matrix(runif(1000000, min=0, max=1), nrow = 10000)

x <- rowMeans(y)

'X looks like normal distribution'
```

```
## [1] "X looks like normal distribution"
```

```r
hist(x)
```

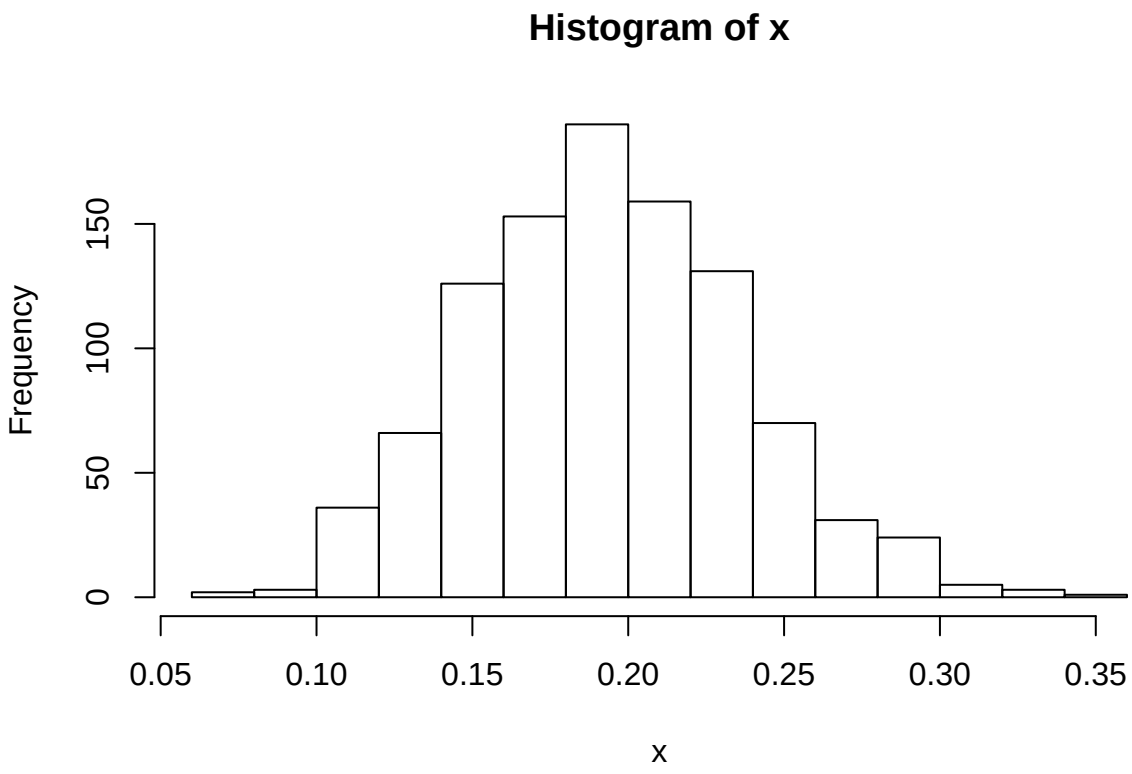


Poisson Distribution

```r
y <- matrix(rpois(100000, 0.2), nrow = 1000)

x <- rowMeans(y)

'X looks like normal distribution'
```

```
## [1] "X looks like normal distribution"
```

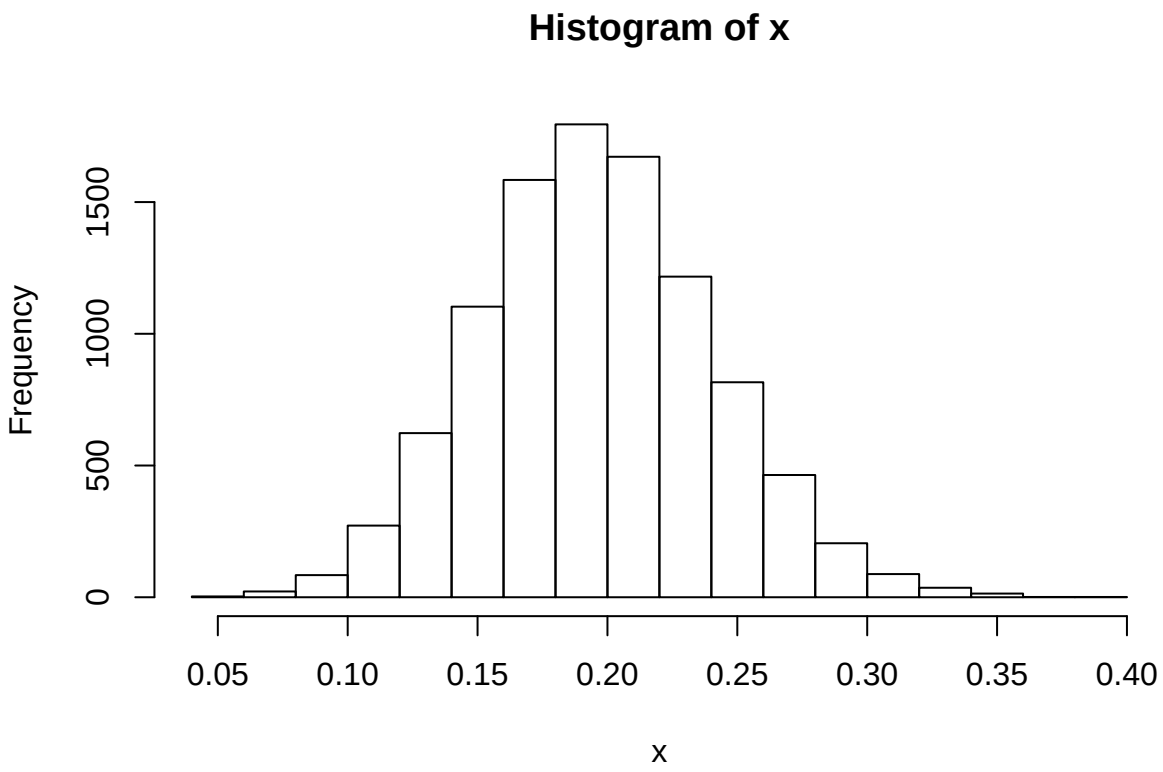
```r
hist(x)
```




```
#Increased Iteration
y <- matrix(rpois(1000000, 0.2), nrow = 10000)
x <- rowMeans(y)

'X looks like normal distribution'
```

```
## [1] "X looks like normal distribution"
```

```
hist(x)
```

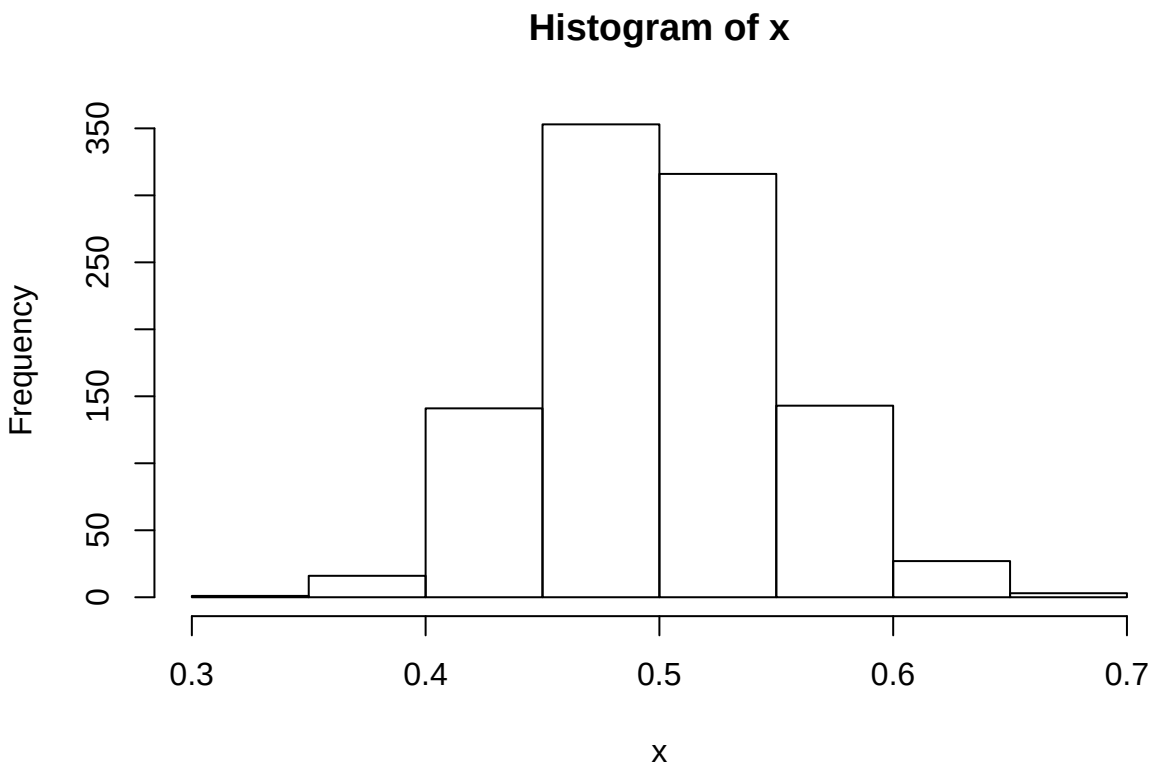


Exponential Distribution

```
y <- matrix(rexp(100000, 2), nrow = 1000)
x <- rowMeans(y)


'X looks like normal distribution'
```

```
## [1] "X looks like normal distribution"
```

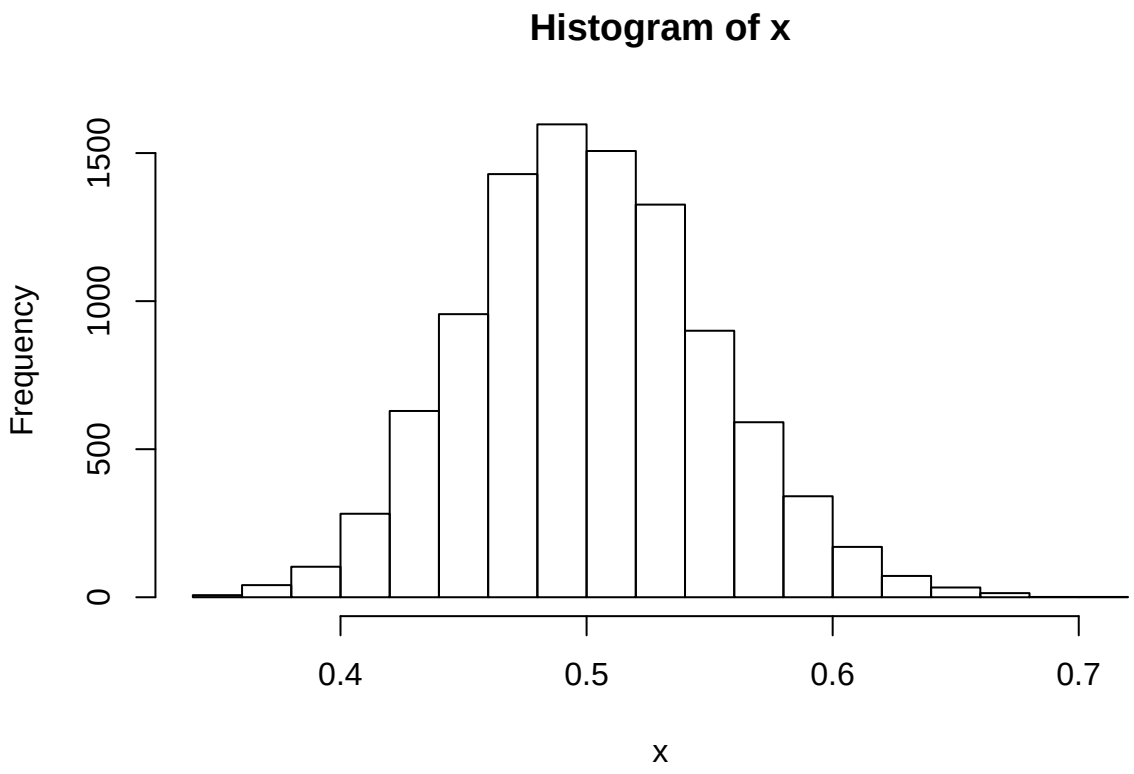
```
hist(x)
```




```
#Increased Iteration
y <- matrix(rexp(1000000, 2), nrow = 10000)
x <- rowMeans(y)


'X looks like normal distribution'
```

```
## [1] "X looks like normal distribution"
```

```
hist(x)
```



#Part II

```
'# 7'
```

```
## [1] "# 7"
```

```
titanic <- read.csv("~/MATH 421/titanic.csv")
str(titanic)
```

```
## 'data.frame':    891 obs. of  12 variables:
##  $ PassengerId: int  1 2 3 4 5 6 7 8 9 10 ...
##  $ Survived   : int  0 1 1 1 0 0 0 0 1 1 ...
##  $ Pclass     : int  3 1 3 1 3 3 1 3 3 2 ...
##  $ Name       : Factor w/ 891 levels "Abbing, Mr. Anthony",..: 109 191 358 277 16 559 520 629 417 581
##  $ Sex        : Factor w/ 2 levels "female","male": 2 1 1 1 2 2 2 2 1 1 ...
##  $ Age        : num  22 38 26 35 35 NA 54 2 27 14 ...
##  $ SibSp      : int  1 1 0 1 0 0 0 3 0 1 ...
##  $ Parch      : int  0 0 0 0 0 0 0 1 2 0 ...
##  $ Ticket     : Factor w/ 681 levels "110152","110413",..: 524 597 670 50 473 276 86 396 345 133 ...
##  $ Fare       : num  7.25 71.28 7.92 53.1 8.05 ...
##  $ Cabin      : Factor w/ 148 levels "","A10","A14",..: 1 83 1 57 1 1 131 1 1 1 ...
##  $ Embarked   : Factor w/ 4 levels "","C","Q","S": 4 2 4 4 4 3 4 4 4 2 ...
```

```
'# 8'
```

```
## [1] "# 8"
```

```
knitr::kable(titanic[1:10,])
```

PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch
1	0	3	Braund, Mr. Owen Harris	male	22	1	0
2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Thayer)	female	38	1	0
3	1	3	Heikkinen, Miss. Laina	female	26	0	0
4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35	1	0
5	0	3	Allen, Mr. William Henry	male	35	0	0
6	0	3	Moran, Mr. James	male	NA	0	0
7	0	1	McCarthy, Mr. Timothy J	male	54	0	0
8	0	3	Palsson, Master. Gosta Leonard	male	2	3	1
9	1	3	Johnson, Mrs. Oscar W (Elisabeth Vilhelmina Berg)	female	27	0	2
10	1	2	Nasser, Mrs. Nicholas (Adele Achem)	female	14	1	0

```
'# 9'
```

```
## [1] "# 9"
```

```
sum(is.na(titanic))
```

```
## [1] 177
```

```
sapply(titanic, function(x) sum(is.na(x)))
```

```
## PassengerId    Survived      Pclass        Name         Sex         Age
##           0           0           0           0           0         177
##       SibSp       Parch      Ticket        Fare       Cabin    Embarked
##           0           0           0           0           0           0
```

```
'# 10'
```

```
## [1] "# 10"
```

```
Average_age <- mean(titanic$Age, na.rm = TRUE)

'# 11'
```

```
## [1] "# 11"
```

```
titanic$Age[is.na(titanic$Age)] <- Average_age

'# 12'
```

```
## [1] "# 12"
```

```r
titanic_rm <- titanic[, c(-1,-4,-9,-11)]

'# 13'
```

```
## [1] "# 13"
```

```r
mean(titanic_rm$Age[titanic_rm$Sex == "female"])
```

```
## [1] 28.21673
```

```r
'# 14'
```

```
## [1] "# 14"
```

```r
median(titanic_rm$Fare[titanic_rm$Pclass==1])
```

```
## [1] 60.2875
```

```r
'# 15'
```

```
## [1] "# 15"
```

```r
median(titanic_rm$Fare[titanic_rm$Sex == "female" & titanic_rm$Pclass !=1])
```

```
## [1] 14.45625
```

```r
'#16'
```

```
## [1] "#16"
```

```r
median(titanic_rm$Age[titanic_rm$Survived==1 & titanic_rm$Sex == "female" & titanic_rm$Pclass !=3])
```

```
## [1] 30
```

```r
'# 17'
```

```
## [1] "# 17"
```

```r
teens <- titanic_rm[titanic_rm$Age >= 10 & titanic_rm$Age <= 19,]
mean(titanic_rm$Fare[titanic_rm$Survived==1 & titanic_rm$Sex =='female'])
```

```
## [1] 51.93857
```

```r
'# 18'
```

```
## [1] "# 18"
```

```r
female_teens <- teens[teens$Sex == 'female',]
aggregate(female_teens$Fare, female_teens[c("Survived", "Pclass")], mean)[c(-3),]
```

```
##   Survived Pclass          x
## 1        1      1 107.540708
## 2        1      2  20.008850
## 4        1      3   8.769885
```

```r
'# 19'
```

```
## [1] "# 19"
```

```r
Average_fare <- mean(titanic$Fare)

Not_Survived_Paid_Lots <- sum(titanic$Survived == 0 & titanic$Fare > Average_fare)

Survived_Paid_Lots <-sum(titanic$Survived == 1 & titanic$Fare > Average_fare)

Survived_Paid_Lots / Not_Survived_Paid_Lots
```

```
## [1] 1.482353
```

```r
'# 20'
```

```
## [1] "# 20"
```

```r
titanic_rm$sfare <- (titanic_rm$Fare - Average_fare) /(sd(titanic_rm$Fare))

'# 21'
```

```
## [1] "# 21"
```

```r
cheap_or_not <- function(x) {
  if (x < Average_fare) {
   y <- "cheap"
  }
  if (x > Average_fare) {
    y <- "expensive"
  }
  if (x == Average_fare) {
    y <- "normal"
  }
  y
}
cheap_or_not(10)
```

```
## [1] "cheap"
```

```
titanic_rm$cfare <- sapply(titanic_rm$Fare, cheap_or_not)

'# 22'
```

```
## [1] "# 22"
```

```
titanic_rm$cage <- sapply(titanic_rm$Age, function(x) x/10 - (x%%10)/10)

'# 23'
```

```
## [1] "# 23"
```

```
table(titanic_rm$Embarked)
```

```
##
##       C   Q   S
##   2 168  77 644
```

```
levels(titanic_rm$Embarked)[1] <- "S"
```