HW1_harinris

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Lab 2.3

2.3.1 - Basic Commands

Create 2 vectors:

```
x <- c(1, 2, 3, 4)
y = c(5, 6, 7 ,8)

x
```

```
## [1] 1 2 3 4
```

```
length(y)
```

```
## [1] 4
```

Add 2 sets of numbers

```
x + y
```

```
## [1]  6  8 10 12
```

List and delete objects

```
ls()
```

```
## [1] "x" "y"
```

```
rm(x)
ls()
```

```
## [1] "y"
```

```
a = 10
b = 20
ls()
```

```
## [1] "a" "b" "y"
```

```
rm(list = ls())
ls()
```

```
## character(0)
```

Generating a sequence of random numbers

```
seq(-pi, pi, length = 7)
```

```
## [1] -3.141593 -2.094395 -1.047198  0.000000  1.047198  2.094395  3.141593
```

Matrix - Creating a matrix and performing basic calculations

```
x = matrix(data = c(1, 2, 3, 4), nrow = 2, ncol = 2, byrow = TRUE)
x
```

```
##      [,1] [,2]
## [1,]    1    2
## [2,]    3    4
```

```
sqrt(x)
```

```
##          [,1]     [,2]
## [1,] 1.000000 1.414214
## [2,] 1.732051 2.000000
```

```
x^2
```

```
##      [,1] [,2]
## [1,]    1    4
## [2,]    9   16
```

Generating 2 vectors of random normal variables and computing correlation between them

```
a = rnorm(50)
b = a + rnorm(50, mean = 50, sd = 0.1)
cor(a, b)
```

```
## [1] 0.9946231
```

Using set.seed to setup a pseudo-random number generator

```
set.seed(3)
x = rnorm(100)
mean(x)
```

```
## [1] 0.01103557
```

```
var(x)
```

```
## [1] 0.7328675
```

```
sqrt(var(x))
```

```
## [1] 0.8560768
```

```
sd(x)
```

```
## [1] 0.8560768
```

2.3.2 - Graphics

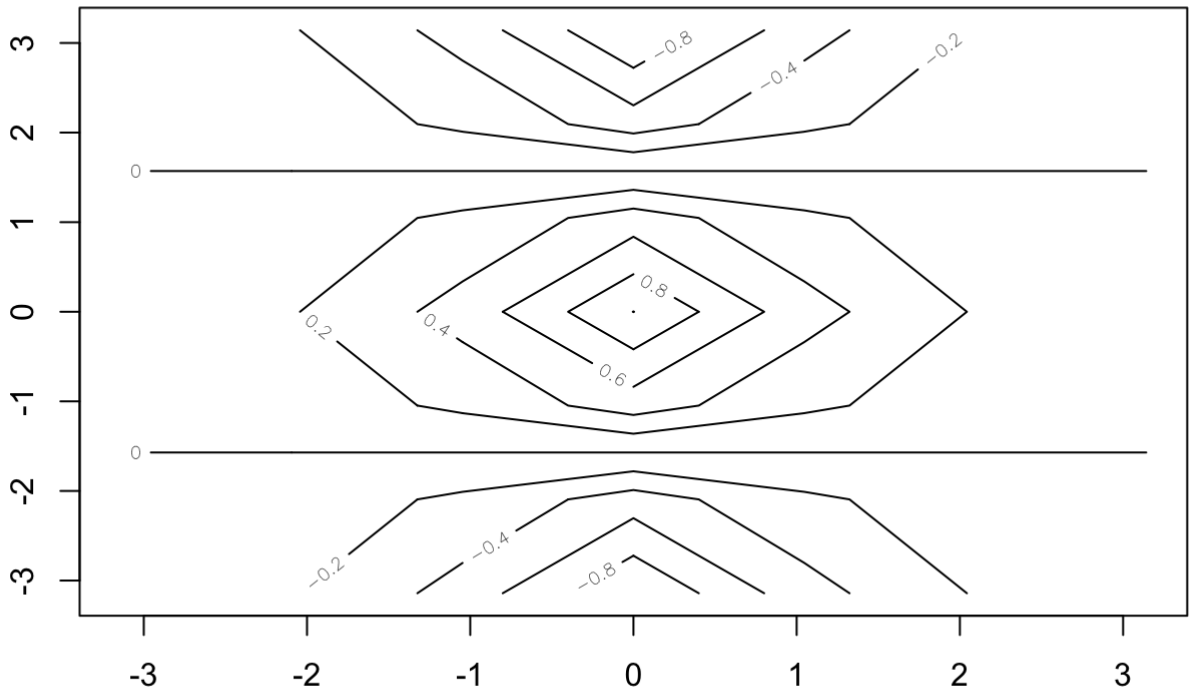
Plotting graphs with labels and saving as PDF

```
pdf("Figure.pdf")
x = rnorm(100)
y = rnorm(100)
plot(x, y, xlab = "X-axis", ylab = "Y-axis", main = "This a graph of X vs Y")
dev.off()
```

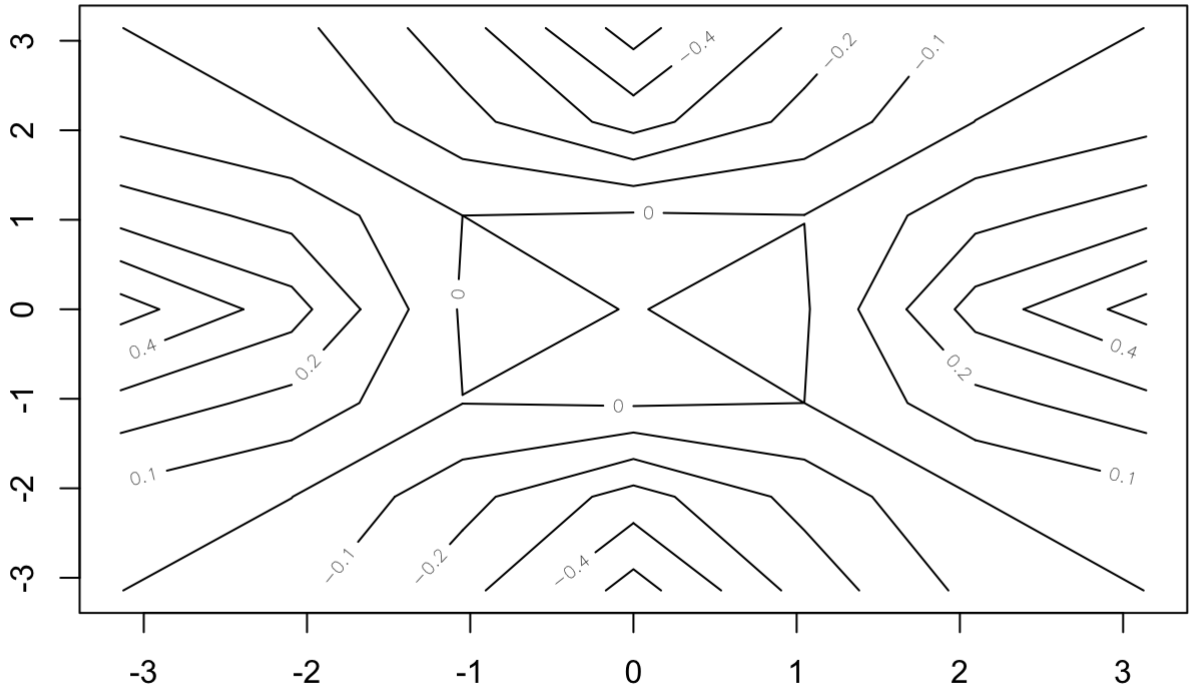
```
## quartz_off_screen
##                 2
```

Using the contour() and persp() function to plot 3-D graphs

```
x = seq(-pi, pi, length = 7)
y = x
f = outer(x, y, function(x , y) cos (y) / (1 + x^2))
contour(x, y, f)
```

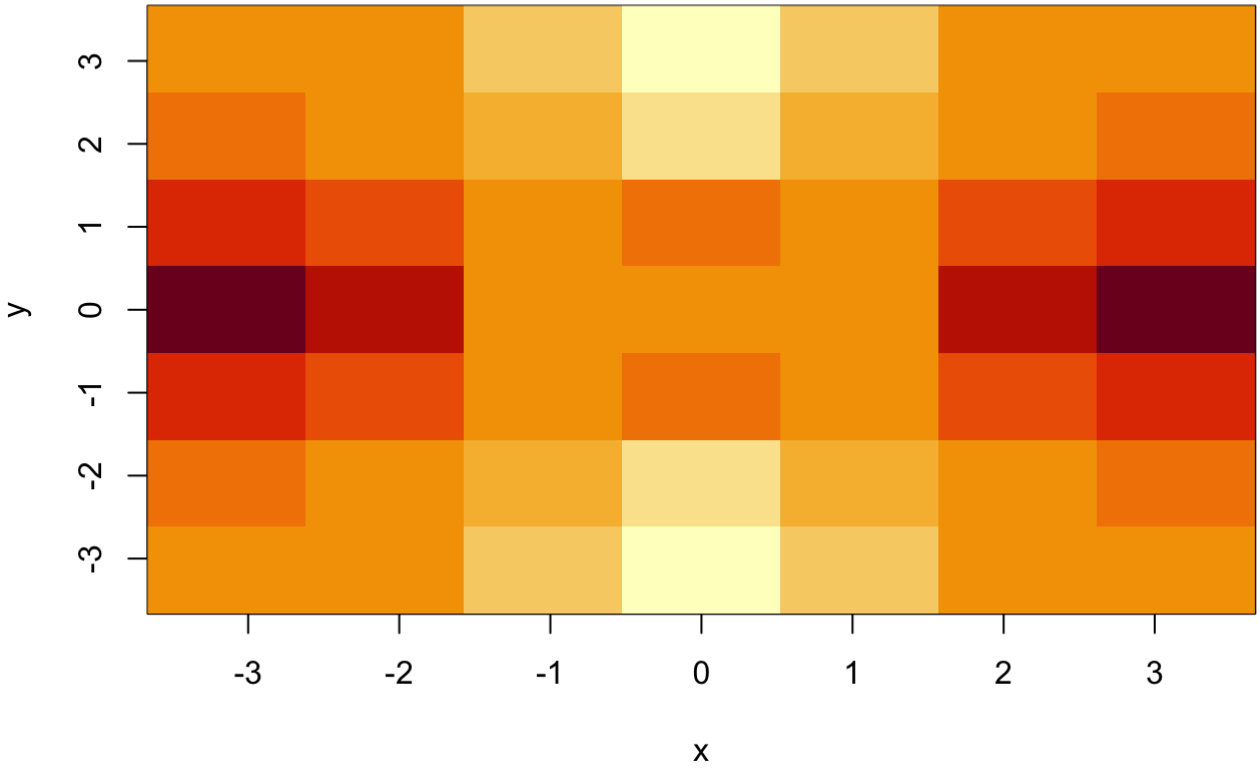



```
fa = (f - t (f)) / 2
contour(x, y, fa, nlevels = 15)
```

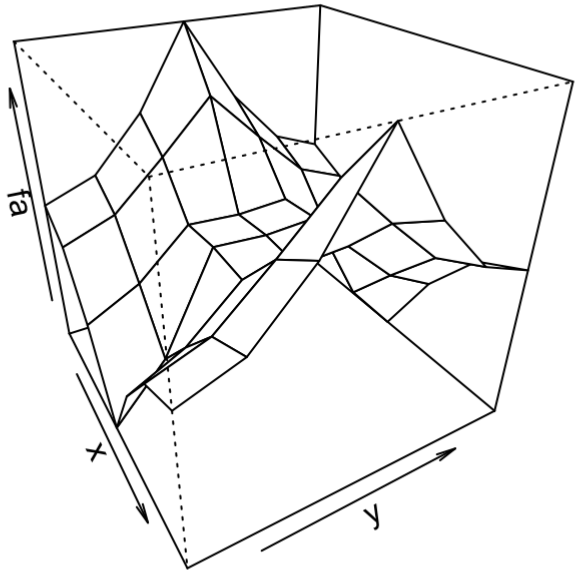


Using image() to plot 3-D graphs

```
image(x, y, fa)
```




```
persp(x, y, fa, theta = 60, phi = 30)
```



2.3.3 - Indexing Data

Exploring different ways to examine a portion of the dataset or refer to particular elements by index

```
A = matrix(1:16, 4, 4)
A
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    1    5    9   13
## [2,]    2    6   10   14
## [3,]    3    7   11   15
## [4,]    4    8   12   16
```

```
A[3, 3]
```

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

```
A [c(1, 3), c(2, 4)]
```

```
##      [,1] [,2]
## [1,]    5   13
## [2,]    7   15
```

```
A[1:3, 2:4]
```

```
##      [,1] [,2] [,3]
## [1,]    5    9   13
## [2,]    6   10   14
## [3,]    7   11   15
```

```
A[1:2,]
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    1    5    9   13
## [2,]    2    6   10   14
```

```
A[, 1:2]
```

```
##      [,1] [,2]
## [1,]    1    5
## [2,]    2    6
## [3,]    3    7
## [4,]    4    8
```

```
A[-c(1, 3), ]
```

```
##      [,1] [,2] [,3] [,4]
## [1,]    2    6   10   14
## [2,]    4    8   12   16
```

```
dim(A)
```

```
## [1] 4 4
```

2.3.4 - Loading Data

We are using the Auto dataset from ISLR2 package. We install the package through console and view the first few rows of the dataset using head. Next, we use na.omit() to remove the rows with missing data.

```
library('ISLR')
head(Auto)
```

```
##   mpg cylinders displacement horsepower weight acceleration year origin
## 1  18         8          307        130   3504         12.0   70      1
## 2  15         8          350        165   3693         11.5   70      1
## 3  18         8          318        150   3436         11.0   70      1
## 4  16         8          304        150   3433         12.0   70      1
## 5  17         8          302        140   3449         10.5   70      1
## 6  15         8          429        198   4341         10.0   70      1
##                       name
## 1 chevrolet chevelle malibu
## 2         buick skylark 320
## 3        plymouth satellite
## 4             amc rebel sst
## 5               ford torino
## 6          ford galaxie 500
```

```
dim(Auto)
```

```
## [1] 392   9
```

```
Auto = na.omit(Auto)
dim(Auto)
```

```
## [1] 392   9
```

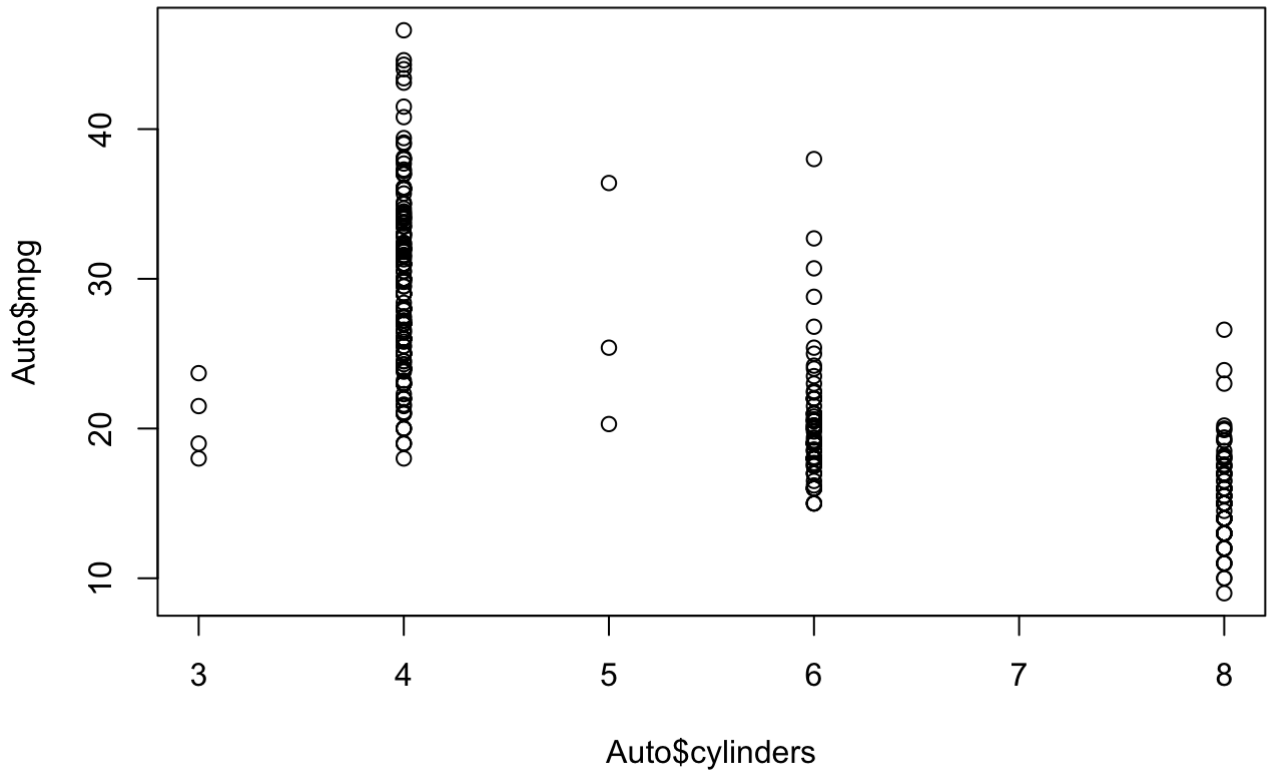
```
names(Auto)
```

```
## [1] "mpg"          "cylinders"    "displacement" "horsepower"   "weight"
## [6] "acceleration" "year"         "origin"       "name"
```

2.3.5 - Additional Graphical and Numerical Summaries

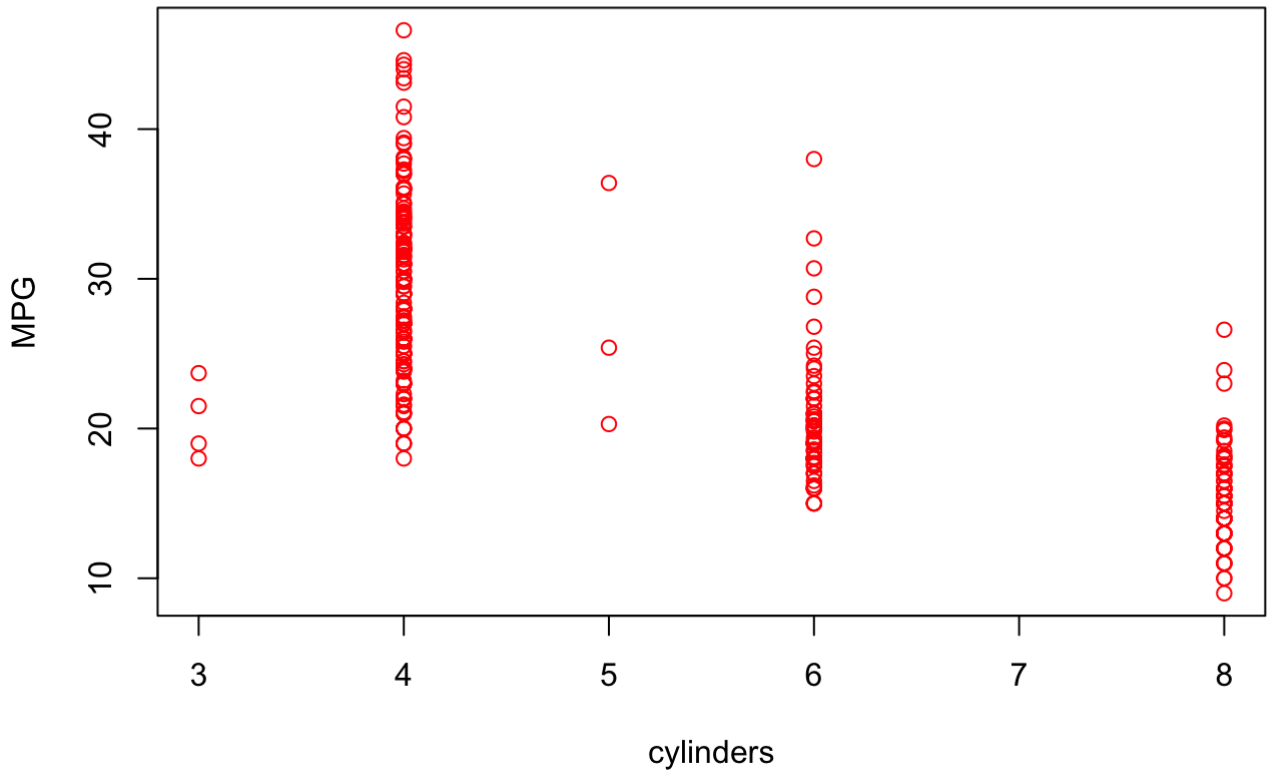
Plotting graphs using values in Auto data set. Data set can be refered to by $ sign.

```
plot(Auto$cylinders, Auto$mpg)
```



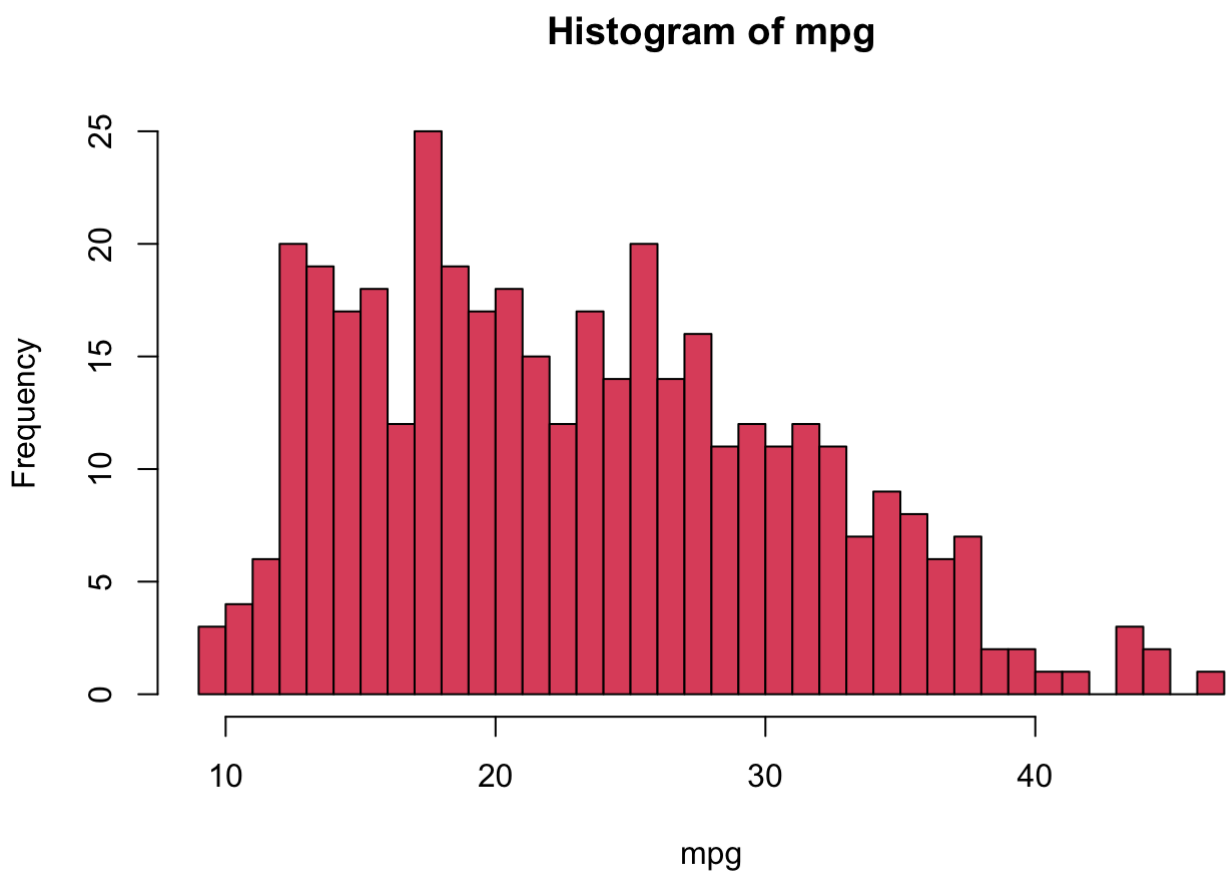
Or by using attach() to make the variables in this data frame available by name.

```
attach(Auto)
plot(cylinders, mpg, col = "red", xlab = "cylinders", ylab = "MPG")
```



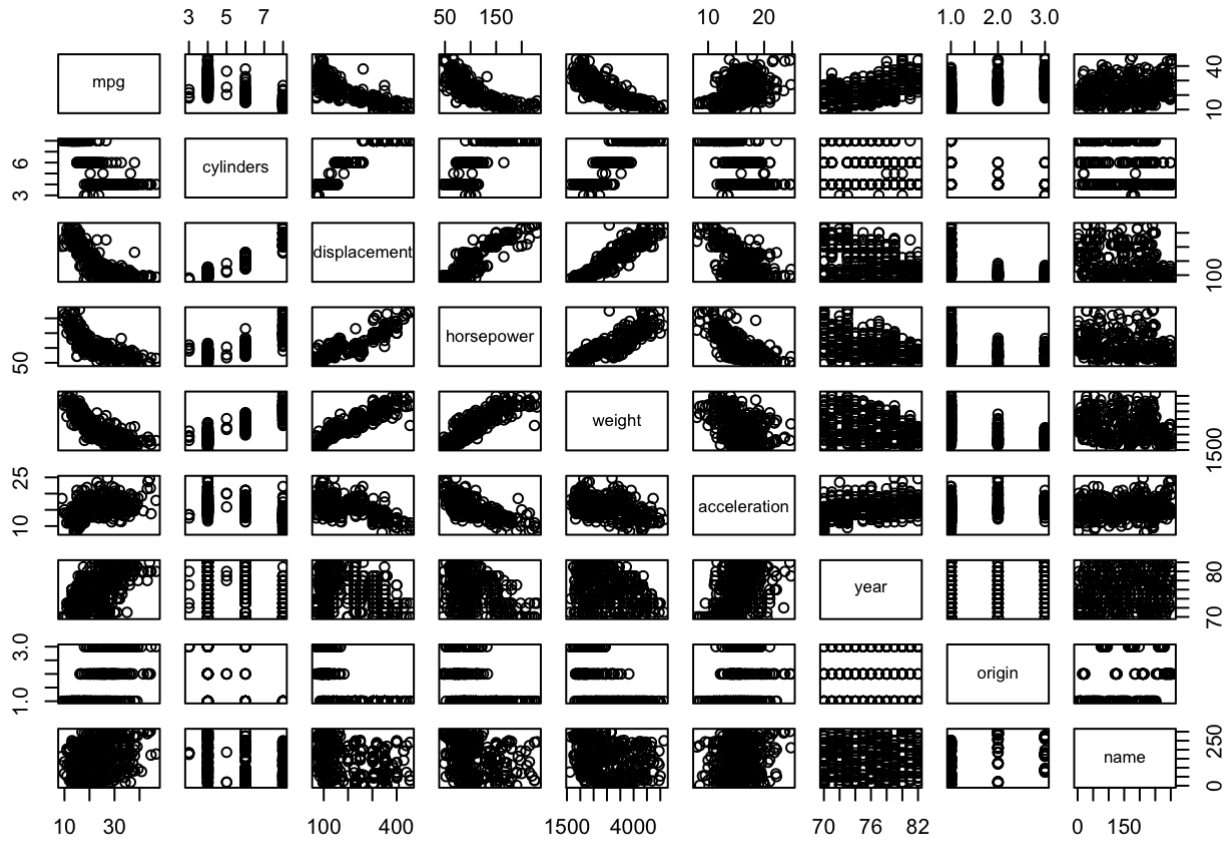
hist() is used to plot Histograms.

```
hist(mpg, col = 2, breaks = 50)
```

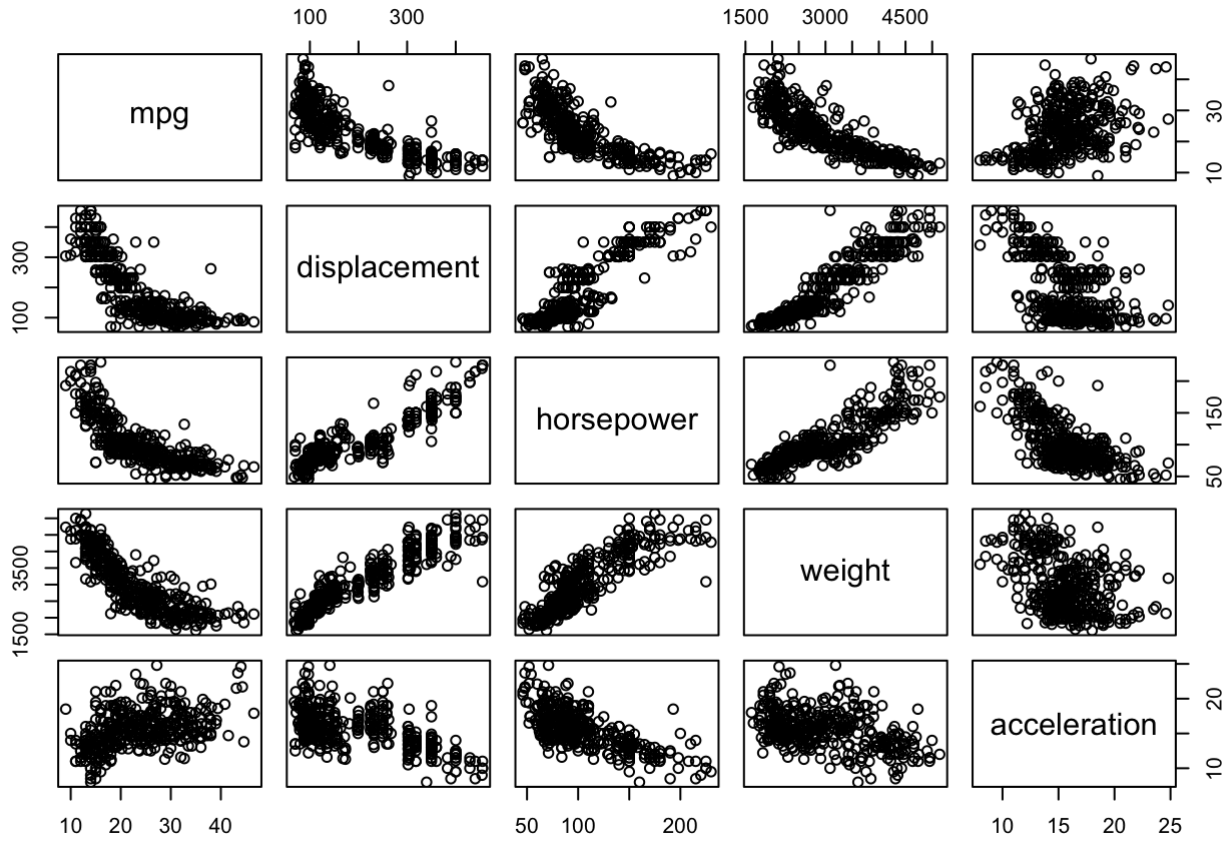


pairs() creates a scatterplot for every pair of variables. We can also produce scatterplots for just a subset of the variables.

```
pairs(Auto)
```




```
pairs(~ mpg + displacement + horsepower + weight + acceleration, data = Auto)
```



We can use summary() to view a numerical summary of each variable in a particular data set.

```
summary(Auto)
```

```
##       mpg          cylinders      displacement     horsepower        weight
##  Min.   : 9.00   Min.   :3.000   Min.   : 68.0   Min.   : 46.0   Min.   :1613
##  1st Qu.:17.00   1st Qu.:4.000   1st Qu.:105.0   1st Qu.: 75.0   1st Qu.:2225
##  Median :22.75   Median :4.000   Median :151.0   Median : 93.5   Median :2804
##  Mean   :23.45   Mean   :5.472   Mean   :194.4   Mean   :104.5   Mean   :2978
##  3rd Qu.:29.00   3rd Qu.:8.000   3rd Qu.:275.8   3rd Qu.:126.0   3rd Qu.:3615
##  Max.   :46.60   Max.   :8.000   Max.   :455.0   Max.   :230.0   Max.   :5140
##
##   acceleration        year           origin                      name
##  Min.   : 8.00   Min.   :70.00   Min.   :1.000   amc matador       :  5
##  1st Qu.:13.78   1st Qu.:73.00   1st Qu.:1.000   ford pinto        :  5
##  Median :15.50   Median :76.00   Median :1.000   toyota corolla    :  5
##  Mean   :15.54   Mean   :75.98   Mean   :1.577   amc gremlin       :  4
##  3rd Qu.:17.02   3rd Qu.:79.00   3rd Qu.:2.000   amc hornet        :  4
##  Max.   :24.80   Max.   :82.00   Max.   :3.000   chevrolet chevette:  4
##                                                  (Other)           :365
```

```
summary(mpg)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    9.00   17.00   22.75   23.45   29.00   46.60
```

Exercise 2.4

9. This exercise involves the Auto data set studied in the lab. Make sure that the missing values have been removed from the data.

(a) Which of the predictors are quantitative, and which are qualitative?

Answer - MPG, Displacement, Horsepower, Weight and Acceleration are Quantitative predictors. Cylinders, name, year and origin are Qualitative predictors.

(b) What is the range of each quantitative predictor? You can answer this using the range() function.

Answer -

```
Auto = na.omit(Auto)
range(mpg)   # Range of MPG
```

```
## [1]  9.0 46.6
```

```
range(displacement)   # Range of Displacement
```

```
## [1]  68 455
```

```
range(horsepower)   # Range of Horsepower
```

```
## [1]  46 230
```

```
range(weight)   # Range of Weight
```

```
## [1] 1613 5140
```

```
range(acceleration)   # Range of Acceleration
```

```
## [1]  8.0 24.8
```

c) What is the mean and standard deviation of each quantitative predictor?

Answer -

```
Auto = na.omit(Auto)
mean(mpg)   # Mean of MPG
```

```
## [1] 23.44592
```

```
sd(mpg)   # Standard Deviation of MPG
```

```
## [1] 7.805007
```

```
mean(displacement)   # Mean of Displacement
```

```
## [1] 194.412
```

```
sd(displacement)   # Standard Deviation of Displacement
```

```
## [1] 104.644
```

```
mean(horsepower)   # Mean of horsepower
```

```
## [1] 104.4694
```

```
sd(horsepower)   # Standard Deviation of Horsepower
```

```
## [1] 38.49116
```

```
mean(weight)   # Mean of Weight
```

```
## [1] 2977.584
```

```
sd(weight)   # Standard Deviation of Weight
```

```
## [1] 849.4026
```

```
mean(acceleration)   # Mean of Acceleration
```

```
## [1] 15.54133
```

```
sd(acceleration)   # Standard Deviation of Acceleration
```

```
## [1] 2.758864
```

(d) Now remove the 10th through 85th observations. What is the range, mean, and standard deviation of each predictor in the subset of the data that remains?

Answer -

```
Auto2 = Auto[-(10:84),]
attach(Auto2)
```

```
## The following objects are masked from Auto:
##
##     acceleration, cylinders, displacement, horsepower, mpg, name,
##     origin, weight, year
```

```
range(mpg)   # Range of MPG
```

```
## [1] 11.0 46.6
```

```
range(displacement)   # Range of Displacement
```

```
## [1]  68 455
```

```
range(horsepower)   # Range of Horsepower
```

```
## [1]  46 230
```

```
range(weight)   # Range of Weight
```

```
## [1] 1649 4997
```

```
range(acceleration)   # Range of Acceleration
```

```
## [1]  8.5 24.8
```

```
mean(mpg)   # Mean of MPG
```

```
## [1] 24.36845
```

```
sd(mpg)   # Standard Deviation of MPG
```

```
## [1] 7.880898
```

```
mean(displacement)   # Mean of Displacement
```

```
## [1] 187.7539
```

```
sd(displacement)   # Standard Deviation of Displacement
```

```
## [1] 99.93949
```

```
mean(horsepower)   # Mean of horsepower
```

```
## [1] 100.9558
```

```
sd(horsepower)   # Standard Deviation of Horsepower
```

```
## [1] 35.89557
```

```
mean(weight)   # Mean of Weight
```

```
## [1] 2939.644
```

```
sd(weight)   # Standard Deviation of Weight
```

```
## [1] 812.6496
```

```
mean(acceleration)   # Mean of Acceleration
```

```
## [1] 15.7183
```

```
sd(acceleration)   # Standard Deviation of Acceleration
```

```
## [1] 2.693813
```

(e) Using the full data set, investigate the predictors graphically, using scatter plots or other tools of your choice. Create some plots highlighting the relationships among the predictors. Comment on your findings.

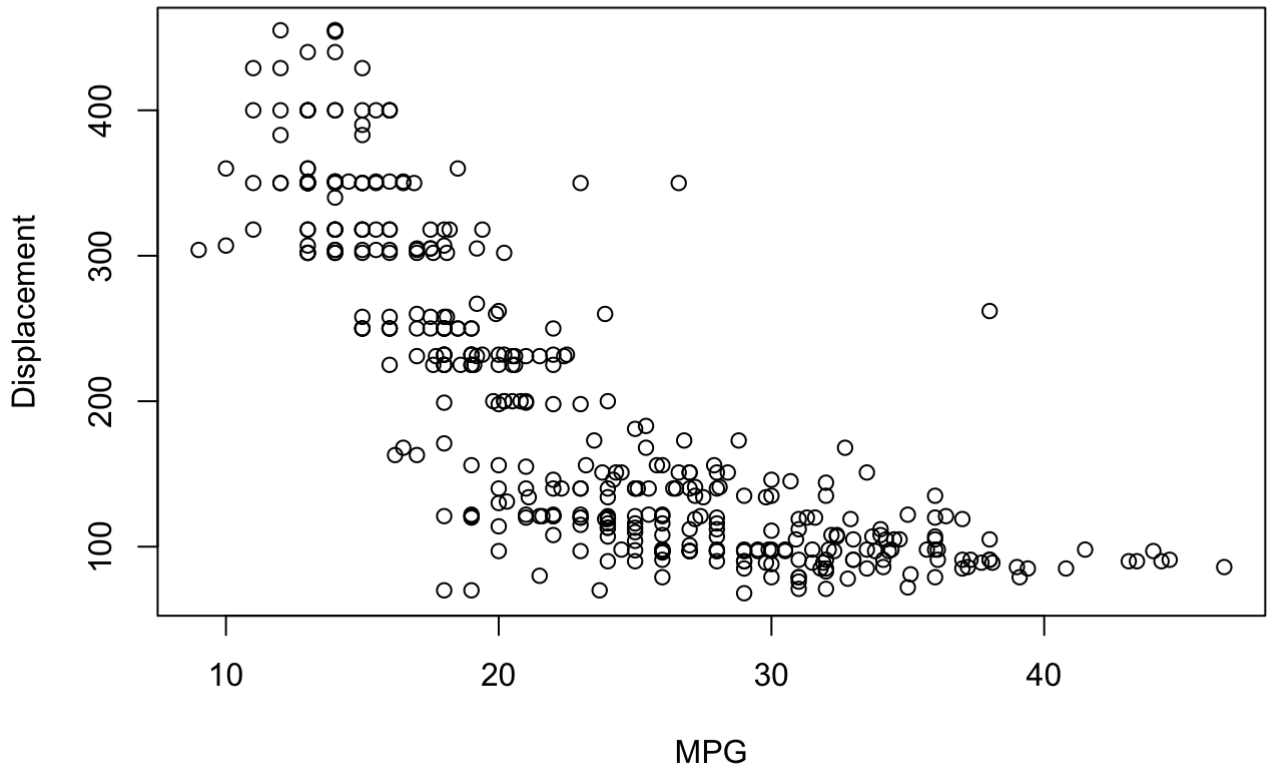
Answer -

```
attach(Auto)
```

```
## The following objects are masked from Auto2:
##
##     acceleration, cylinders, displacement, horsepower, mpg, name,
##     origin, weight, year
```

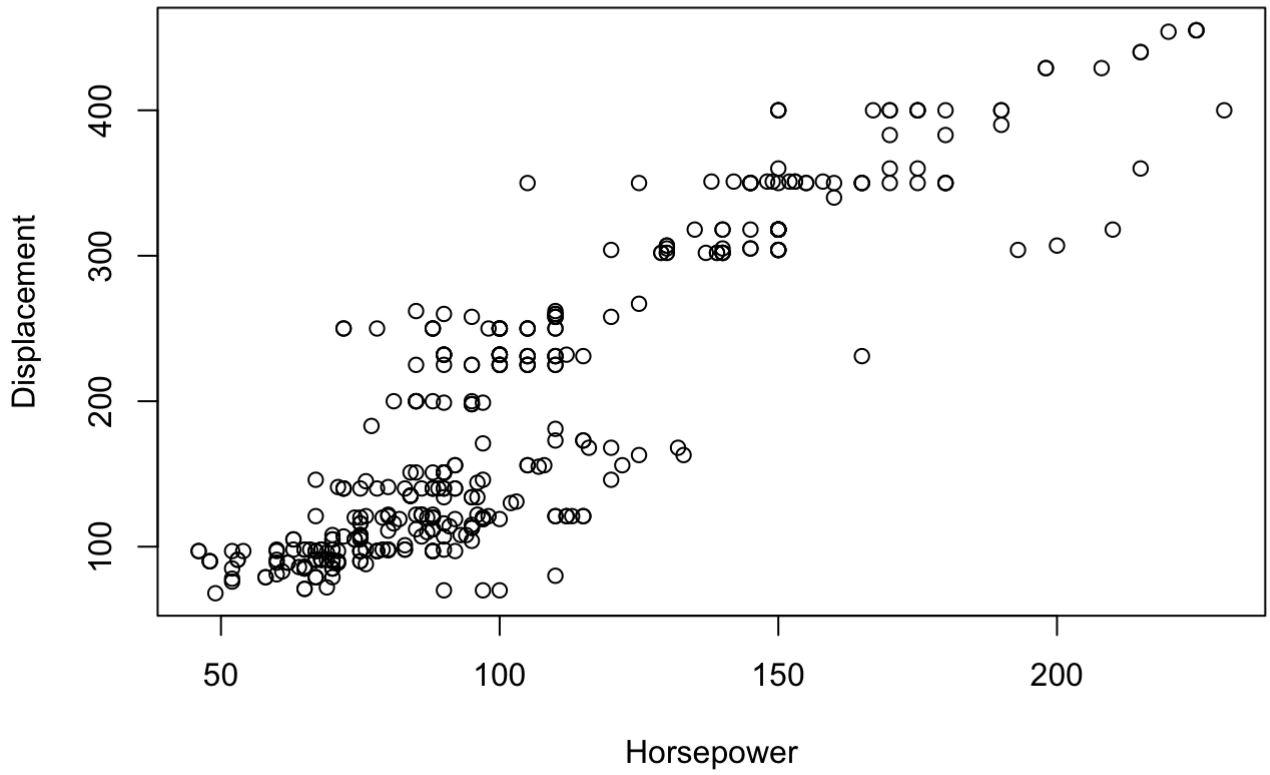
```
## The following objects are masked from Auto (pos = 4):
##
##     acceleration, cylinders, displacement, horsepower, mpg, name,
##     origin, weight, year
```

```
plot(mpg, displacement, xlab = "MPG", ylab = "Displacement")
```



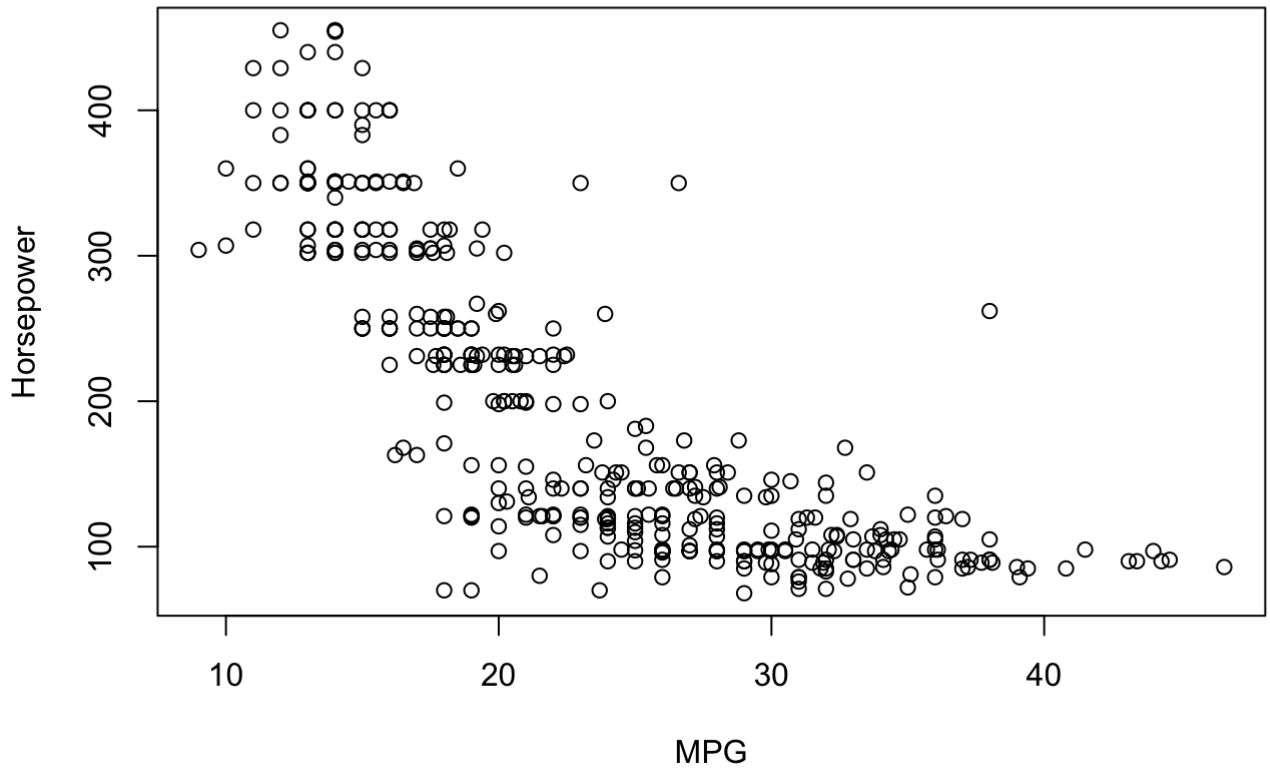

```
# This graphs shows us that more the displacement of the engine, lower the Miles per gallon(mileage)

plot(horsepower, displacement, xlab = "Horsepower", ylab = "Displacement")
```




```
# This graphs shows us that more the displacement of the engine, more the horsepower usually

plot(mpg, displacement, xlab = "MPG", ylab = "Horsepower")
```




```
# This graphs shows us that more the horsepower of the engine, lower the Miles per ga
llon(mileage)
```

(f) Suppose that we wish to predict gas mileage (mpg) on the basis of the other variables. Do your plots suggest that any of the other variables might be useful in predicting mpg? Justify your answer.
Answer - Yes according to my plots, mpg is inversely proportional to displacement and horsepower of the engine. Furthermore, mpg can also be predicted from weight. More the weight of the car, lesser the mpg.

8) a
Answer -

```
#reading the csv file from local desktop by using the read.csv function
College=read.csv("/Users/rishabh/Downloads//College.csv")
head(College)
```

```
##                              X Private Apps Accept Enroll Top10perc Top25perc
## 1 Abilene Christian University     Yes 1660   1232    721        23        52
## 2           Adelphi University     Yes 2186   1924    512        16        29
## 3               Adrian College     Yes 1428   1097    336        22        50
## 4          Agnes Scott College     Yes  417    349    137        60        89
## 5    Alaska Pacific University     Yes  193    146     55        16        44
## 6            Albertson College     Yes  587    479    158        38        62
##   F.Undergrad P.Undergrad Outstate Room.Board Books Personal PhD Terminal
## 1        2885         537     7440       3300   450     2200  70       78
## 2        2683        1227    12280       6450   750     1500  29       30
## 3        1036          99    11250       3750   400     1165  53       66
## 4         510          63    12960       5450   450      875  92       97
## 5         249         869     7560       4120   800     1500  76       72
## 6         678          41    13500       3335   500      675  67       73
##   S.F.Ratio perc.alumni Expend Grad.Rate
## 1      18.1          12   7041        60
## 2      12.2          16  10527        56
## 3      12.9          30   8735        54
## 4       7.7          37  19016        59
## 5      11.9           2  10922        15
## 6       9.4          11   9727        55
```

8) b) i)

Answer -

```
#printing the first column of the data frame
rownames(College) <- College[, 1]
rownames(College)
```

```
##   [1] "Abilene Christian University"
##   [2] "Adelphi University"
##   [3] "Adrian College"
##   [4] "Agnes Scott College"
##   [5] "Alaska Pacific University"
##   [6] "Albertson College"
##   [7] "Albertus Magnus College"
##   [8] "Albion College"
##   [9] "Albright College"
##  [10] "Alderson-Broaddus College"
##  [11] "Alfred University"
##  [12] "Allegheny College"
##  [13] "Allentown Coll. of St. Francis de Sales"
##  [14] "Alma College"
##  [15] "Alverno College"
##  [16] "American International College"
##  [17] "Amherst College"
##  [18] "Anderson University"
##  [19] "Andrews University"
##  [20] "Angelo State University"
##  [21] "Antioch University"
##  [22] "Appalachian State University"
##  [23] "Aquinas College"
##  [24] "Arizona State University Main campus"
##  [25] "Arkansas College (Lyon College)"
##  [26] "Arkansas Tech University"
##  [27] "Assumption College"
##  [28] "Auburn University-Main Campus"
##  [29] "Augsburg College"
##  [30] "Augustana College IL"
##  [31] "Augustana College"
##  [32] "Austin College"
##  [33] "Averett College"
##  [34] "Baker University"
##  [35] "Baldwin-Wallace College"
##  [36] "Barat College"
##  [37] "Bard College"
##  [38] "Barnard College"
##  [39] "Barry University"
##  [40] "Baylor University"
##  [41] "Beaver College"
##  [42] "Bellarmine College"
##  [43] "Belmont Abbey College"
##  [44] "Belmont University"
##  [45] "Beloit College"
##  [46] "Bemidji State University"
##  [47] "Benedictine College"
##  [48] "Bennington College"
##  [49] "Bentley College"
##  [50] "Berry College"
##  [51] "Bethany College"
##  [52] "Bethel College KS"
##  [53] "Bethel College"
##  [54] "Bethune Cookman College"
##  [55] "Birmingham-Southern College"
```

```
##  [56] "Blackburn College"
##  [57] "Bloomsburg Univ. of Pennsylvania"
##  [58] "Bluefield College"
##  [59] "Bluffton College"
##  [60] "Boston University"
##  [61] "Bowdoin College"
##  [62] "Bowling Green State University"
##  [63] "Bradford College"
##  [64] "Bradley University"
##  [65] "Brandeis University"
##  [66] "Brenau University"
##  [67] "Brewton-Parker College"
##  [68] "Briar Cliff College"
##  [69] "Bridgewater College"
##  [70] "Brigham Young University at Provo"
##  [71] "Brown University"
##  [72] "Bryn Mawr College"
##  [73] "Bucknell University"
##  [74] "Buena Vista College"
##  [75] "Butler University"
##  [76] "Cabrini College"
##  [77] "Caldwell College"
##  [78] "California Lutheran University"
##  [79] "California Polytechnic-San Luis"
##  [80] "California State University at Fresno"
##  [81] "Calvin College"
##  [82] "Campbell University"
##  [83] "Campbellsville College"
##  [84] "Canisius College"
##  [85] "Capital University"
##  [86] "Capitol College"
##  [87] "Carleton College"
##  [88] "Carnegie Mellon University"
##  [89] "Carroll College"
##  [90] "Carson-Newman College"
##  [91] "Carthage College"
##  [92] "Case Western Reserve University"
##  [93] "Castleton State College"
##  [94] "Catawba College"
##  [95] "Catholic University of America"
##  [96] "Cazenovia College"
##  [97] "Cedar Crest College"
##  [98] "Cedarville College"
##  [99] "Centenary College"
## [100] "Centenary College of Louisiana"
## [101] "Center for Creative Studies"
## [102] "Central College"
## [103] "Central Connecticut State University"
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## [755] "Wheeling Jesuit College"
## [756] "Whitman College"
## [757] "Whittier College"
## [758] "Whitworth College"
## [759] "Widener University"
## [760] "Wilkes University"
## [761] "Willamette University"
## [762] "William Jewell College"
## [763] "William Woods University"
## [764] "Williams College"
## [765] "Wilson College"
## [766] "Wingate College"
## [767] "Winona State University"
## [768] "Winthrop University"
## [769] "Wisconsin Lutheran College"
## [770] "Wittenberg University"
## [771] "Wofford College"
## [772] "Worcester Polytechnic Institute"
## [773] "Worcester State College"
## [774] "Xavier University"
## [775] "Xavier University of Louisiana"
## [776] "Yale University"
## [777] "York College of Pennsylvania"
```

```
head(College)
```

```
##                                                    X Private Apps Accept
## Abilene Christian University Abilene Christian University     Yes 1660   1232
## Adelphi University                     Adelphi University     Yes 2186   1924
## Adrian College                             Adrian College     Yes 1428   1097
## Agnes Scott College                   Agnes Scott College     Yes  417    349
## Alaska Pacific University       Alaska Pacific University     Yes  193    146
## Albertson College                       Albertson College     Yes  587    479
##                              Enroll Top10perc Top25perc F.Undergrad P.Undergrad
## Abilene Christian University    721        23        52        2885         537
## Adelphi University              512        16        29        2683        1227
## Adrian College                  336        22        50        1036          99
## Agnes Scott College             137        60        89         510          63
## Alaska Pacific University        55        16        44         249         869
## Albertson College               158        38        62         678          41
##                              Outstate Room.Board Books Personal PhD Terminal
## Abilene Christian University     7440       3300   450     2200  70       78
## Adelphi University              12280       6450   750     1500  29       30
## Adrian College                  11250       3750   400     1165  53       66
## Agnes Scott College             12960       5450   450      875  92       97
## Alaska Pacific University        7560       4120   800     1500  76       72
## Albertson College               13500       3335   500      675  67       73
##                              S.F.Ratio perc.alumni Expend Grad.Rate
## Abilene Christian University      18.1          12   7041        60
## Adelphi University                12.2          16  10527        56
## Adrian College                    12.9          30   8735        54
## Agnes Scott College                7.7          37  19016        59
## Alaska Pacific University         11.9           2  10922        15
## Albertson College                  9.4          11   9727        55
```

```
#deleting the first column of the data frame
College <- College[, -1]
head(College)
```

```
##                              Private Apps Accept Enroll Top10perc Top25perc
## Abilene Christian University     Yes 1660   1232    721        23        52
## Adelphi University               Yes 2186   1924    512        16        29
## Adrian College                   Yes 1428   1097    336        22        50
## Agnes Scott College              Yes  417    349    137        60        89
## Alaska Pacific University        Yes  193    146     55        16        44
## Albertson College                Yes  587    479    158        38        62
##                              F.Undergrad P.Undergrad Outstate Room.Board Books
## Abilene Christian University        2885         537     7440       3300   450
## Adelphi University                  2683        1227    12280       6450   750
## Adrian College                      1036          99    11250       3750   400
## Agnes Scott College                  510          63    12960       5450   450
## Alaska Pacific University            249         869     7560       4120   800
## Albertson College                    678          41    13500       3335   500
##                              Personal PhD Terminal S.F.Ratio perc.alumni Expend
## Abilene Christian University     2200  70       78      18.1          12   7041
## Adelphi University               1500  29       30      12.2          16  10527
## Adrian College                   1165  53       66      12.9          30   8735
## Agnes Scott College               875  92       97       7.7          37  19016
## Alaska Pacific University        1500  76       72      11.9           2  10922
## Albertson College                 675  67       73       9.4          11   9727
##                              Grad.Rate
## Abilene Christian University        60
## Adelphi University                  56
## Adrian College                      54
## Agnes Scott College                 59
## Alaska Pacific University           15
## Albertson College                   55
```

8) c) i)

Answer -

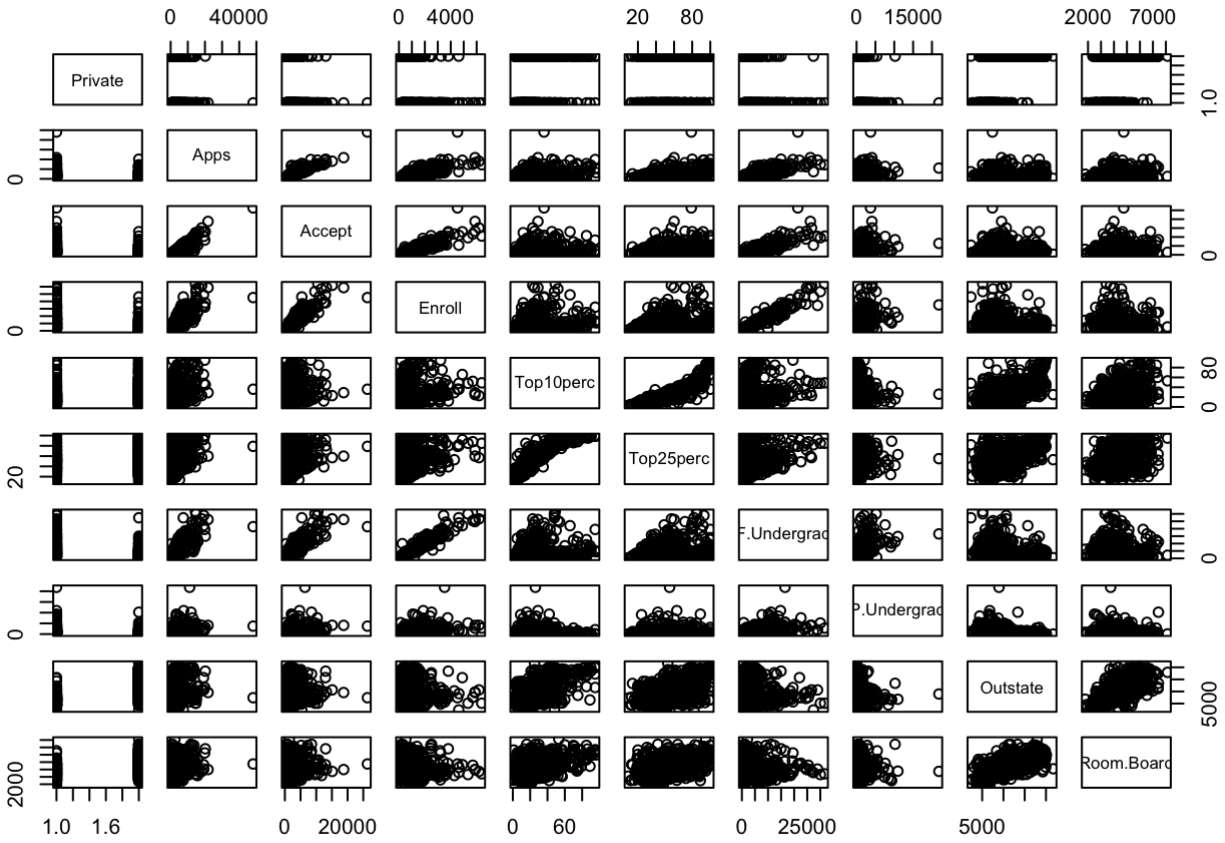
```
summary(College)
```

```
##    Private                Apps           Accept          Enroll
##  Length:777         Min.   :   81   Min.   :   72   Min.   :  35
##  Class :character   1st Qu.:  776   1st Qu.:  604   1st Qu.: 242
##  Mode  :character   Median : 1558   Median : 1110   Median : 434
##                     Mean   : 3002   Mean   : 2019   Mean   : 780
##                     3rd Qu.: 3624   3rd Qu.: 2424   3rd Qu.: 902
##                     Max.   :48094   Max.   :26330   Max.   :6392
##    Top10perc       Top25perc      F.Undergrad     P.Undergrad
##  Min.   : 1.00   Min.   :  9.0   Min.   :  139   Min.   :    1.0
##  1st Qu.:15.00   1st Qu.: 41.0   1st Qu.:  992   1st Qu.:   95.0
##  Median :23.00   Median : 54.0   Median : 1707   Median :  353.0
##  Mean   :27.56   Mean   : 55.8   Mean   : 3700   Mean   :  855.3
##  3rd Qu.:35.00   3rd Qu.: 69.0   3rd Qu.: 4005   3rd Qu.:  967.0
##  Max.   :96.00   Max.   :100.0   Max.   :31643   Max.   :21836.0
##     Outstate       Room.Board       Books           Personal
##  Min.   : 2340   Min.   :1780   Min.   :  96.0   Min.   : 250
##  1st Qu.: 7320   1st Qu.:3597   1st Qu.: 470.0   1st Qu.: 850
##  Median : 9990   Median :4200   Median : 500.0   Median :1200
##  Mean   :10441   Mean   :4358   Mean   : 549.4   Mean   :1341
##  3rd Qu.:12925   3rd Qu.:5050   3rd Qu.: 600.0   3rd Qu.:1700
##  Max.   :21700   Max.   :8124   Max.   :2340.0   Max.   :6800
##       PhD            Terminal       S.F.Ratio      perc.alumni
##  Min.   :  8.00   Min.   : 24.0   Min.   : 2.50   Min.   : 0.00
##  1st Qu.: 62.00   1st Qu.: 71.0   1st Qu.:11.50   1st Qu.:13.00
##  Median : 75.00   Median : 82.0   Median :13.60   Median :21.00
##  Mean   : 72.66   Mean   : 79.7   Mean   :14.09   Mean   :22.74
##  3rd Qu.: 85.00   3rd Qu.: 92.0   3rd Qu.:16.50   3rd Qu.:31.00
##  Max.   :103.00   Max.   :100.0   Max.   :39.80   Max.   :64.00
##      Expend        Grad.Rate
##  Min.   : 3186   Min.   : 10.00
##  1st Qu.: 6751   1st Qu.: 53.00
##  Median : 8377   Median : 65.00
##  Mean   : 9660   Mean   : 65.46
##  3rd Qu.:10830   3rd Qu.: 78.00
##  Max.   :56233   Max.   :118.00
```

8) c) ii)

Answer -

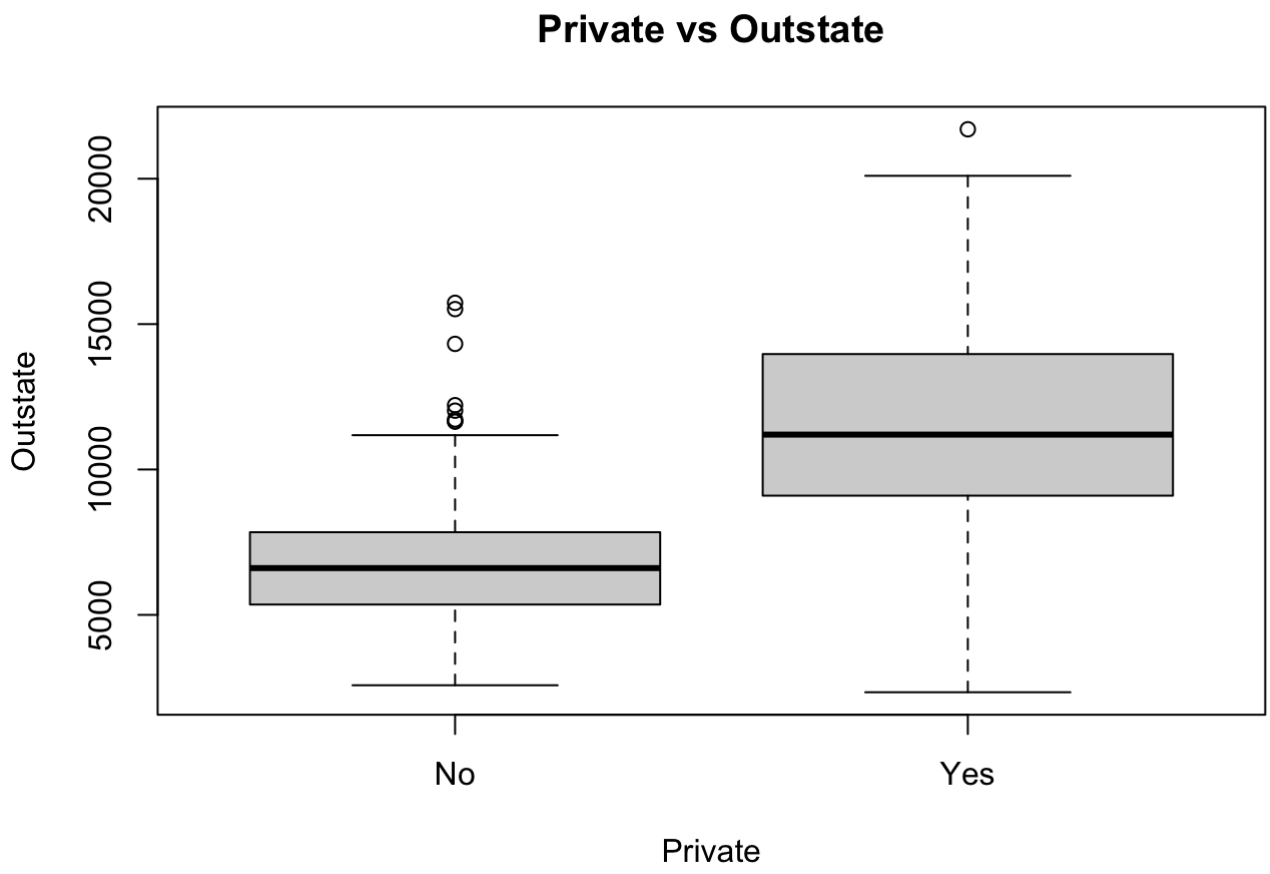
```
#converting the categorical value to the numeric by using the as.factor
College[,1] <-as.factor(College[,1])
#plotting the scatter plot for the first 10 features
pairs(College[,1:10])
```



8) c) iii)

Answer -

```
#plotting the box plot for the private and out-state features
College$Private <- as.factor(College$Private)
plot(College$Private,College$Outstate,xlab="Private",ylab="Outstate",main='Private vs
Outstate')
```



8) c) iv)

Answer -

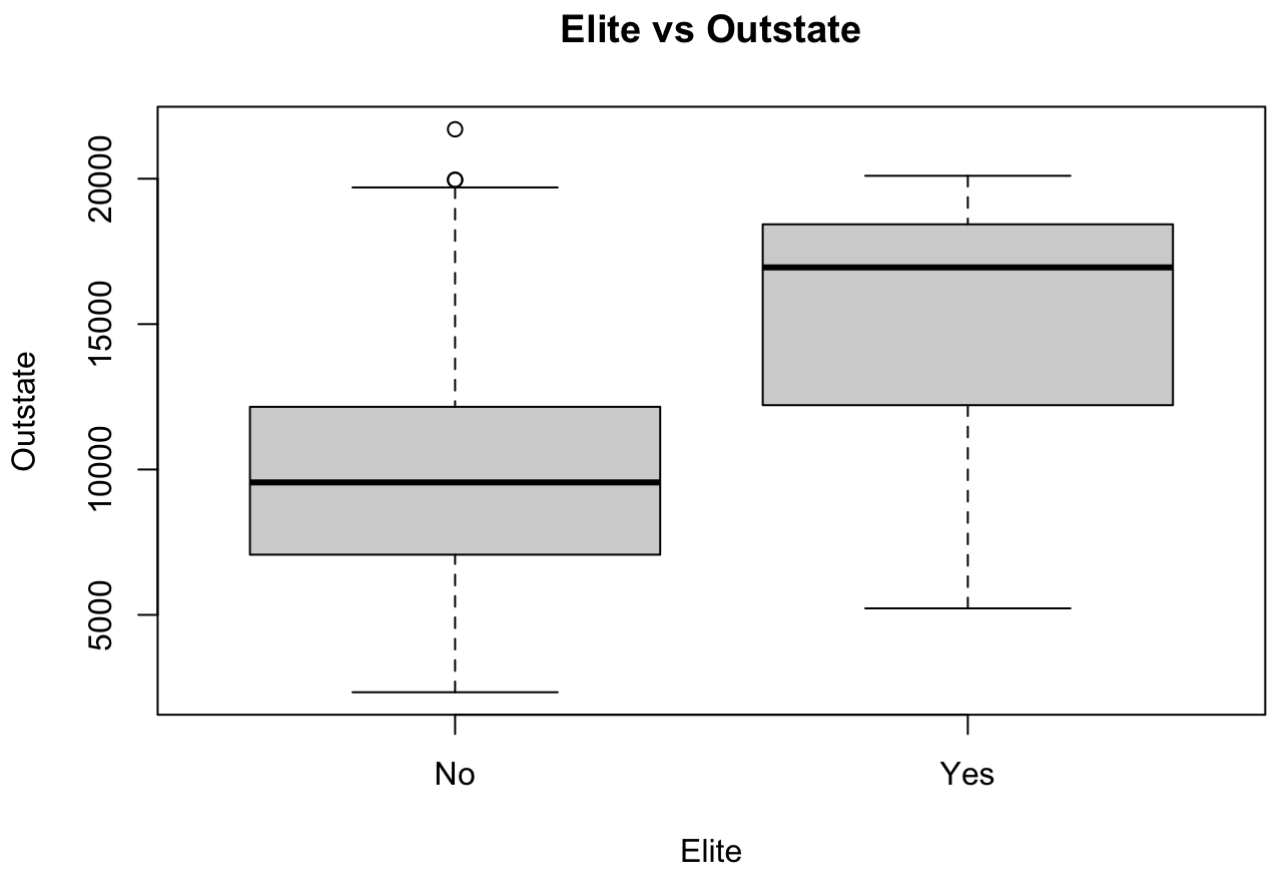
```
# creating a new feature called elite and filling the column with No
# in second line we are checking the that top 10% >50 then it changes to YES and chan
ging to numerical by using as.factor
Elite <- rep("No", nrow(College))
Elite[College$Top10perc > 50] <- "Yes"
Elite <- as.factor(Elite)
College <- data.frame(College,Elite)
head(College) # printing the the first 5 rows of the data frame
```

```
##                              Private Apps Accept Enroll Top10perc Top25perc
## Abilene Christian University     Yes 1660   1232    721        23        52
## Adelphi University               Yes 2186   1924    512        16        29
## Adrian College                   Yes 1428   1097    336        22        50
## Agnes Scott College              Yes  417    349    137        60        89
## Alaska Pacific University        Yes  193    146     55        16        44
## Albertson College                Yes  587    479    158        38        62
##                              F.Undergrad P.Undergrad Outstate Room.Board Books
## Abilene Christian University        2885         537     7440       3300   450
## Adelphi University                  2683        1227    12280       6450   750
## Adrian College                      1036          99    11250       3750   400
## Agnes Scott College                  510          63    12960       5450   450
## Alaska Pacific University            249         869     7560       4120   800
## Albertson College                    678          41    13500       3335   500
##                              Personal PhD Terminal S.F.Ratio perc.alumni Expend
## Abilene Christian University     2200  70       78      18.1          12   7041
## Adelphi University               1500  29       30      12.2          16  10527
## Adrian College                   1165  53       66      12.9          30   8735
## Agnes Scott College               875  92       97       7.7          37  19016
## Alaska Pacific University        1500  76       72      11.9           2  10922
## Albertson College                 675  67       73       9.4          11   9727
##                              Grad.Rate Elite
## Abilene Christian University        60    No
## Adelphi University                  56    No
## Adrian College                      54    No
## Agnes Scott College                 59   Yes
## Alaska Pacific University           15    No
## Albertson College                   55    No
```

```
# printing the summary of the college
summary(College)
```

```
##  Private        Apps           Accept          Enroll       Top10perc
##  No :212   Min.   :   81   Min.   :   72   Min.   :  35   Min.   : 1.00
##  Yes:565   1st Qu.:  776   1st Qu.:  604   1st Qu.: 242   1st Qu.:15.00
##            Median : 1558   Median : 1110   Median : 434   Median :23.00
##            Mean   : 3002   Mean   : 2019   Mean   : 780   Mean   :27.56
##            3rd Qu.: 3624   3rd Qu.: 2424   3rd Qu.: 902   3rd Qu.:35.00
##            Max.   :48094   Max.   :26330   Max.   :6392   Max.   :96.00
##    Top25perc      F.Undergrad     P.Undergrad         Outstate
##  Min.   :  9.0   Min.   :  139   Min.   :    1.0   Min.   : 2340
##  1st Qu.: 41.0   1st Qu.:  992   1st Qu.:   95.0   1st Qu.: 7320
##  Median : 54.0   Median : 1707   Median :  353.0   Median : 9990
##  Mean   : 55.8   Mean   : 3700   Mean   :  855.3   Mean   :10441
##  3rd Qu.: 69.0   3rd Qu.: 4005   3rd Qu.:  967.0   3rd Qu.:12925
##  Max.   :100.0   Max.   :31643   Max.   :21836.0   Max.   :21700
##    Room.Board       Books           Personal         PhD
##  Min.   :1780   Min.   :  96.0   Min.   : 250   Min.   :  8.00
##  1st Qu.:3597   1st Qu.: 470.0   1st Qu.: 850   1st Qu.: 62.00
##  Median :4200   Median : 500.0   Median :1200   Median : 75.00
##  Mean   :4358   Mean   : 549.4   Mean   :1341   Mean   : 72.66
##  3rd Qu.:5050   3rd Qu.: 600.0   3rd Qu.:1700   3rd Qu.: 85.00
##  Max.   :8124   Max.   :2340.0   Max.   :6800   Max.   :103.00
##     Terminal       S.F.Ratio      perc.alumni        Expend
##  Min.   : 24.0   Min.   : 2.50   Min.   : 0.00   Min.   : 3186
##  1st Qu.: 71.0   1st Qu.:11.50   1st Qu.:13.00   1st Qu.: 6751
##  Median : 82.0   Median :13.60   Median :21.00   Median : 8377
##  Mean   : 79.7   Mean   :14.09   Mean   :22.74   Mean   : 9660
##  3rd Qu.: 92.0   3rd Qu.:16.50   3rd Qu.:31.00   3rd Qu.:10830
##  Max.   :100.0   Max.   :39.80   Max.   :64.00   Max.   :56233
##    Grad.Rate      Elite
##  Min.   : 10.00   No :699
##  1st Qu.: 53.00   Yes: 78
##  Median : 65.00
##  Mean   : 65.46
##  3rd Qu.: 78.00
##  Max.   :118.00
```

```
#printing the Box plot between Elite and Outstate
plot(College$Elite,College$Outstate,xlab="Elite",ylab="Outstate",main='Elite vs Outst
ate')
```

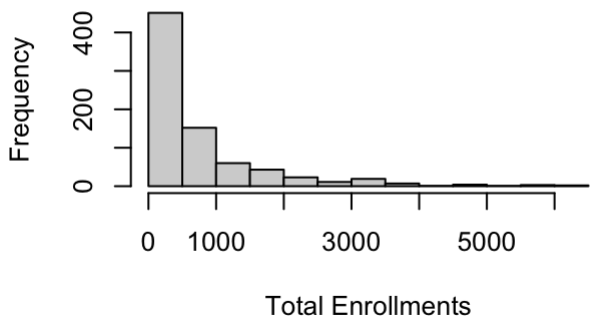


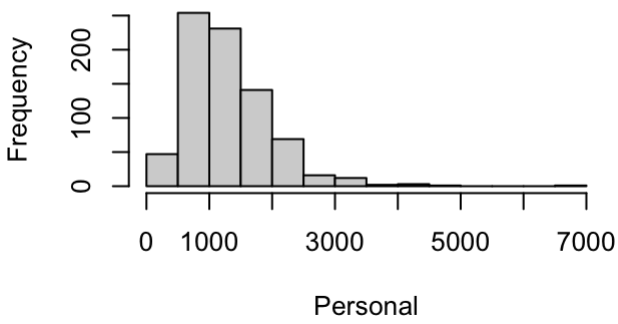
8)

c) v)

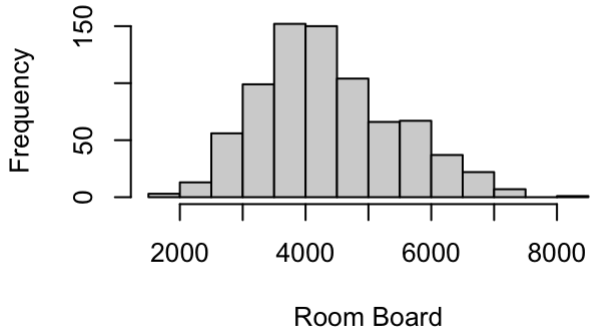
Answer -

```
#plotting the histogram plots for quantitative variables
par(mfrow=c(2,2))
hist(College$Enroll,xlab="Total Enrollments",main="")
hist(College$Personal,xlab="Personal",main="")
hist(College$Room.Board,xlab="Room Board",main="")
```





8)



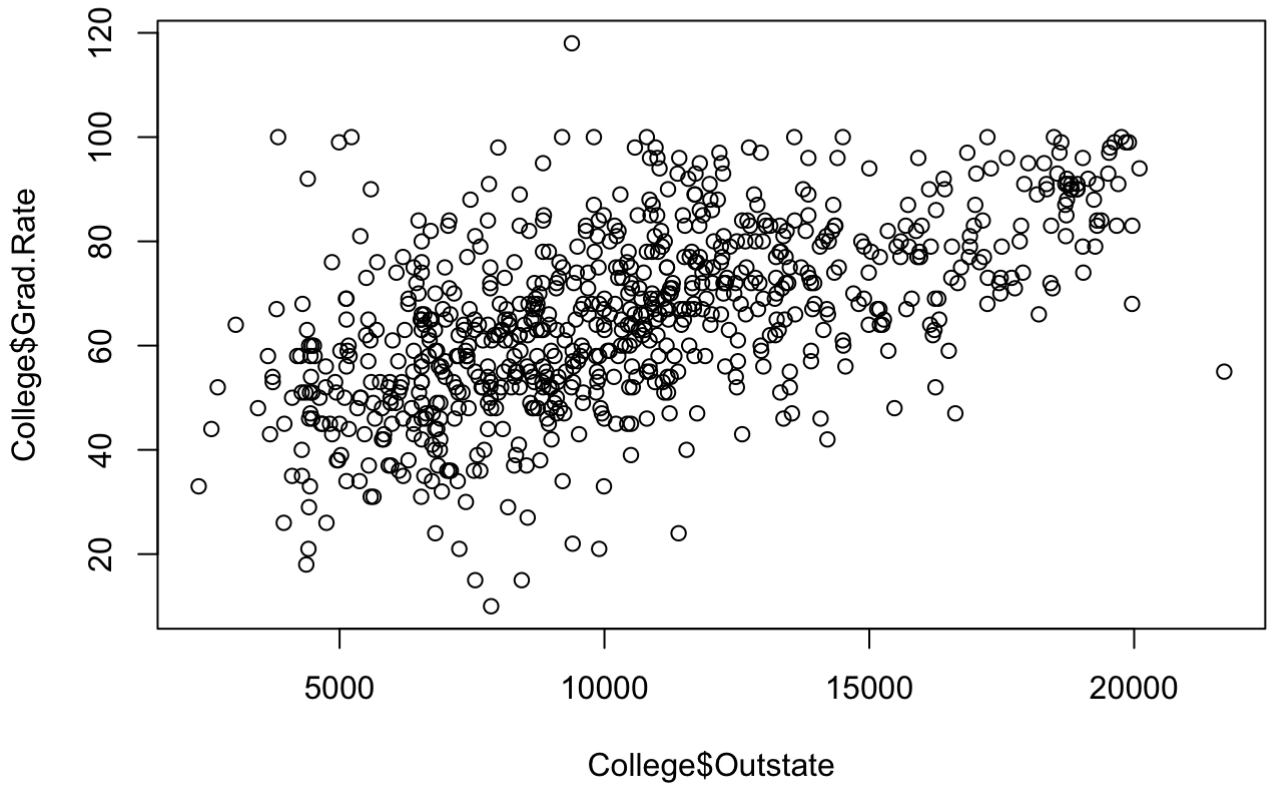
c) vi)

Answer -

```
# finding mean Graduation Rate
print(paste("The mean Graduation Rate of the universities:",mean(College$Grad.Rate)))
```

```
## [1] "The mean Graduation Rate of the universities: 65.4633204633205"
```

```
# Plotting the scatterplot for the outstate vs the Graduation rate
plot(College$Outstate,College$Grad.Rate)
```




```
# university with the Minimum applications
print(paste("Minimum applications for university:",
row.names(College)[which.min(College$Apps)]))
```

```
## [1] "Minimum applications for university: Christendom College"
```