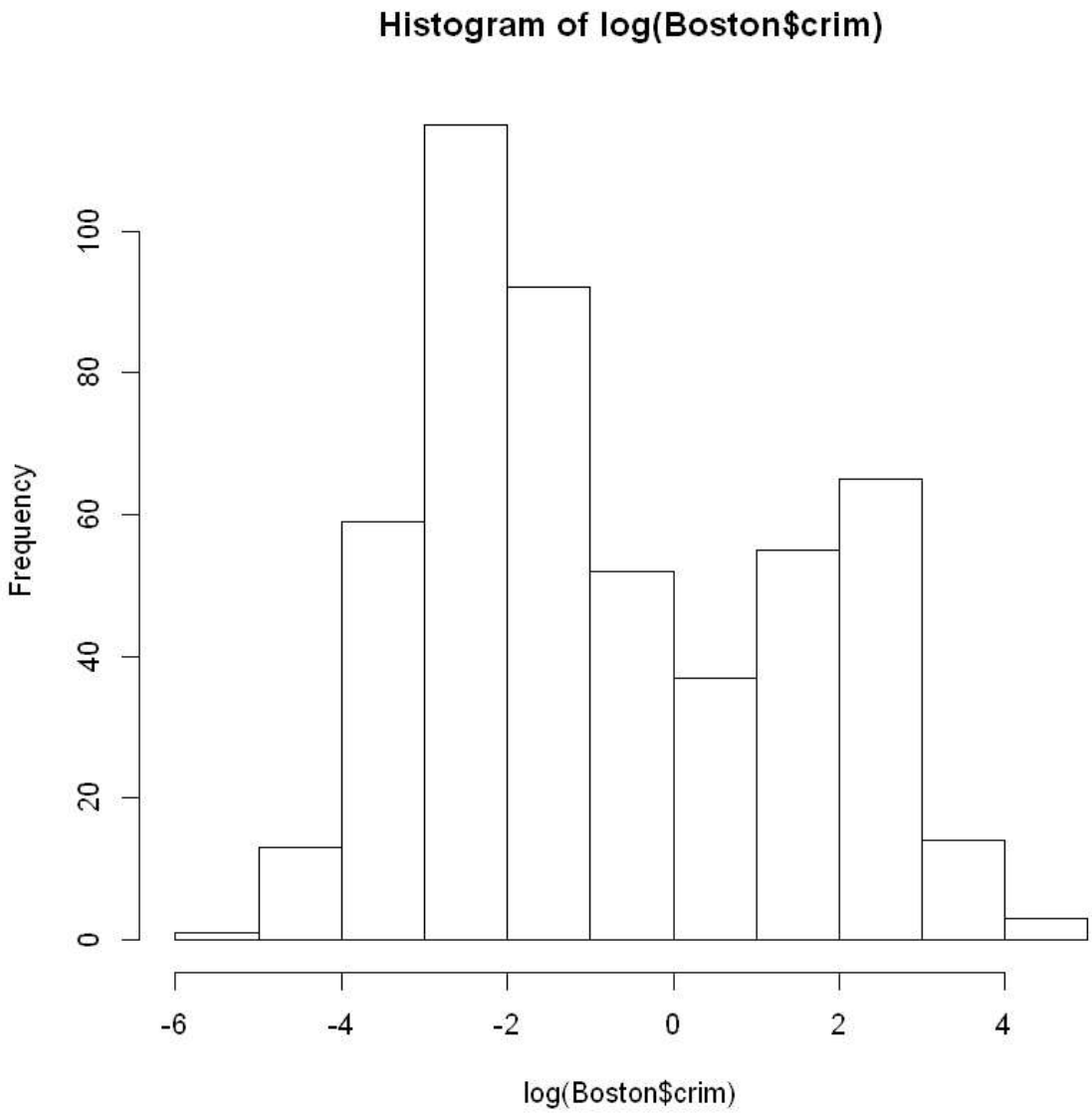
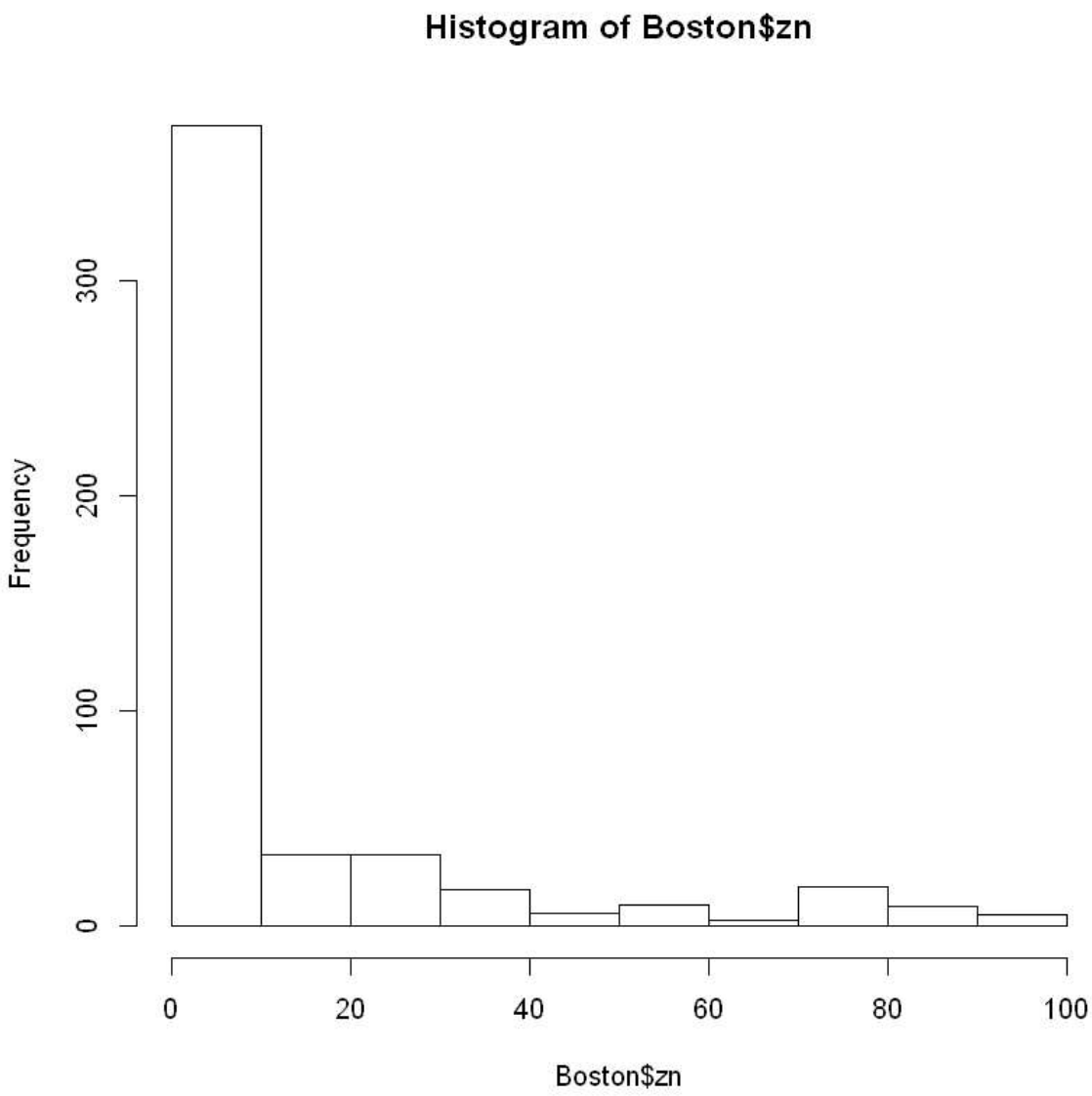
In [23]:
```
#STAT 420 HW9 Donghan Liu Donghan2
```

In [24]:
```
#1A
library(MASS)
data(Boston)
```

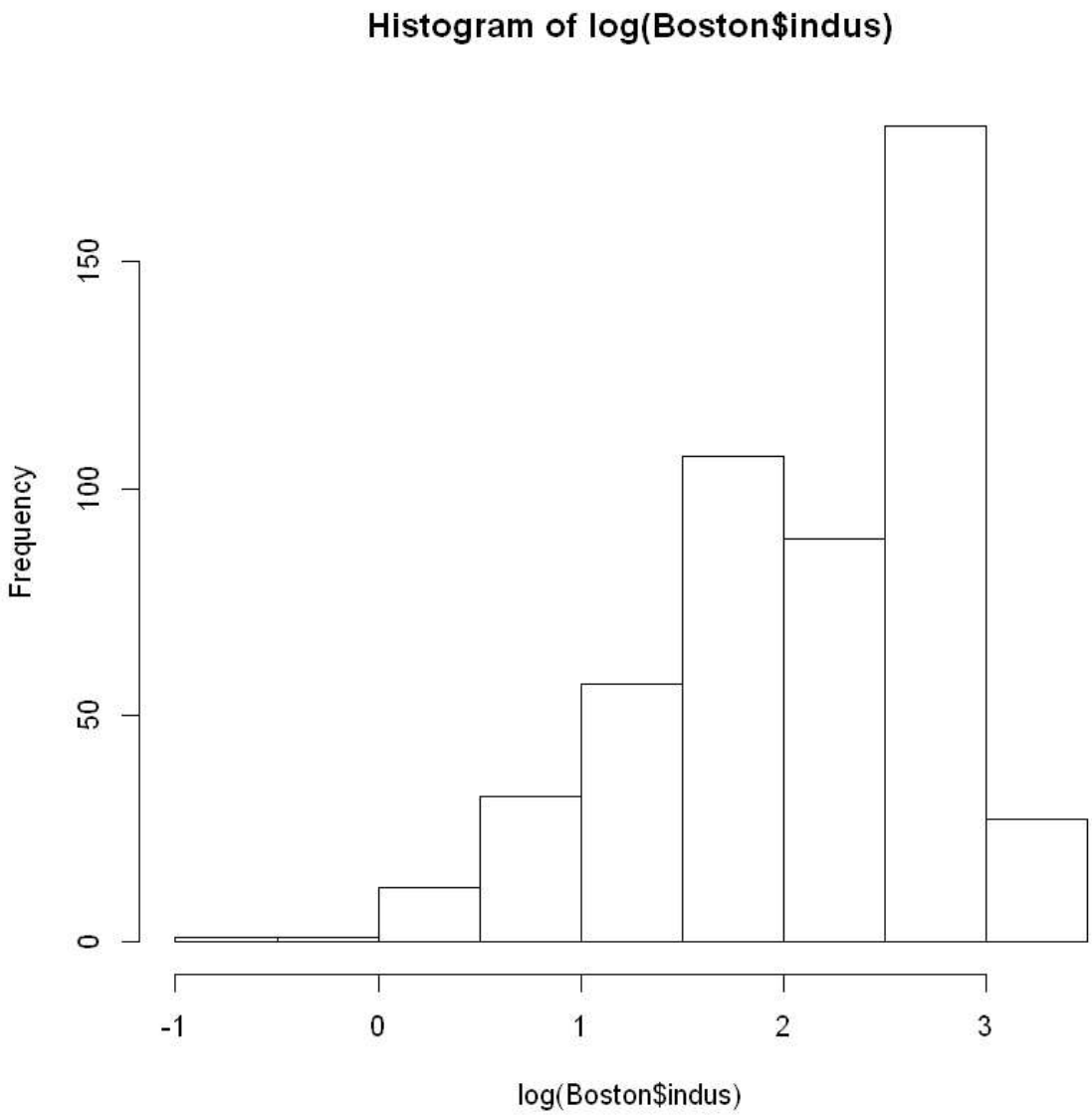
In [25]:
```
fit = lm(medv~crim+zn+indus+chas+nox+rm+age+dis+rad+tax+ptratio+black+lstat,data = Bost
on)
hist(log(Boston$crim))
crim1 = log(Boston$crim)
```



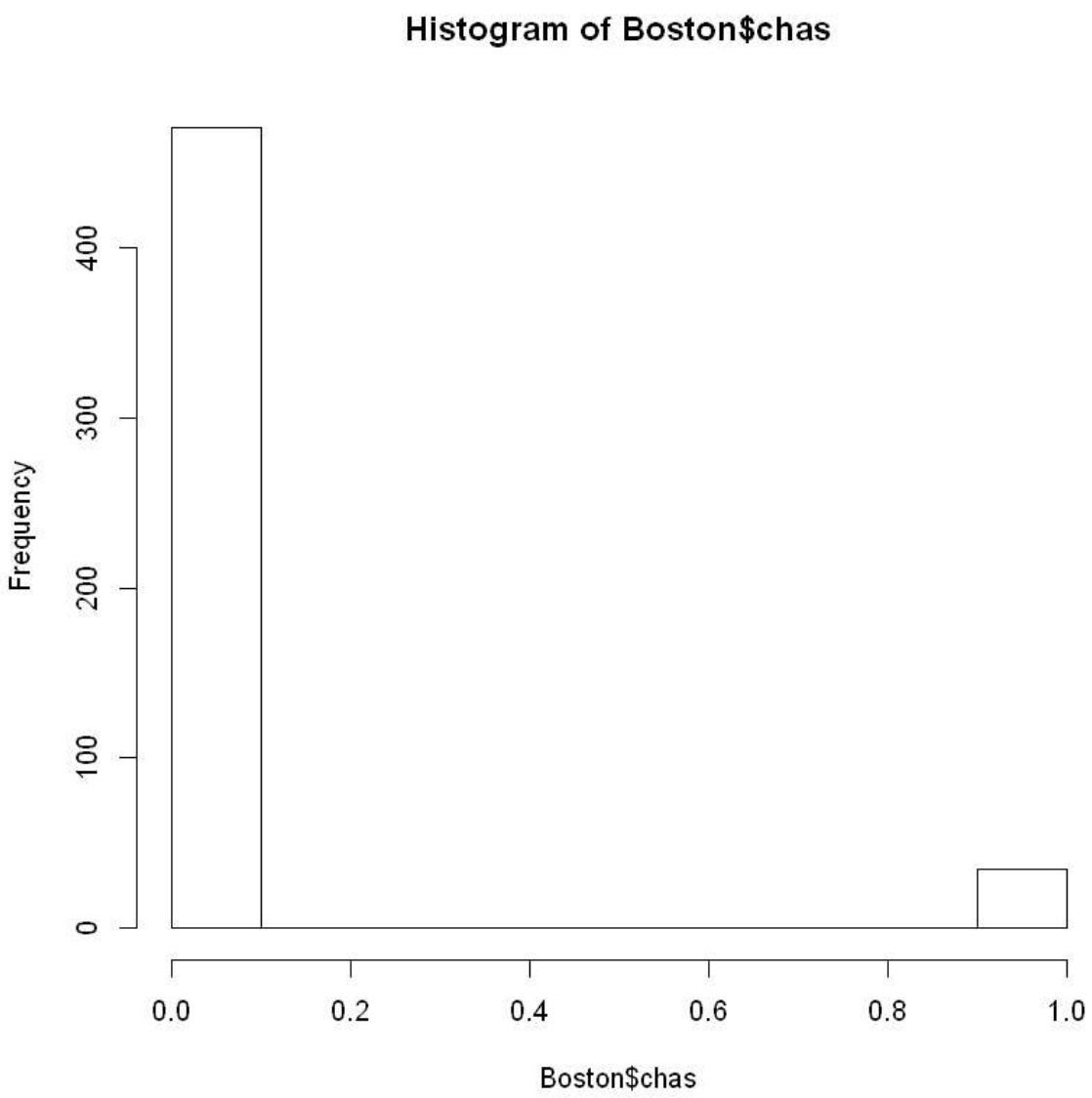
In [26]:
```
hist(Boston$zn)
zn1 = Boston$zn
```



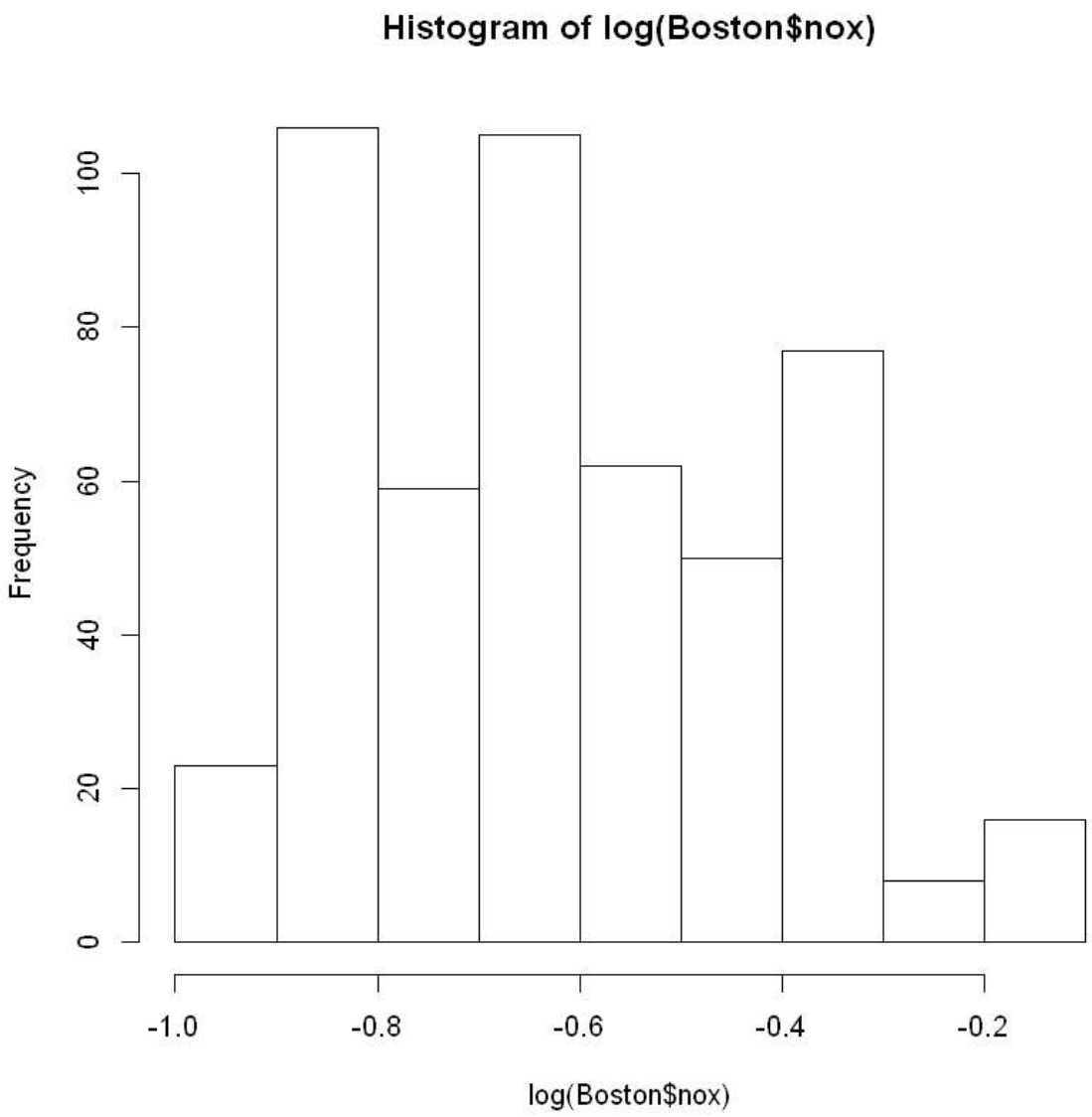
In [27]:
```
hist(log(Boston$indus))
indus1 = log(Boston$indus)
```



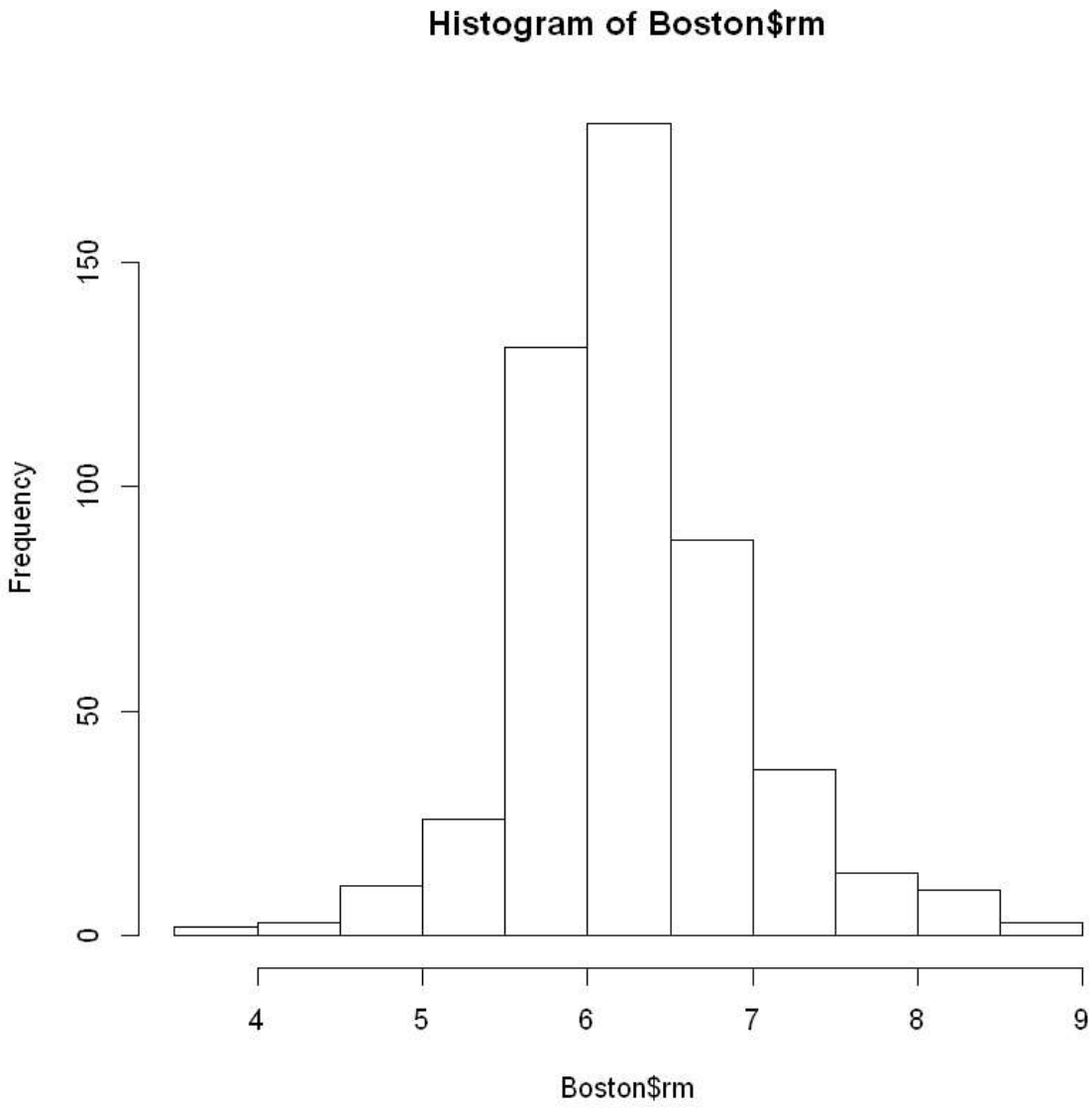
In [28]:
```
hist(Boston$chas)
chas1= Boston$chas
```



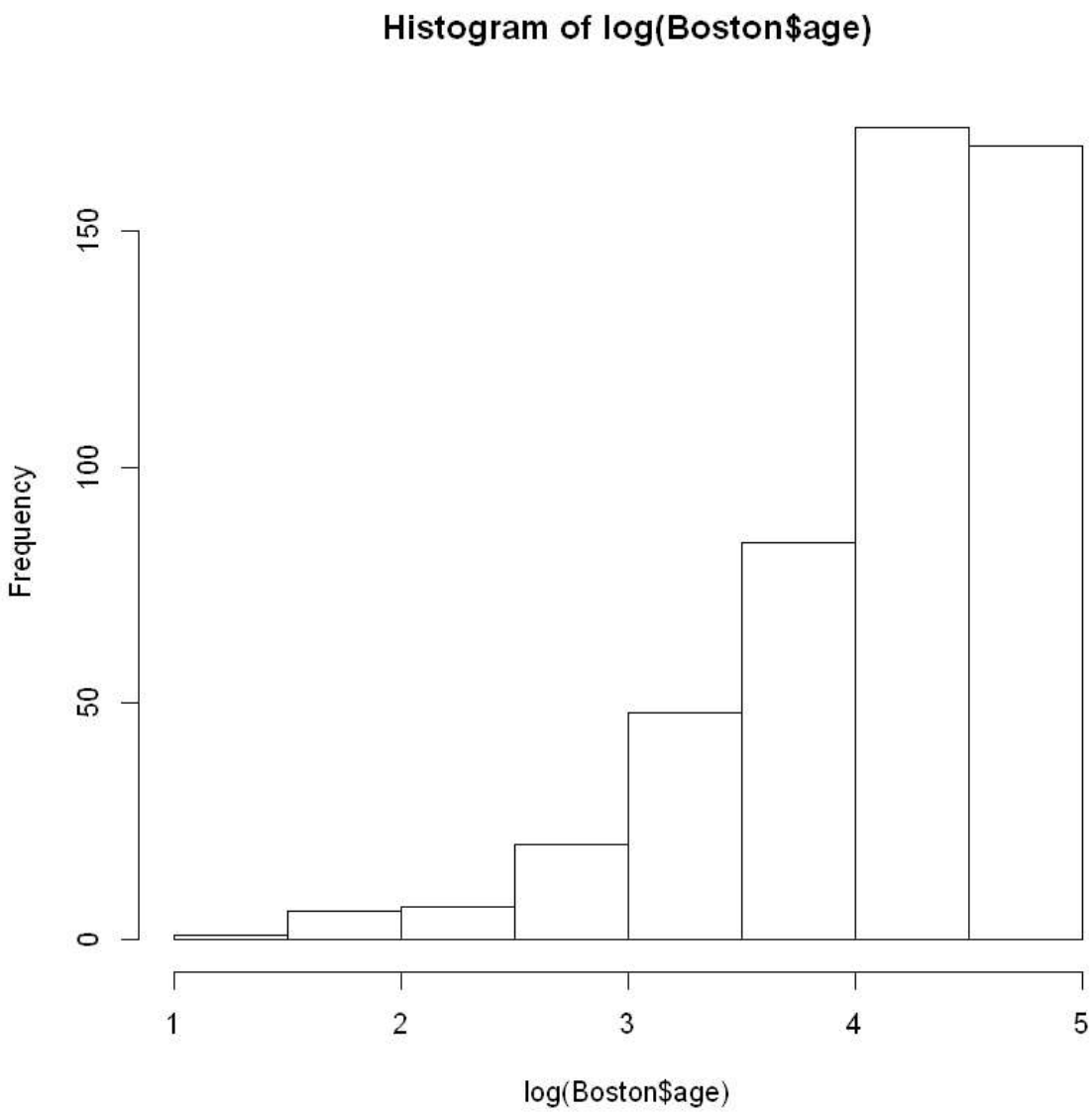
In [29]:
```
hist(log(Boston$nox))
nox1 = log(Boston$nox)
```



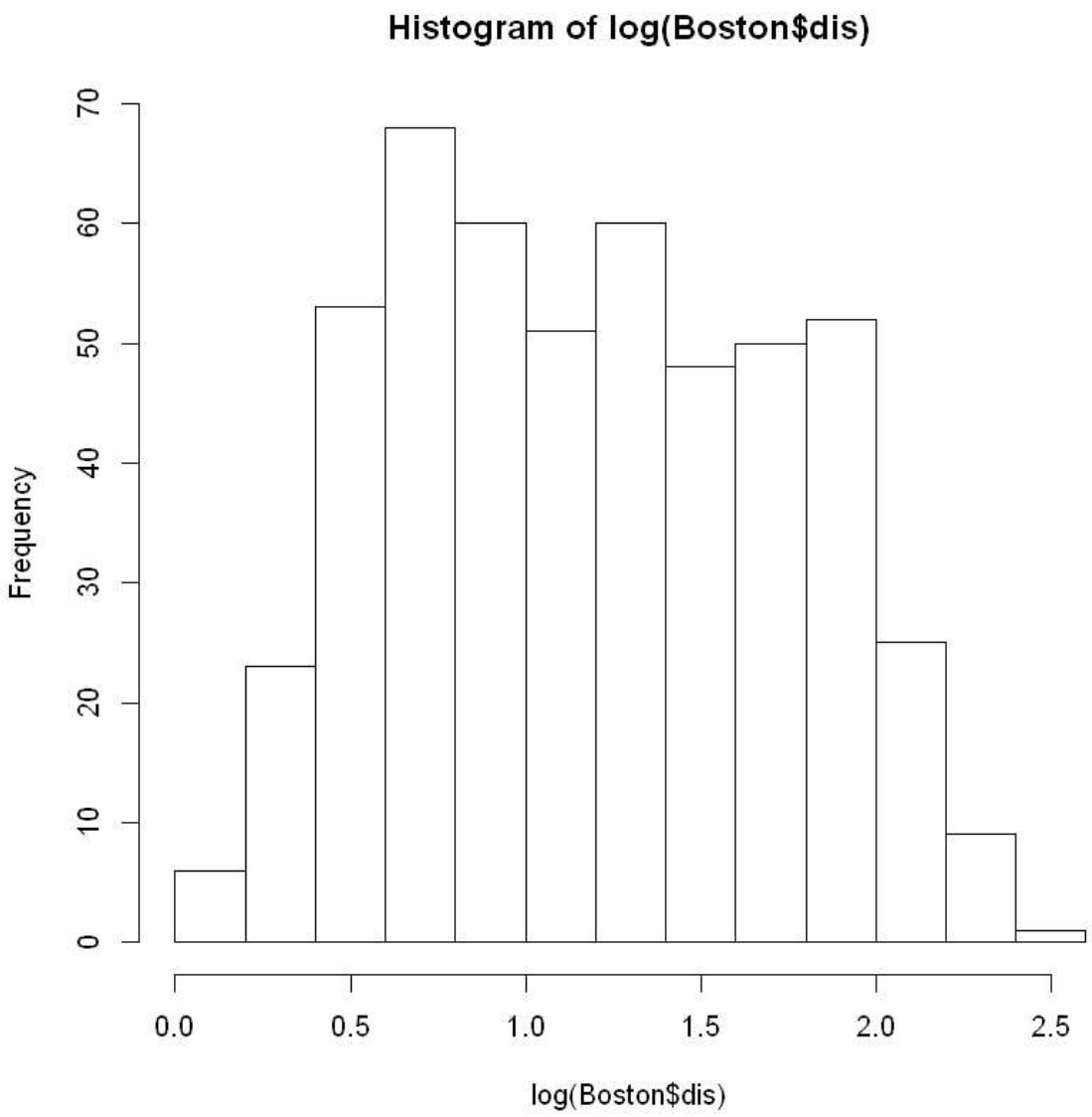
In [30]:
```
hist(Boston$rm)
rm1 = (Boston$rm)
```



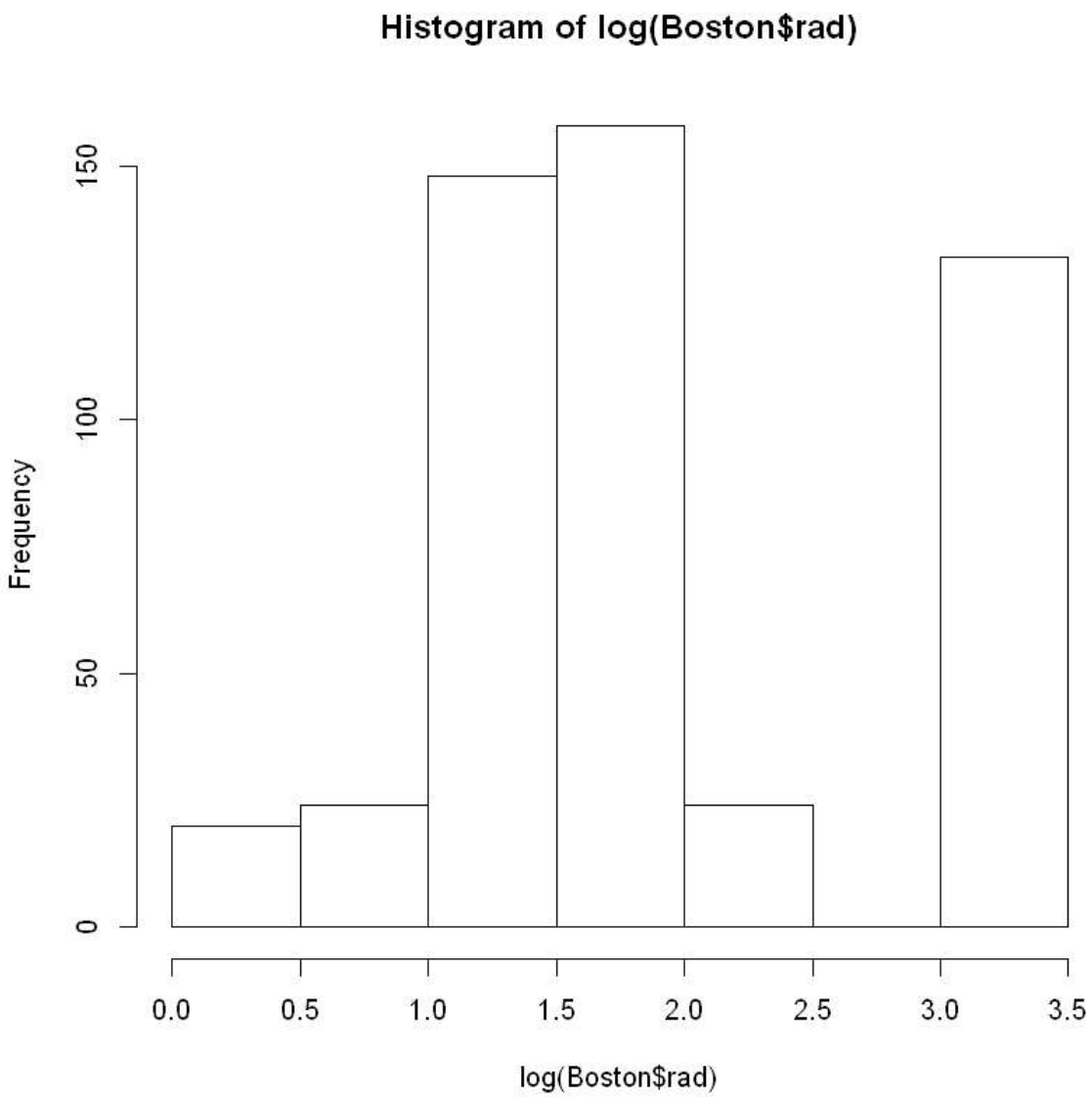
In [31]:
```
hist(log(Boston$age))
age1 =log(Boston$age)
```



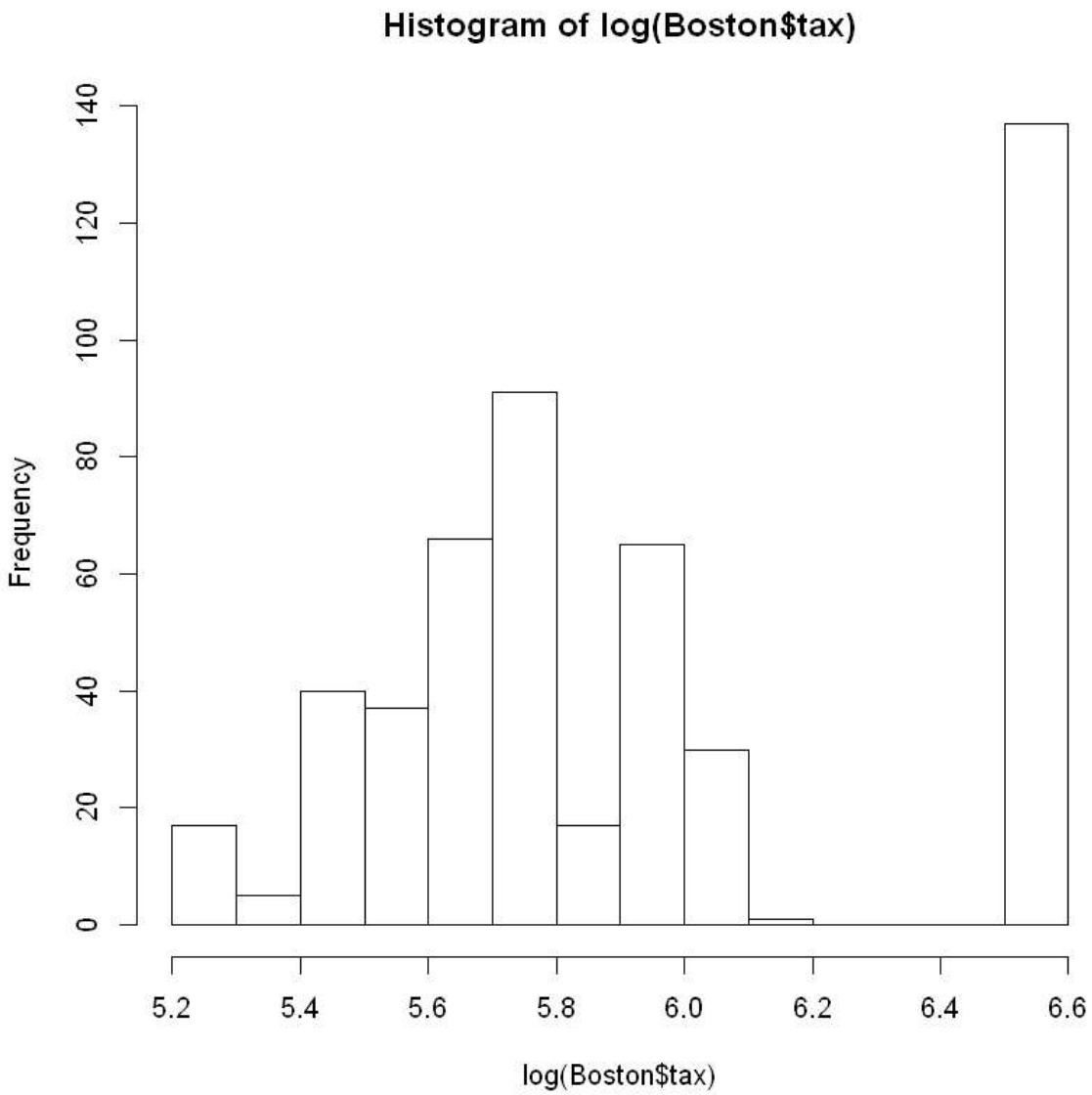
In [32]:
```
hist(log(Boston$dis))
dis1 = (log(Boston$dis))
```



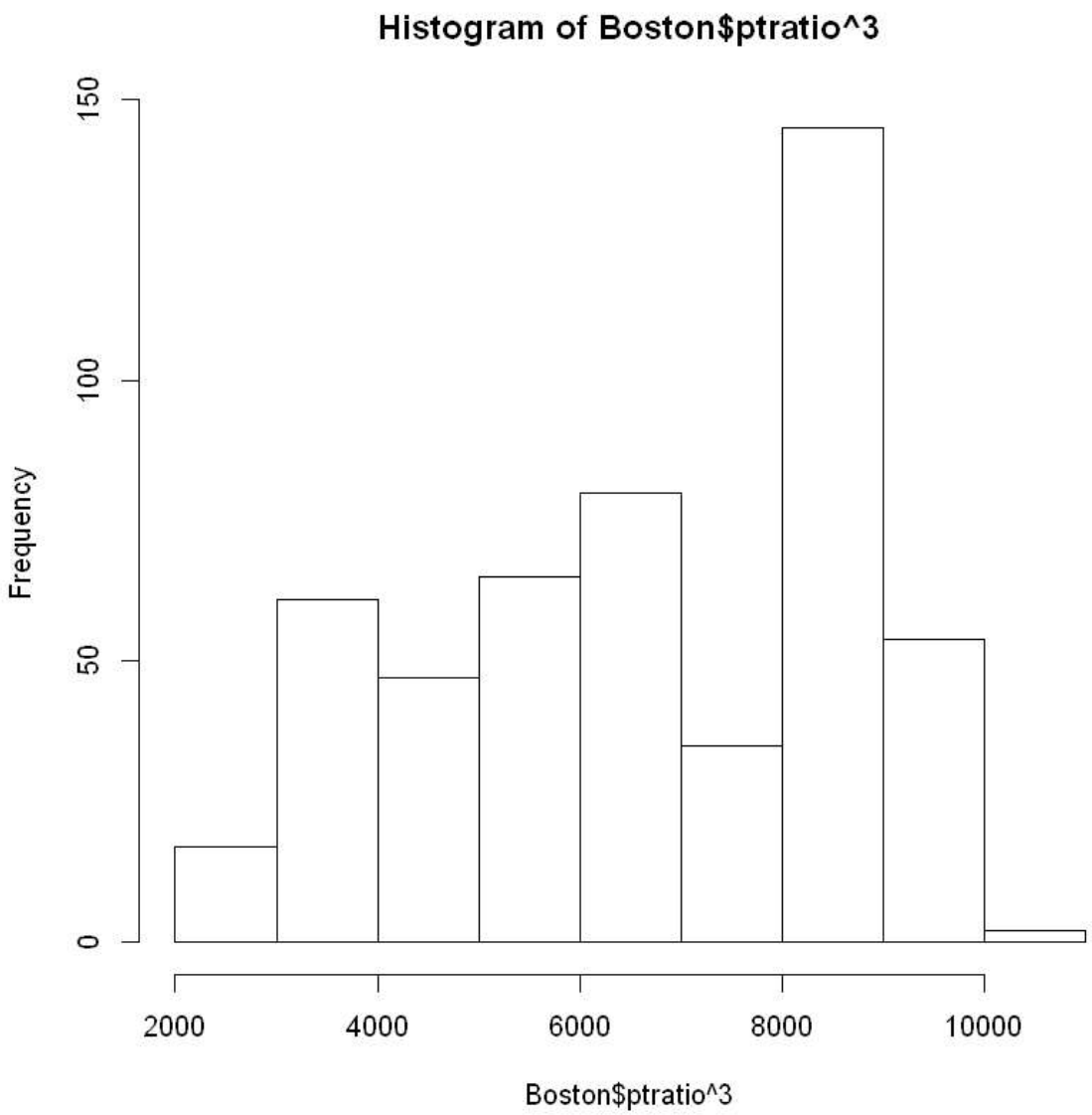
In [33]:
```
hist(log(Boston$rad))
rad1 = (log(Boston$rad))
```



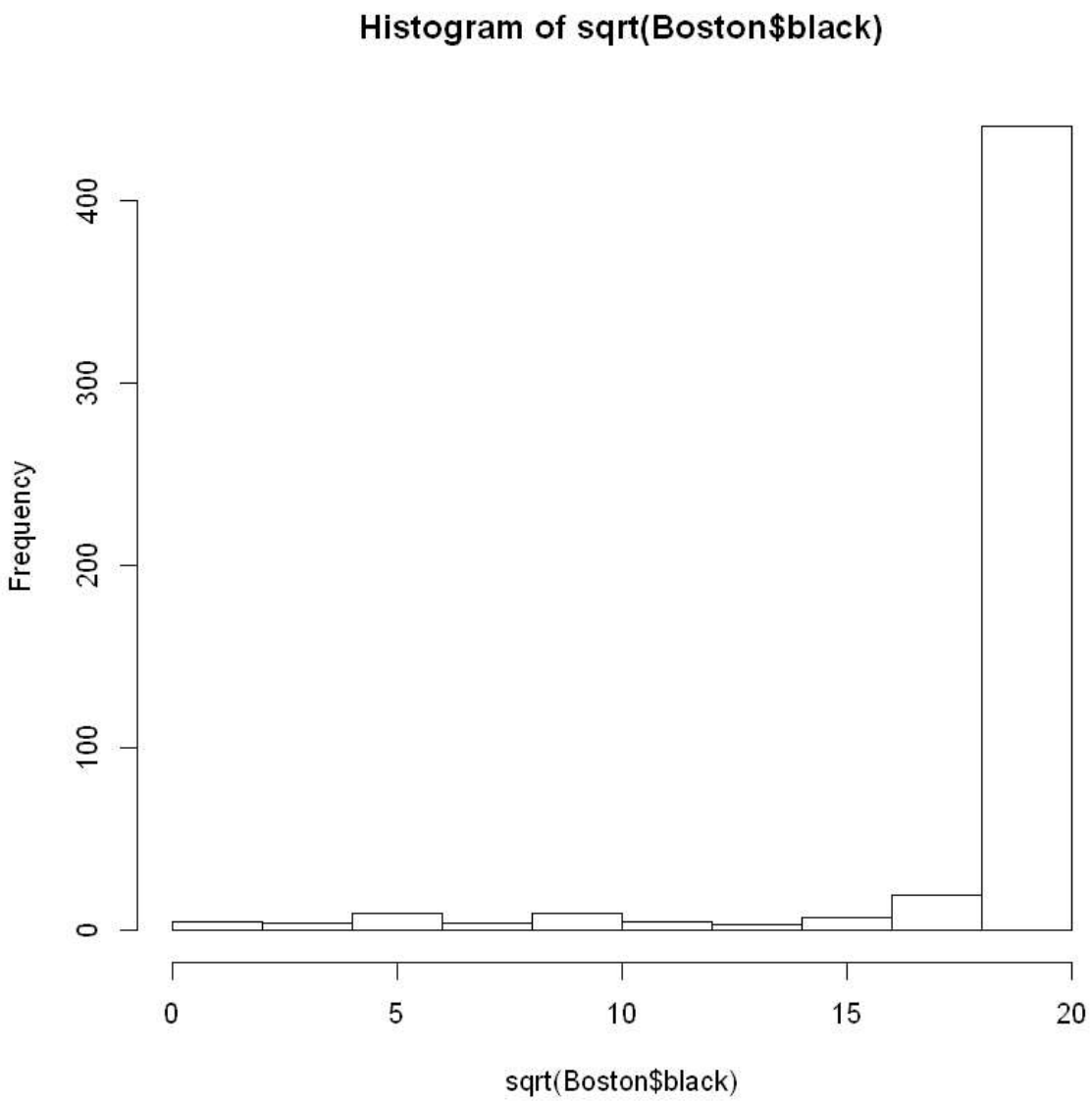
In [34]:
```
hist(log(Boston$tax))
tax1 = log(Boston$tax)
```



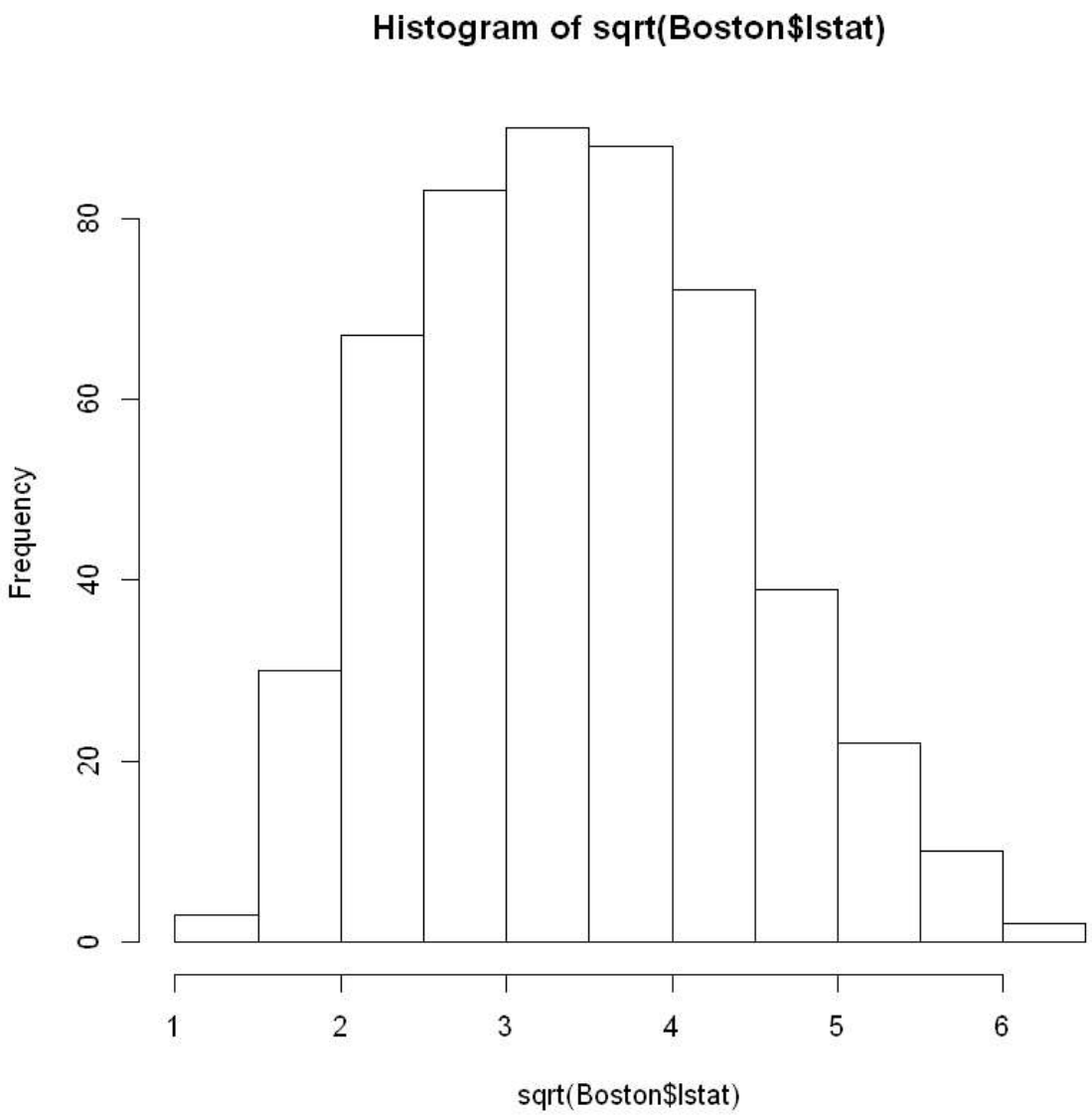
In [35]:
```
hist(Boston$ptratio^3)
ptratio1 = (Boston$ptratio^3)
```



In [36]:
```
hist(sqrt(Boston$black))
black1 = sqrt(Boston$black)
```



In [37]:
```
hist(sqrt(Boston$lstat))
lstat1 =(sqrt(Boston$lstat))
```



In [38]:
```
# After transforming variable above, we could fit a new linear model. And we could see
 that r_squared
# increased from 0.7406 to 0.7766, which is a big improvement due to the predictors tra
nsformation.
# Moreover, the ACI, BIC value for new fitted model is lower than the old model, indica
ting better
# goodness of fit model was genereatd here.

fit1 = lm(Boston$medv~crim1+zn1+indus1+chas1+nox1+rm1+age1+dis1+rad1+tax1+ptratio1+blac
k1+lstat1)
AIC(fit)
AIC(fit1)
BIC(fit)
BIC(fit1)
summary(fit)
summary(fit1)
```

3027.60859407555

2952.20415060613

3091.00664411486

3015.60220064544

```
Call:
lm(formula = medv ~ crim + zn + indus + chas + nox + rm + age +
    dis + rad + tax + ptratio + black + lstat, data = Boston)

Residuals:
    Min      1Q  Median      3Q     Max
-15.595  -2.730  -0.518   1.777  26.199

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  3.646e+01  5.103e+00   7.144 3.28e-12 ***
crim        -1.080e-01  3.286e-02  -3.287 0.001087 **
zn           4.642e-02  1.373e-02   3.382 0.000778 ***
indus        2.056e-02  6.150e-02   0.334 0.738288
chas         2.687e+00  8.616e-01   3.118 0.001925 **
nox         -1.777e+01  3.820e+00  -4.651 4.25e-06 ***
rm           3.810e+00  4.179e-01   9.116  < 2e-16 ***
age          6.922e-04  1.321e-02   0.052 0.958229
dis         -1.476e+00  1.995e-01  -7.398 6.01e-13 ***
rad          3.060e-01  6.635e-02   4.613 5.07e-06 ***
tax         -1.233e-02  3.760e-03  -3.280 0.001112 **
ptratio     -9.527e-01  1.308e-01  -7.283 1.31e-12 ***
black        9.312e-03  2.686e-03   3.467 0.000573 ***
lstat       -5.248e-01  5.072e-02 -10.347  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 4.745 on 492 degrees of freedom
Multiple R-squared:  0.7406,    Adjusted R-squared:  0.7338
F-statistic: 108.1 on 13 and 492 DF,  p-value: < 2.2e-16
```

```
Call:
lm(formula = Boston$medv ~ crim1 + zn1 + indus1 + chas1 + nox1 +
    rm1 + age1 + dis1 + rad1 + tax1 + ptratio1 + black1 + lstat1)

Residuals:
     Min       1Q   Median       3Q      Max
-15.5717  -2.4805  -0.3525   2.0145  22.1015

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  4.641e+01  7.536e+00   6.158 1.53e-09 ***
crim1        3.165e-01  2.508e-01   1.262  0.20749
zn1          1.930e-02  1.276e-02   1.513  0.13104
indus1      -9.629e-01  4.972e-01  -1.937  0.05334 .
chas1        2.652e+00  8.039e-01   3.298  0.00104 **
nox1        -1.141e+01  2.348e+00  -4.861 1.57e-06 ***
rm1          3.238e+00  3.927e-01   8.244 1.52e-15 ***
age1         1.806e-01  4.906e-01   0.368  0.71299
dis1        -7.097e+00  7.857e-01  -9.033  < 2e-16 ***
rad1         1.596e+00  4.869e-01   3.278  0.00112 **
tax1        -4.549e+00  1.061e+00  -4.288 2.17e-05 ***
ptratio1    -7.490e-04  1.219e-04  -6.147 1.64e-09 ***
black1       2.482e-01  6.240e-02   3.977 8.02e-05 ***
lstat1      -5.054e+00  3.520e-01 -14.358  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 4.405 on 492 degrees of freedom
Multiple R-squared:  0.7766,    Adjusted R-squared:  0.7706
F-statistic: 131.5 on 13 and 492 DF,  p-value: < 2.2e-16
```

In [46]:
```
#1B
library(wle)
mle.cp(fit1)
fit2 = lm(Boston$medv~zn1+indus1+chas1+nox1+rm1+dis1+rad1+tax1+ptratio1+black1+lstat1)
summary(fit2)
# Based on Mallows Cp, the best and lower cp value is 11.71, and the
# corresponding to first row. It is obvious that crim1 and age1 are not
# supposed to kept in the model due to reducing Complexity Penalty
# Futher, removing crim1 and age1 and refit the new model, and the
# parameter are shown below.
# zn1           1.708e-02
# indus1       -9.311e-01
# chas1         2.676e+00
# nox1         -1.047e+01
# rm1           3.286e+00
# dis1         -7.298e+00
# rad1          1.923e+00
# tax1         -4.364e+00
# ptratio1     -7.431e-04
# black1        2.369e-01
# lstat1       -4.948e+00
```

```
Call:
mle.cp(formula = fit1)


Mallows Cp:
(Intercept)         zn1      indus1       chas1        nox1         rm1
          1           1           1           1           1           1
       dis1        rad1        tax1    ptratio1      black1      lstat1
          1           1           1           1           1           1
         cp
         12

Printed the first  1  best models

Call:
lm(formula = Boston$medv ~ zn1 + indus1 + chas1 + nox1 + rm1 +
    dis1 + rad1 + tax1 + ptratio1 + black1 + lstat1)

Residuals:
    Min      1Q  Median      3Q     Max
-15.859  -2.547  -0.339   2.107  22.250

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  4.547e+01  7.142e+00   6.366 4.43e-10 ***
zn1          1.708e-02  1.254e-02   1.362 0.173893
indus1      -9.311e-01  4.899e-01  -1.901 0.057924 .
chas1        2.676e+00  8.010e-01   3.341 0.000899 ***
nox1        -1.047e+01  2.215e+00  -4.727 2.98e-06 ***
rm1          3.286e+00  3.861e-01   8.510  < 2e-16 ***
dis1        -7.298e+00  7.532e-01  -9.689  < 2e-16 ***
rad1         1.923e+00  4.092e-01   4.699 3.39e-06 ***
tax1        -4.364e+00  1.048e+00  -4.163 3.71e-05 ***
ptratio1    -7.431e-04  1.214e-04  -6.121 1.89e-09 ***
black1       2.369e-01  6.150e-02   3.852 0.000132 ***
lstat1      -4.948e+00  3.315e-01 -14.929  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 4.403 on 494 degrees of freedom
Multiple R-squared:  0.7758,    Adjusted R-squared:  0.7708
F-statistic: 155.4 on 11 and 494 DF,  p-value: < 2.2e-16
```

In [40]:
```
# 1C

# Backward selection based on AIC
step(fit1, direction="backward")
# According to this precedure, the results are shown below, and we conclude that
# the transformed form of indus,chas,nox1,rm1,dis,rad,tax,ptratio,black and lstat
# are potentially kept in this model in terms of variable selection.
# And their parameter estimate are
# 4.312e+01   -1.183e+00    2.715e+00   -1.082e+01    3.303e+00   -7.120e+00
# 1.853e+00   -3.857e+00   -7.834e-04    2.342e-01   -4.950e+00, respectively.
```

```
Start:  AIC=1514.24
Boston$medv ~ crim1 + zn1 + indus1 + chas1 + nox1 + rm1 + age1 +
    dis1 + rad1 + tax1 + ptratio1 + black1 + lstat1

           Df Sum of Sq     RSS    AIC
- age1      1       2.6  9547.6 1512.4
- crim1     1      30.9  9575.8 1513.9
<none>                   9544.9 1514.2
- zn1       1      44.4  9589.3 1514.6
- indus1    1      72.8  9617.7 1516.1
- rad1      1     208.4  9753.4 1523.2
- chas1     1     211.1  9756.0 1523.3
- black1    1     306.9  9851.8 1528.2
- tax1      1     356.7  9901.7 1530.8
- nox1      1     458.4 10003.3 1536.0
- ptratio1  1     732.9 10277.9 1549.7
- rm1       1    1318.6 10863.6 1577.7
- dis1      1    1583.0 11127.9 1589.9
- lstat1    1    3999.2 13544.1 1689.3

Step:  AIC=1512.38
Boston$medv ~ crim1 + zn1 + indus1 + chas1 + nox1 + rm1 + dis1 +
    rad1 + tax1 + ptratio1 + black1 + lstat1

           Df Sum of Sq     RSS    AIC
- crim1     1      30.5  9578.1 1512.0
<none>                   9547.6 1512.4
- zn1       1      42.1  9589.7 1512.6
- indus1    1      78.3  9625.9 1514.5
- rad1      1     207.6  9755.2 1521.3
- chas1     1     216.3  9763.9 1521.7
- black1    1     310.7  9858.3 1526.6
- tax1      1     359.0  9906.5 1529.0
- nox1      1     463.7 10011.3 1534.4
- ptratio1  1     730.7 10278.3 1547.7
- rm1       1    1381.4 10929.0 1578.8
- dis1      1    1724.8 11272.4 1594.4
- lstat1    1    4327.9 13875.5 1699.5

Step:  AIC=1511.99
Boston$medv ~ zn1 + indus1 + chas1 + nox1 + rm1 + dis1 + rad1 +
    tax1 + ptratio1 + black1 + lstat1

           Df Sum of Sq     RSS    AIC
- zn1       1      36.0  9614.1 1511.9
<none>                   9578.1 1512.0
- indus1    1      70.0  9648.2 1513.7
- chas1     1     216.4  9794.5 1521.3
- black1    1     287.7  9865.8 1525.0
- tax1      1     336.0  9914.1 1527.4
- rad1      1     428.2 10006.3 1532.1
- nox1      1     433.2 10011.4 1532.4
- ptratio1  1     726.5 10304.6 1547.0
- rm1       1    1404.2 10982.3 1579.2
- dis1      1    1820.3 11398.4 1598.0
- lstat1    1    4321.0 13899.1 1698.4
```

```
Step:  AIC=1511.89
Boston$medv ~ indus1 + chas1 + nox1 + rm1 + dis1 + rad1 + tax1 +
    ptratio1 + black1 + lstat1

           Df Sum of Sq     RSS    AIC
<none>                  9614.1 1511.9
- indus1    1     132.1  9746.1 1516.8
- chas1     1     223.1  9837.1 1521.5
- black1    1     281.5  9895.5 1524.5
- tax1      1     300.3  9914.4 1525.5
- rad1      1     403.9 10018.0 1530.7
- nox1      1     468.7 10082.8 1534.0
- ptratio1  1     858.6 10472.7 1553.2
- rm1       1    1420.0 11034.1 1579.6
- dis1      1    1786.4 11400.5 1596.1
- lstat1    1    4323.1 13937.2 1697.8

Call:
lm(formula = Boston$medv ~ indus1 + chas1 + nox1 + rm1 + dis1 +
    rad1 + tax1 + ptratio1 + black1 + lstat1)

Coefficients:
(Intercept)       indus1        chas1         nox1          rm1         dis1
  4.312e+01   -1.183e+00    2.715e+00   -1.082e+01    3.303e+00   -7.120e+00
       rad1         tax1     ptratio1       black1       lstat1
  1.853e+00   -3.857e+00   -7.834e-04    2.342e-01   -4.950e+00
```

In [41]:
```
# Backward selection based on BIC
n = nrow(Boston)
step(fit1, direction="backward", k = log(n))
# As the result generated here, indus1 + chas1 + nox1 + rm1 + dis1 + rad1 + tax1 +
# ptratio1 + black1 + lstat1 are more likely to have the spots in this model and
# should not be removed.
# Respectively, 4.312e+01   -1.183e+00    2.715e+00   -1.082e+01    3.303e+00   -7.120e
+00
# 1.853e+00   -3.857e+00   -7.834e-04    2.342e-01   -4.950e+00 are their coefficients
#
# Based on the comparison between AIC and BIC value, the AIC value is lower than BIC
# value in the their final model selection. Since lower value of AIC and BIC indicating
# better goodness of fit, in this perspective, AIC is better in this case.
```

```
Start:  AIC=1573.41
Boston$medv ~ crim1 + zn1 + indus1 + chas1 + nox1 + rm1 + age1 +
    dis1 + rad1 + tax1 + ptratio1 + black1 + lstat1

           Df Sum of Sq     RSS    AIC
- age1      1       2.6  9547.6 1567.3
- crim1     1      30.9  9575.8 1568.8
- zn1       1      44.4  9589.3 1569.5
- indus1    1      72.8  9617.7 1571.0
<none>                   9544.9 1573.4
- rad1      1     208.4  9753.4 1578.1
- chas1     1     211.1  9756.0 1578.2
- black1    1     306.9  9851.8 1583.2
- tax1      1     356.7  9901.7 1585.8
- nox1      1     458.4 10003.3 1590.9
- ptratio1  1     732.9 10277.9 1604.6
- rm1       1    1318.6 10863.6 1632.7
- dis1      1    1583.0 11127.9 1644.8
- lstat1    1    3999.2 13544.1 1744.2

Step:  AIC=1567.32
Boston$medv ~ crim1 + zn1 + indus1 + chas1 + nox1 + rm1 + dis1 +
    rad1 + tax1 + ptratio1 + black1 + lstat1

           Df Sum of Sq     RSS    AIC
- crim1     1      30.5  9578.1 1562.7
- zn1       1      42.1  9589.7 1563.3
- indus1    1      78.3  9625.9 1565.2
<none>                   9547.6 1567.3
- rad1      1     207.6  9755.2 1572.0
- chas1     1     216.3  9763.9 1572.4
- black1    1     310.7  9858.3 1577.3
- tax1      1     359.0  9906.5 1579.8
- nox1      1     463.7 10011.3 1585.1
- ptratio1  1     730.7 10278.3 1598.4
- rm1       1    1381.4 10929.0 1629.5
- dis1      1    1724.8 11272.4 1645.1
- lstat1    1    4327.9 13875.5 1750.3

Step:  AIC=1562.71
Boston$medv ~ zn1 + indus1 + chas1 + nox1 + rm1 + dis1 + rad1 +
    tax1 + ptratio1 + black1 + lstat1

           Df Sum of Sq     RSS    AIC
- zn1       1      36.0  9614.1 1558.4
- indus1    1      70.0  9648.2 1560.2
<none>                   9578.1 1562.7
- chas1     1     216.4  9794.5 1567.8
- black1    1     287.7  9865.8 1571.5
- tax1      1     336.0  9914.1 1573.9
- rad1      1     428.2 10006.3 1578.6
- nox1      1     433.2 10011.4 1578.9
- ptratio1  1     726.5 10304.6 1593.5
- rm1       1    1404.2 10982.3 1625.7
- dis1      1    1820.3 11398.4 1644.5
- lstat1    1    4321.0 13899.1 1744.9
```

```
Step:  AIC=1558.38
Boston$medv ~ indus1 + chas1 + nox1 + rm1 + dis1 + rad1 + tax1 +
    ptratio1 + black1 + lstat1

           Df Sum of Sq     RSS    AIC
<none>                   9614.1 1558.4
- indus1    1     132.1  9746.1 1559.1
- chas1     1     223.1  9837.1 1563.8
- black1    1     281.5  9895.5 1566.8
- tax1      1     300.3  9914.4 1567.7
- rad1      1     403.9 10018.0 1573.0
- nox1      1     468.7 10082.8 1576.2
- ptratio1  1     858.6 10472.7 1595.4
- rm1       1    1420.0 11034.1 1621.9
- dis1      1    1786.4 11400.5 1638.4
- lstat1    1    4323.1 13937.2 1740.0

Call:
lm(formula = Boston$medv ~ indus1 + chas1 + nox1 + rm1 + dis1 +
    rad1 + tax1 + ptratio1 + black1 + lstat1)

Coefficients:
(Intercept)       indus1        chas1         nox1          rm1         dis1
  4.312e+01   -1.183e+00    2.715e+00   -1.082e+01    3.303e+00   -7.120e+00
       rad1         tax1     ptratio1       black1       lstat1
  1.853e+00   -3.857e+00   -7.834e-04    2.342e-01   -4.950e+00
```

In [42]:
```
# IC
install.packages("leaps",repos = "http://cran.us.r-project.org")
```

```
Warning message:
"package 'leaps' is in use and will not be installed"
```

In [43]:
```
library(leaps)
```

In [44]:
```
RSSleaps=regsubsets(Boston$medv~crim1+zn1+indus1+chas1+nox1+rm1+age1+dis1+rad1+tax1+ptr
atio1+black1+lstat1,data = Boston, nvmax = 13)
summary(RSSleaps, matrix=T)
RSSleaps=regsubsets(Boston[,1:13],Boston[,14],nvmax = 13)
sumleaps=summary(RSSleaps,matrix=T)
sumleaps$which
inrange = function(x) { (x - min(x)) / (max(x) - min(x)) }

sumleaps = summary(RSSleaps,matrix=T)
msize = apply(sumleaps$which,1,sum)
n=nrow(Boston)
p=nrow(Boston)
Cp = sumleaps$rss/(summary(fit)$sigma^2) + 2*msize - n
AIC = n*log(sumleaps$rss/n) + 2*msize
BIC = n*log(sumleaps$rss/n) + msize*log(n)
Cp1=inrange(Cp)
BIC1 = inrange(BIC)
AIC1 = inrange(AIC)
plot(range(msize), c(0, 1.1), type="n", xlab="Model Size (with Intercept)", ylab="Model
 Selection Criteria")
points(msize, Cp1, col="red", type="b")
points(msize, AIC1, col="blue", type="b")
points(msize, BIC1, col="black", type="b")
legend("topright", lty=rep(1,3), col=c("red", "blue", "black"), cex = 2, legend=c("Cp",
 "AIC", "BIC"))
AIC
BIC
# Based on the subset model selection, we found that the point of lowest value for both
 AIC
# and BIC are 10, in accordance with both value table and plot. Due to that lower AIC a
nd BIC value
# is a good indicator for better goodness of fit for the model, so at the subset table,
 in the 10th
# row, crim1, zn1 and age1 are not stared, stating that these variable are unlikely to
# kept in the model and should be removed.
# In addition, the plot shows that the value for BIC is always lower than AIC except at
 the points of
# 10-13. Thus, in general, BIC model is slightly and relatively better than AIC.
```

```
Subset selection object
Call: regsubsets.formula(Boston$medv ~ crim1 + zn1 + indus1 + chas1 +
    nox1 + rm1 + age1 + dis1 + rad1 + tax1 + ptratio1 + black1 +
    lstat1, data = Boston, nvmax = 13)
13 Variables  (and intercept)
         Forced in Forced out
crim1        FALSE      FALSE
zn1          FALSE      FALSE
indus1       FALSE      FALSE
chas1        FALSE      FALSE
nox1         FALSE      FALSE
rm1          FALSE      FALSE
age1         FALSE      FALSE
dis1         FALSE      FALSE
rad1         FALSE      FALSE
tax1         FALSE      FALSE
ptratio1     FALSE      FALSE
black1       FALSE      FALSE
lstat1       FALSE      FALSE
1 subsets of each size up to 13
Selection Algorithm: exhaustive
          crim1 zn1 indus1 chas1 nox1 rm1 age1 dis1 rad1 tax1 ptratio1 black1
1  ( 1 )  " "   " " " "   " "   " "  " " " " " "  " "  " "  " "      " "
2  ( 1 )  " "   " " " "   " "   " "  "*" " " " "  " "  " "  " "      " "
3  ( 1 )  " "   " " " "   " "   " "  "*" " " " "  " "  " "  "*"      " "
4  ( 1 )  " "   " " " "   " "   " "  "*" " " "*"  " "  " "  "*"      " "
5  ( 1 )  " "   " " " "   " "   "*"  "*" " " "*"  " "  " "  "*"      " "
6  ( 1 )  " "   " " " "   " "   "*"  "*" " " "*"  " "  " "  "*"      "*"
7  ( 1 )  " "   " " " "   "*"   "*"  "*" " " "*"  " "  " "  "*"      "*"
8  ( 1 )  " "   " " " "   " "   "*"  "*" " " "*"  "*"  "*"  "*"      "*"
9  ( 1 )  " "   " " " "   "*"   "*"  "*" " " "*"  "*"  "*"  "*"      "*"
10  ( 1 ) " "   " " "*"   "*"   "*"  "*" " " "*"  "*"  "*"  "*"      "*"
11  ( 1 ) " "   "*" "*"   "*"   "*"  "*" " " "*"  "*"  "*"  "*"      "*"
12  ( 1 ) "*"   "*" "*"   "*"   "*"  "*" " " "*"  "*"  "*"  "*"      "*"
13  ( 1 ) "*"   "*" "*"   "*"   "*"  "*" "*" "*"  "*"  "*"  "*"      "*"
          lstat1
1  ( 1 )  "*"
2  ( 1 )  "*"
3  ( 1 )  "*"
4  ( 1 )  "*"
5  ( 1 )  "*"
6  ( 1 )  "*"
7  ( 1 )  "*"
8  ( 1 )  "*"
9  ( 1 )  "*"
10  ( 1 ) "*"
11  ( 1 ) "*"
12  ( 1 ) "*"
13  ( 1 ) "*"
```

	(Intercept)	crim	zn	indus	chas	nox	rm	age	dis	rad	tax
1	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FA
2	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FA
3	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FA
4	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	TRUE	FALSE	FA
5	TRUE	FALSE	FALSE	FALSE	FALSE	TRUE	TRUE	FALSE	TRUE	FALSE	FA
6	TRUE	FALSE	FALSE	FALSE	TRUE	TRUE	TRUE	FALSE	TRUE	FALSE	FA
7	TRUE	FALSE	FALSE	FALSE	TRUE	TRUE	TRUE	FALSE	TRUE	FALSE	FA
8	TRUE	FALSE	TRUE	FALSE	TRUE	TRUE	TRUE	FALSE	TRUE	FALSE	FA
9	TRUE	TRUE	FALSE	FALSE	TRUE	TRUE	TRUE	FALSE	TRUE	TRUE	FA
10	TRUE	TRUE	TRUE	FALSE	FALSE	TRUE	TRUE	FALSE	TRUE	TRUE	TR
11	TRUE	TRUE	TRUE	FALSE	TRUE	TRUE	TRUE	FALSE	TRUE	TRUE	TR
12	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	TRUE	TRUE	TR
13	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TR

1	1851.00916129703
2	1735.57651869607
3	1678.1314718162
4	1661.39324925963
5	1633.47283756409
6	1621.97325411599
7	1612.47258710803
8	1606.30919749529
9	1601.67230057464
10	1594.03074459126
11	1585.76059222193
12	1587.64562261755
13	1589.64279847242

1	1859.4622346356
2	1748.25612870393
3	1695.03761849335
4	1682.52593260607
5	1658.83205757981
6	1651.559010801
7	1646.28488046233
8	1644.34802751888
9	1643.93766726751
10	1640.52264795343
11	1636.47903225338
12	1642.59059931829
13	1648.81431184244