Assignment3

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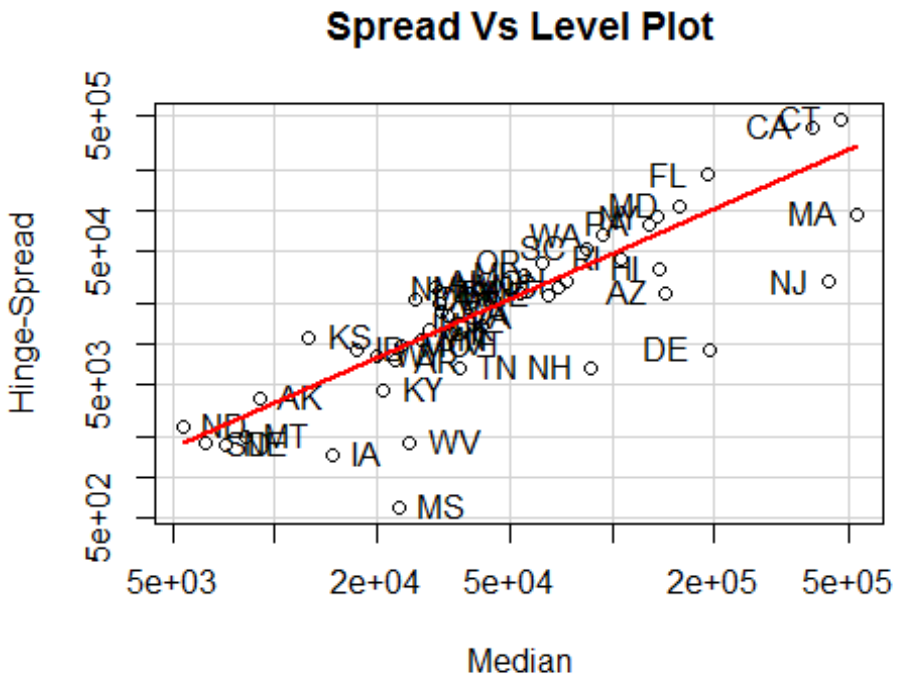
Question 1

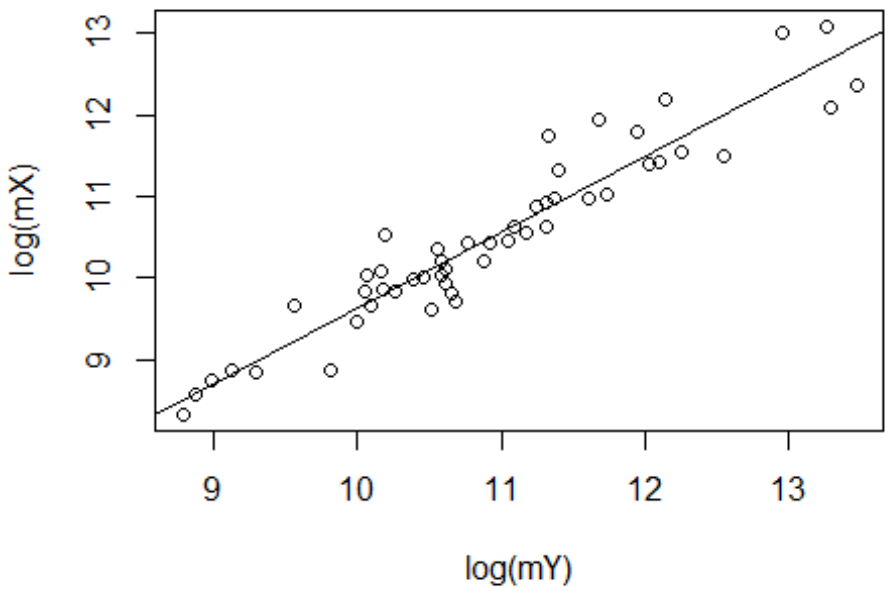
```
#1 a)
library(noncensus)
data(counties)
library(car)

completeCounties<-counties[complete.cases(counties),]
stateAggre<-with(counties, aggregate(counties$state, list(counties$state),
FUN=unique))
med<-with(counties, aggregate(counties$population,
list(counties$state),FUN=median))
median<-as.vector(med$x)
state<-as.matrix(stateAggre$x)
stateMedianCombine <- cbind(median, state)
completeMedian<-stateMedianCombine[complete.cases(stateMedianCombine),]

quantiles<-with(counties, aggregate(counties$population,
list(counties$state),FUN=quantile, na.rm = TRUE ))

completeQuantiles <- quantiles[complete.cases(quantiles),]
Forths<-matrix()
for(i in 1:nrow(quantiles$x)){
  Forths<-c(Forths,(quantiles$x[i,'75%'] - quantiles$x[i,'25%']))
}
transForths<- t(t(Forths))
completeForths <- transForths[complete.cases(transForths)]
matrixMH<- cbind(completeMedian,completeForths)
mX<-as.numeric(matrixMH[-c(8),1])
mY<-as.numeric(matrixMH[-c(8),3])
matrixMH2 <- cbind(mX,mY)

#Level vs Spread Plot
spreadLevelPlot(matrixMH2,by=matrixMH[-c(8),2],main="Spread Vs Level Plot")

## Warning in spreadLevelPlot.default(matrixMH2, by = matrixMH[-c(8), 2],
main
## = "Spread Vs Level Plot"): NAs ignored
```




```
##    LowerHinge     Median UpperHinge Hinge-Spread
## ND    4153.00   5347.500    6542.00      2389.00
## SD    5369.50   6269.375    7169.25      1799.75
## NE    6274.00   7152.500    8031.00      1757.00
## MT    7198.00   8218.125    9238.25      2040.25
## AK    7029.00   8999.000   10969.00      3940.00
## KS    7053.00  12674.000   18295.00     11242.00
## IA   14200.50  14939.750   15679.00      1478.50
## ID   13014.00  17491.875   21969.75      8955.75
## WY   15885.00  19987.250   24089.50      8204.50
## KY   18751.00  20992.375   23233.75      4482.75
## AR   19019.00  22763.000   26507.00      7488.00
## MS   22989.50  23290.625   23591.75       602.25
## MO   18956.00  23816.250   28676.50      9720.50
## WV   24069.00  24983.250   25897.50      1828.50
## CO   15083.50  26006.250   36929.00     21845.50
## MN   21676.00  27043.000   32410.00     10734.00
## OK   22119.00  28499.500   34880.00     12761.00
## NV   16528.00  30000.500   43473.00     26945.00
## TX   18381.00  30535.375   42689.75     24308.75
## UT   20802.00  30776.000   40750.00     19948.00
## GA   22598.00  31214.500   39831.00     17233.00
## VT   26781.75  31877.375   36973.00     10191.25
## VA   24544.00  32585.375   40626.75     16082.75
## IL   27315.50  33364.500   39413.50     12098.00
## TN   31807.00  35074.250   38341.50      6534.50
## NM   27213.00  39976.000   52739.00     25526.00
```

```
## IN   33844.00  40806.375   47768.75     13924.75
## LA   33685.50  44425.500   55165.50     21480.00
## AL   34339.00  48512.000   62685.00     28346.00
## WI   41384.00  53248.000   65112.00     23728.00
## MI   38520.00  55003.750   71487.50     32967.50
## OR   41536.50  61540.500   81544.50     40008.00
## ME   53323.00  64776.625   76230.25     22907.25
## NC   55621.50  68953.125   82284.75     26663.25
## OH   58185.50  72728.500   87271.50     29086.00
## SC   57750.00  83540.250  109330.50     51580.50
## NH   83117.50  86425.750   89734.00      6616.50
## WA   60699.00  93059.500  125420.00     64721.00
## RI   83270.00 105124.500  126979.00     43709.00
## PA   88880.00 127905.000  166930.00     78050.00
## NY   91301.00 135558.875  179816.75     88515.75
## HI  117988.00 136411.000  154834.00     36846.00
## AZ  131346.00 143223.500  155101.00     23755.00
## MD  103129.50 156613.125  210096.75    106967.25
## FL   98786.00 190115.000  281444.00    182658.00
## DE  188084.50 192614.750  197145.00      9060.50
## CA  179140.50 386866.250  594592.00    415451.50
## NJ  419669.00 434201.500  448734.00     29065.00
## CT  231991.00 469961.250  707931.50    475940.50
## MA  479204.50 525250.000  571295.50     92091.00
##
## Suggested power transformation:  -0.113459
```

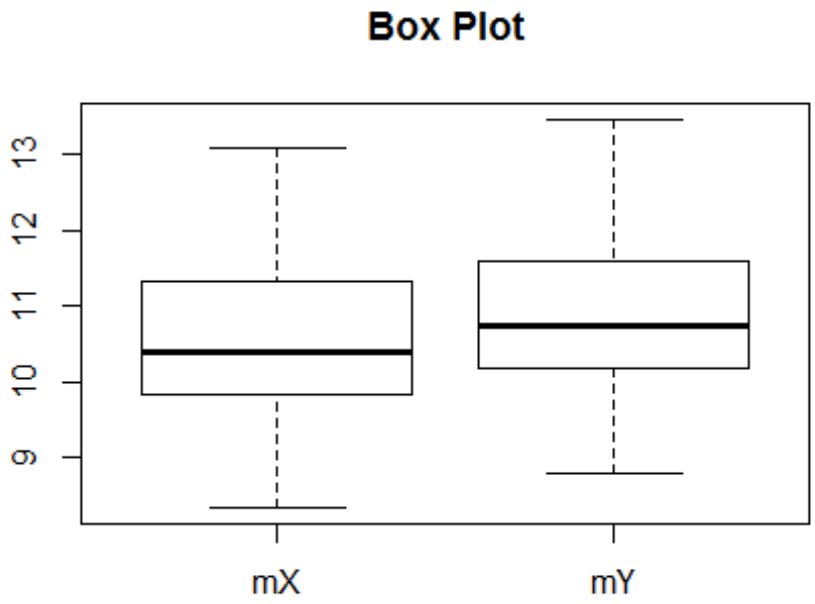
```
#Scatter plot with log transform
#scatterplotMatrix(log(matrixMH))
#abline(lm(log(matrixMH[-c(7),1])~log(matrixMH[-c(7),2])))

#matrixMHState<-cbind(matrixMH,as.matrix(stateAggre$x))


plot(log(mX)~log(mY))
abline(mod<-lm(log(mX)~log(mY)))
```



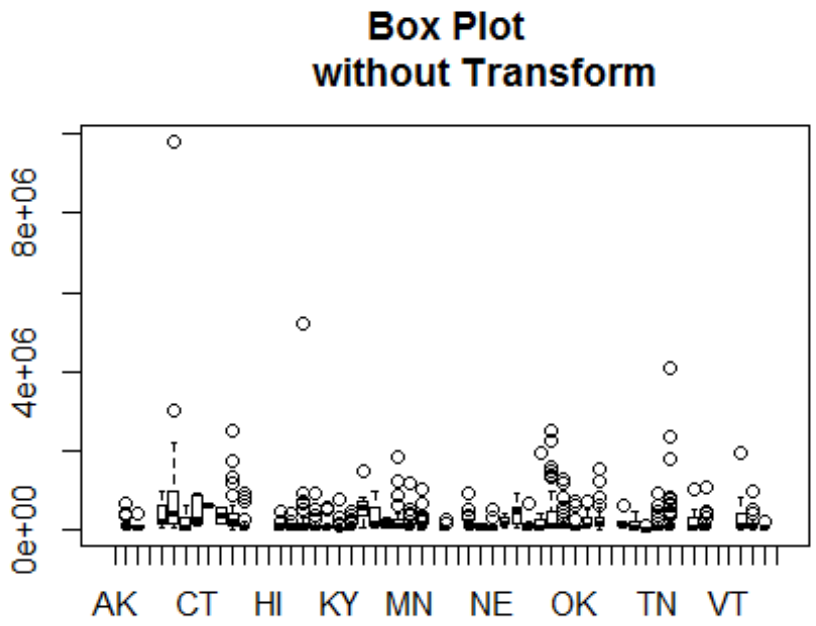

```
slope<- coef(mod)[2]
slope
```

```
##   log(mY)
## 0.9290134
```

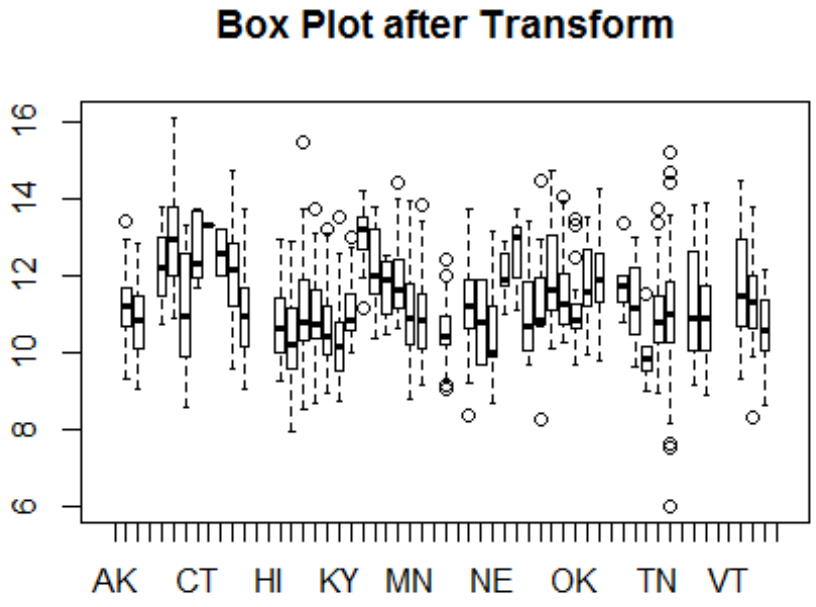
```
# Equation of line that fits is y=0.93x+c where Slope m=0.93
# Substituting (10,9.5) we get c=0.2
# Equation of line is y=0.93x+0.2
# b)
#The slope of the line is is 0.93, so p = 1-b = 1-0.93 = 0.07 = 0 (approx)
#T(x) = log(x)
boxplot(log(matrixMH2),main="Box Plot")
```




```
# c)
# Without Transform
boxplot(completeCounties$population~completeCounties$state,main="Box Plot
        without Transform")
```



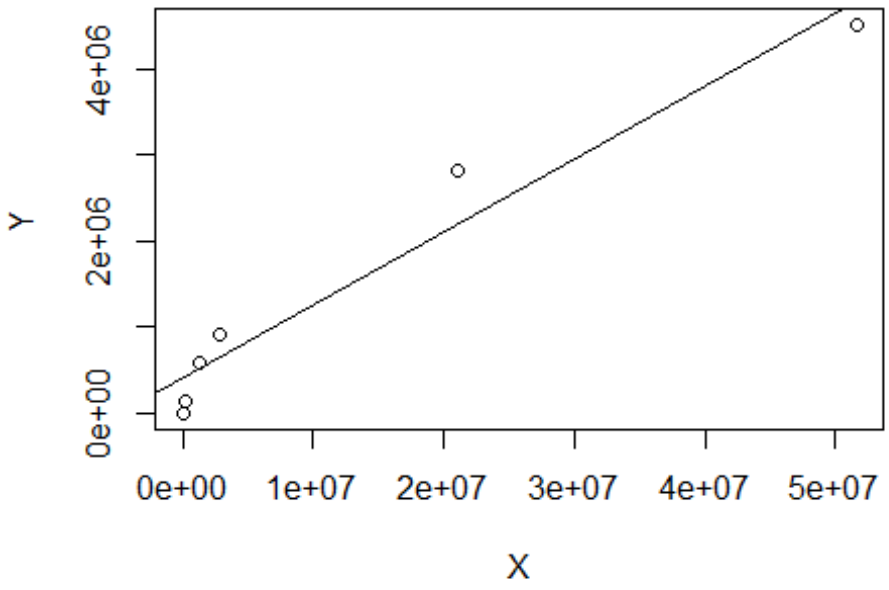

```r
# After Transform
boxplot((log(completeCounties$population)~completeCounties$state),
main="Box Plot after Transform")
```



```r
# d)
source("C:/Users/lenovo/Documents/lvalprogs.R")
CAsubset<- completeCounties[completeCounties["state"] == "CA",]
letterValues <- lval(CAsubset$population)
#root<-letterValues^(1/30)
VectorXL <- as.vector(letterValues[,2])
VectorXU <- as.vector(letterValues[,3])

M <- letterValues[1,"Lower"]

Y<- (VectorXL + VectorXU)/2 - M
X<- ((VectorXL-M)^2 + (VectorXU - M)^2) / (4*M)
letterValue<-c("M","F","E","D","C","B");
p<- (1-Y/X)
p
```

```
## [1]       NaN 0.3345424 0.5727270 0.6801925 0.8663948 0.9126492
```

```r
Table<- data.frame(letterValue,VectorXL,VectorXU,X,Y,p)

# e)
plot(Y~X)
abline(mod<-lm(Y~X))
```

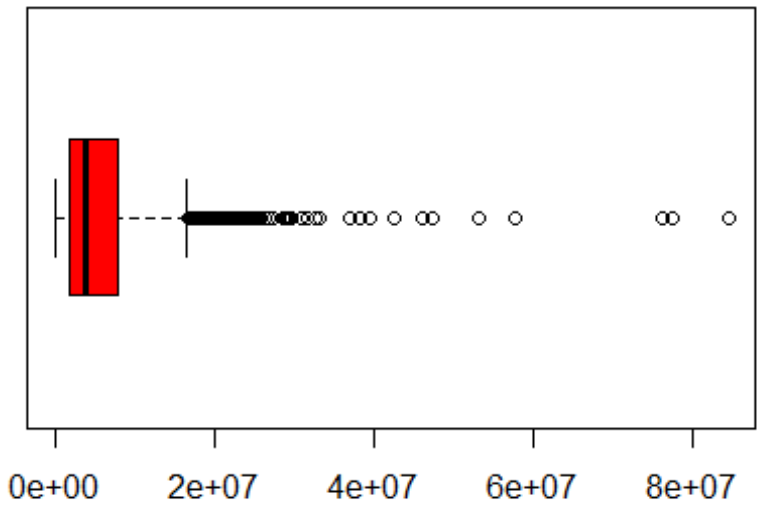



```r
slope <- coef(mod)[2]
slope
```

```
##          X
## 0.08475095

# b=0 after rounding slope to nearest 0.5
# Power transform p= 1-0= 1.


# f)
# T(x) = log(x), then T'(x) = 1/x i.e. z = x0*(1 + log(x) - log(x0)) =
427761.5 * log(x) - 5118731
#a = 427761.5, b = - 5118731
```

Question 2

```
data = read.table("ceo.txt", header = T)
# a) Number of CEO's and Highest Paid CEO's
n=length(data$TotalCompensation)
max_sal=max(data$TotalCompensation)
print(max_sal)

## [1] 84515000

print(n)

## [1] 1835

boxplot(data,horizontal = TRUE,col="red")
```




```
# There are many Outliers which can be said to be unusual values.
# b) Graphical Display for Data
```

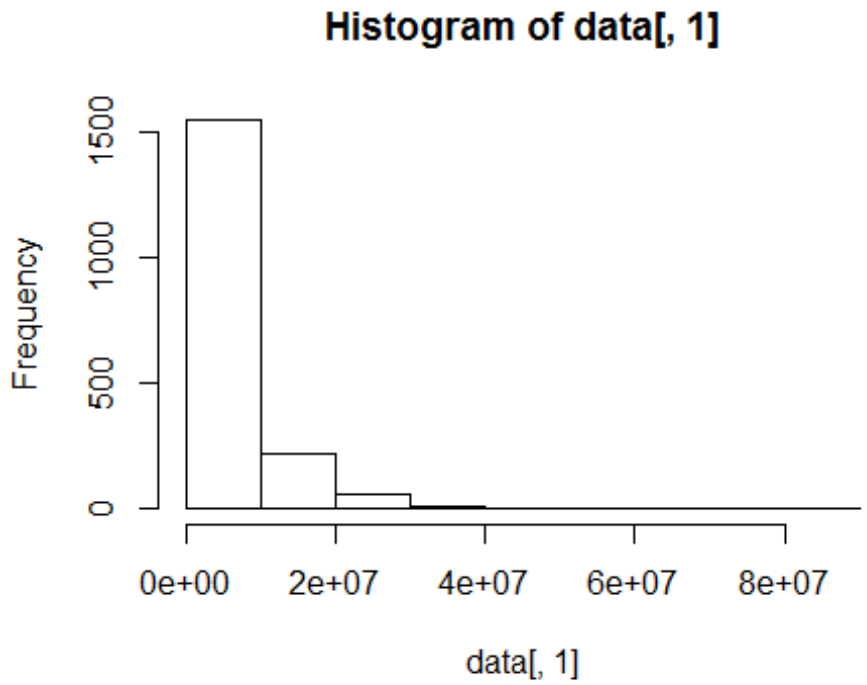
```r
hist(data[,1])
# Distribution is skewed to the right and I would like to transform the
#data.

# c) Cube root transform will be more appropriate as it will make data
#symmetric and can resemble normal distribution.

# d) We need to remove low valued data also few Ceo with salary 0 as it
# affect mean.
summary(data)
```

```
##  TotalCompensation
##  Min.   :       0
##  1st Qu.: 1987500
##  Median : 4011000
##  Mean   : 6010907
##  3rd Qu.: 7857000
##  Max.   :84515000
```

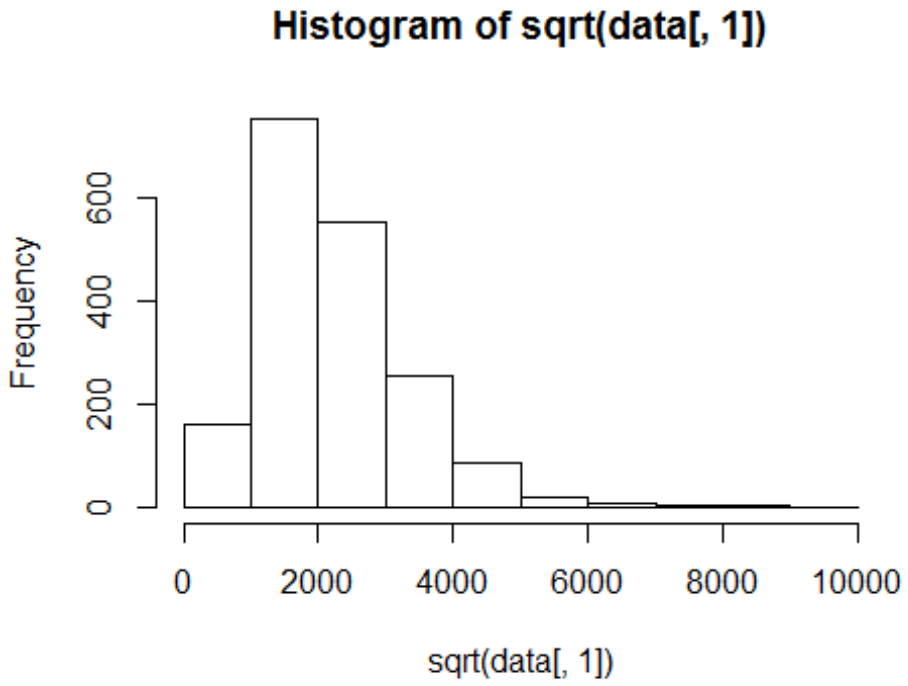
```r
clear_data<- data[data[,1]> 10000,]
summary(clear_data)
```

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
##    14000  2011000  4044000  6041000  7870000 84520000
```

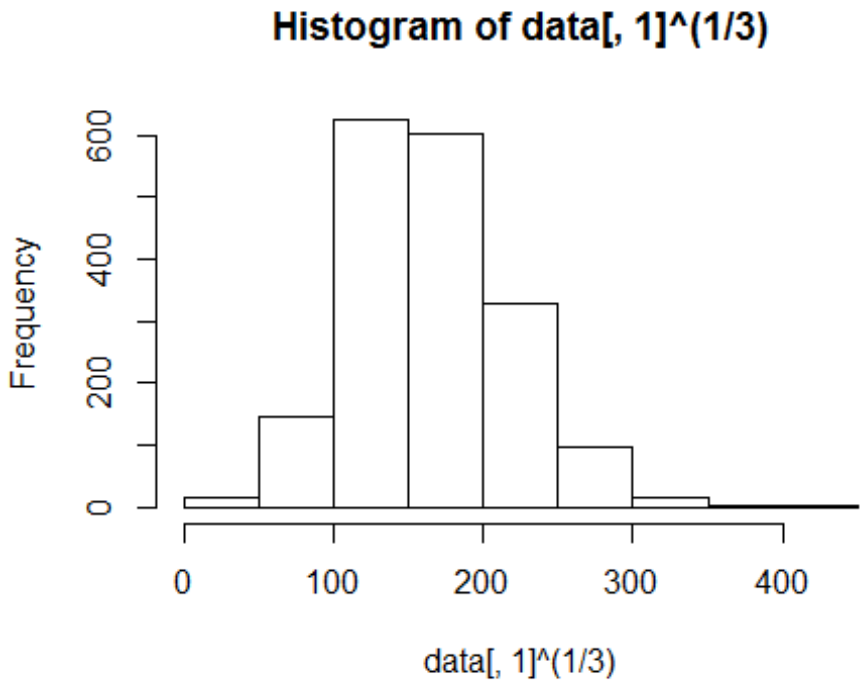
```r
# e)
hist(data[,1])
```



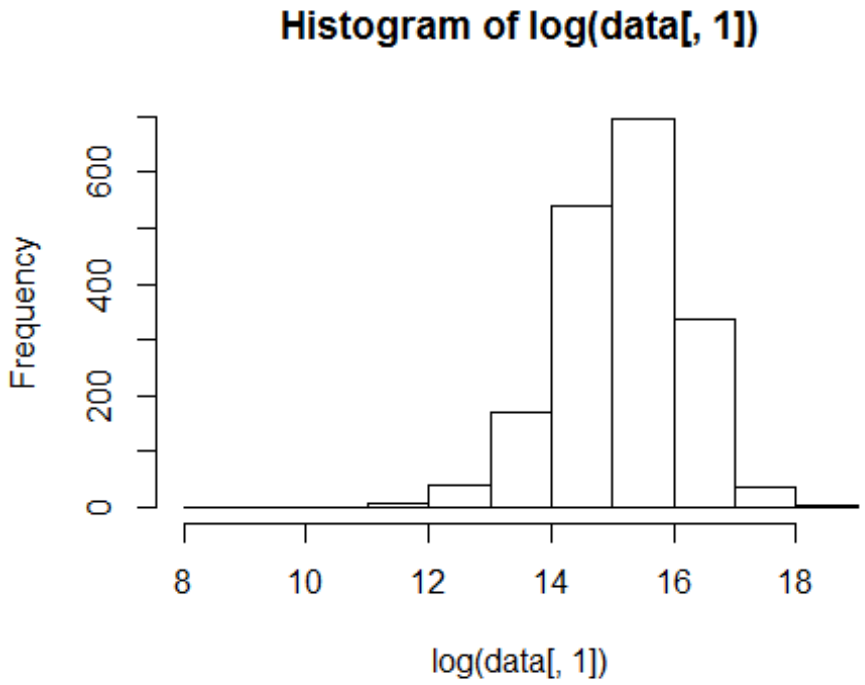
```r
# Square root Transform
hist(sqrt(data[,1]))
```



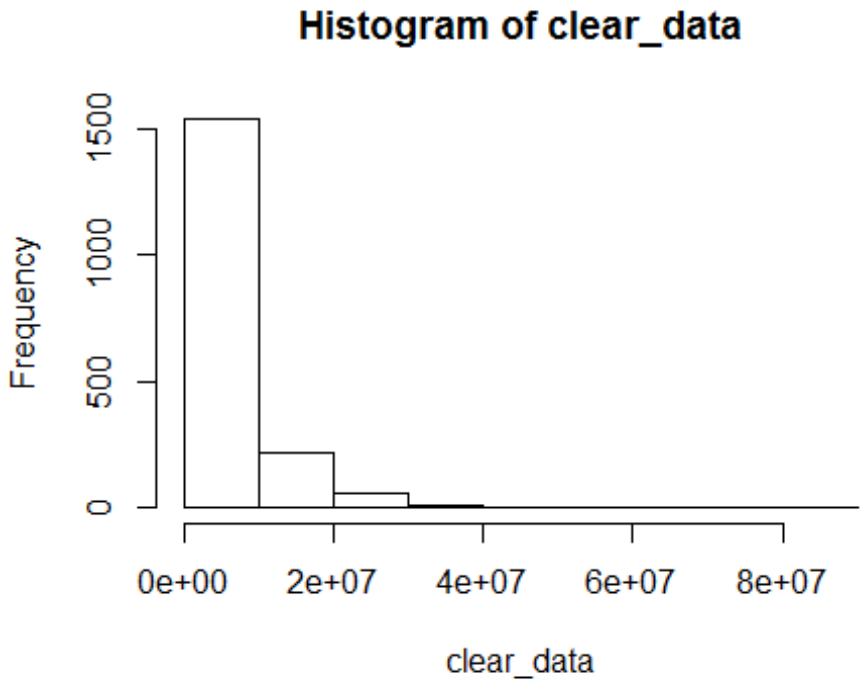

```r
# Cube root Transform
hist(data[,1]^(1/3))
```



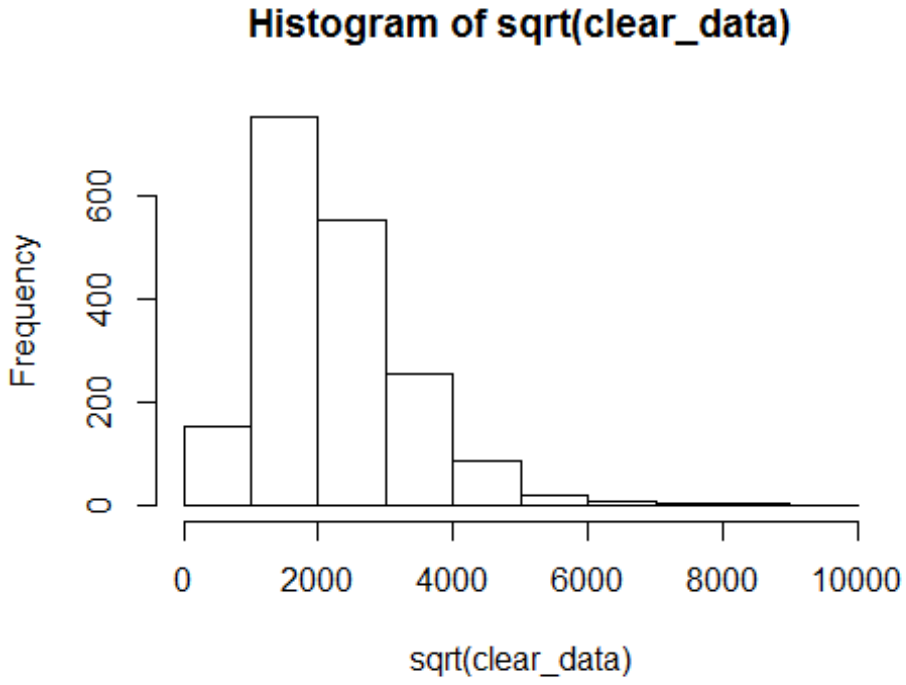

```r
# Log Transform
hist(log(data[,1]))
```



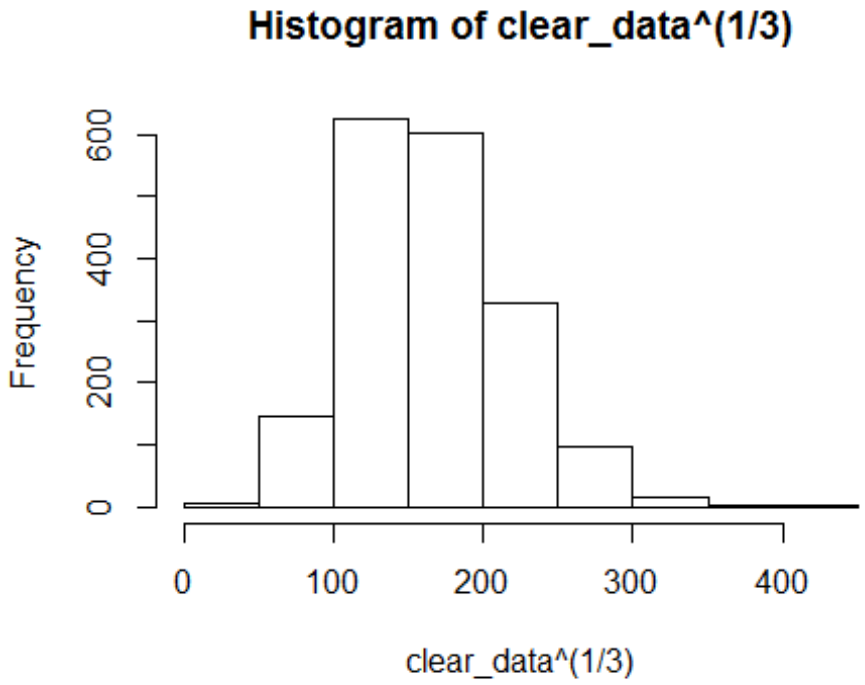
```r
# Transform after removing outliers
hist(clear_data)
```



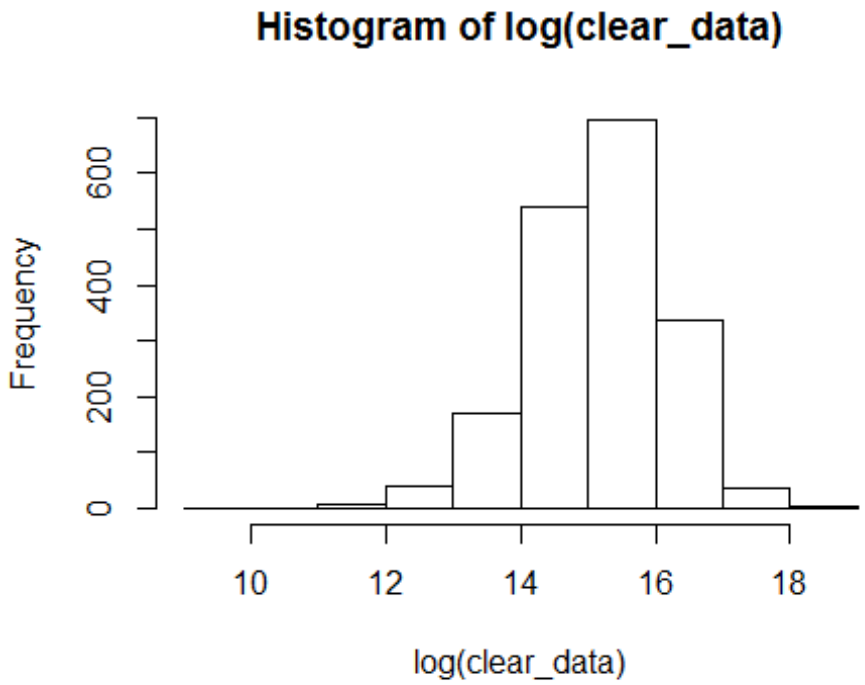

```r
hist(sqrt(clear_data))
```



```
hist(clear_data^(1/3))
```




```
hist(log(clear_data))
```



```
# As you can see data has become more symmetric when cube root transform
#is applied.

# f) I would choose cube root transform as it makes data symmetric and
#less skewed compared to log or square root transform
```

Question 3

```
#3 a)
LVhouseHold_data <- cbind(c(rep(0, 10)),c(0, 2412, 1788, 1517, 1248, 963.5,
727.5,
579,345,114),c(3480,3678,4115.5,4400.5,4799,4978.75,5241,5394.5,5510.25,5494)
,c(0,4944,6443,7284,8350,8994,9754.5,10210,10675.5,10874));

#x0 = 3480, z = a*x^(1/3) + b, dz/dx = (1/3)a*x^(-2/3), Now, at x0 = 3480 , a
= 688.9284 , b = -6960 Hence, z = 688.9284* x^(1/3) - 6960

# b)
Transformed_value <- 688.9284* (LVhouseHold_data)^(1/3) - 6960
Transformed_value

##        [,1]       [,2]     [,3]      [,4]
##  [1,] -6960 -6960.0000 3480.000 -6960.000
##  [2,] -6960  2279.1749 3674.359  4776.364
##  [3,] -6960  1401.7387 4080.319  5859.472
##  [4,] -6960   955.9422 4329.501  6394.595
##  [5,] -6960   457.2961 4660.487  7016.644
##  [6,] -6960  -155.5766 4803.797  7367.103
##  [7,] -6960  -763.9000 5006.821  7760.043
##  [8,] -6960 -1217.9504 5122.528  7985.691
##  [9,] -6960 -2128.1462 5208.336  8209.461
## [10,] -6960 -3619.5187 5196.362  8302.905

# c)
# Mids are almost same as compared to data in table 4-5.But mids are very
# far seperated compared to log, square root, fourth root transform,
# By Comparing 25th and 75th quantiles, it has moved away from  orignal
# data. Spread has increased compared to other transforms hence we can
# easily identify any outliers.
```