

# IRIS

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## R Markdown

This is the R Markdown file created for introducing the basic building blocks of R to PSA Data Analytics Technical Participants.

```
install.packages("PerformanceAnalytics",repos = "http://cran.us.r-
project.org")

## package 'PerformanceAnalytics' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
## C:\Users\pramodkv\AppData\Local\Temp\RtmpgjppLB\downloaded_packages

library(PerformanceAnalytics)

head(iris)

##   Sepal.Length Sepal.Width Petal.Length Petal.Width Species
## 1           5.1         3.5          1.4          0.2  setosa
## 2           4.9         3.0          1.4          0.2  setosa
## 3           4.7         3.2          1.3          0.2  setosa
## 4           4.6         3.1          1.5          0.2  setosa
## 5           5.0         3.6          1.4          0.2  setosa
## 6           5.4         3.9          1.7          0.4  setosa

str(iris)

## 'data.frame':   150 obs. of  5 variables:
##  $ Sepal.Length: num  5.1 4.9 4.7 4.6 5 5.4 4.6 5 4.4 4.9 ...
##  $ Sepal.Width : num  3.5 3 3.2 3.1 3.6 3.9 3.4 3.4 2.9 3.1 ...
##  $ Petal.Length: num  1.4 1.4 1.3 1.5 1.4 1.7 1.4 1.5 1.4 1.5 ...
##  $ Petal.Width : num  0.2 0.2 0.2 0.2 0.2 0.4 0.3 0.2 0.2 0.1 ...
##  $ Species      : Factor w/ 3 levels "setosa","versicolor",...: 1 1 1 1 1 1
## 1 1 1 1 ...

dim(iris)

## [1] 150  5

names(iris)

## [1] "Sepal.Length" "Sepal.Width" "Petal.Length" "Petal.Width" "Species"

class(iris)
```

```
## [1] "data.frame"
```

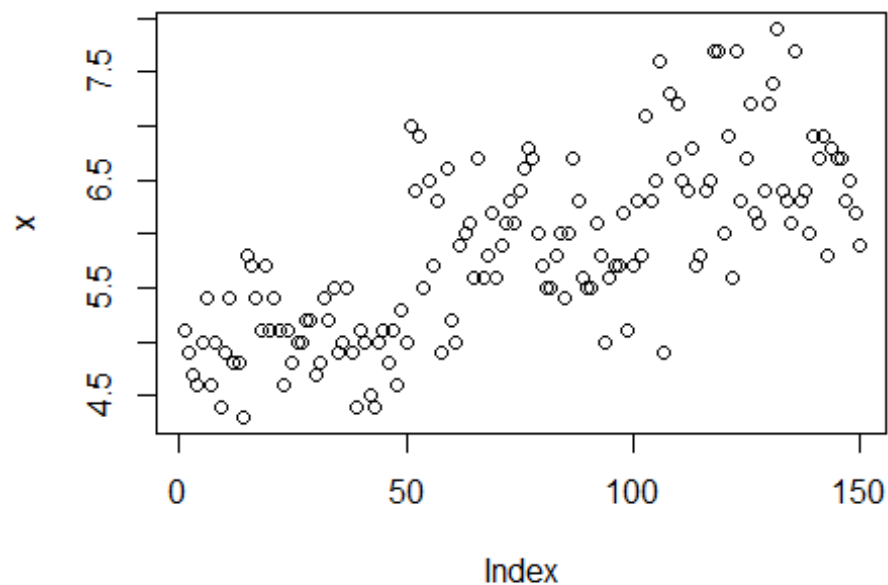
```
summary(iris)
```

```
##   Sepal.Length   Sepal.Width   Petal.Length   Petal.Width
##   Min.    :4.300   Min.    :2.000   Min.    :1.000   Min.    :0.100
##   1st Qu.:5.100   1st Qu.:2.800   1st Qu.:1.600   1st Qu.:0.300
##   Median :5.800   Median :3.000   Median :4.350   Median :1.300
##   Mean    :5.843   Mean    :3.057   Mean    :3.758   Mean    :1.199
##   3rd Qu.:6.400   3rd Qu.:3.300   3rd Qu.:5.100   3rd Qu.:1.800
##   Max.    :7.900   Max.    :4.400   Max.    :6.900   Max.    :2.500
##      Species
##   setosa    :50
##   versicolor:50
##   virginica  :50
##
##
##
```

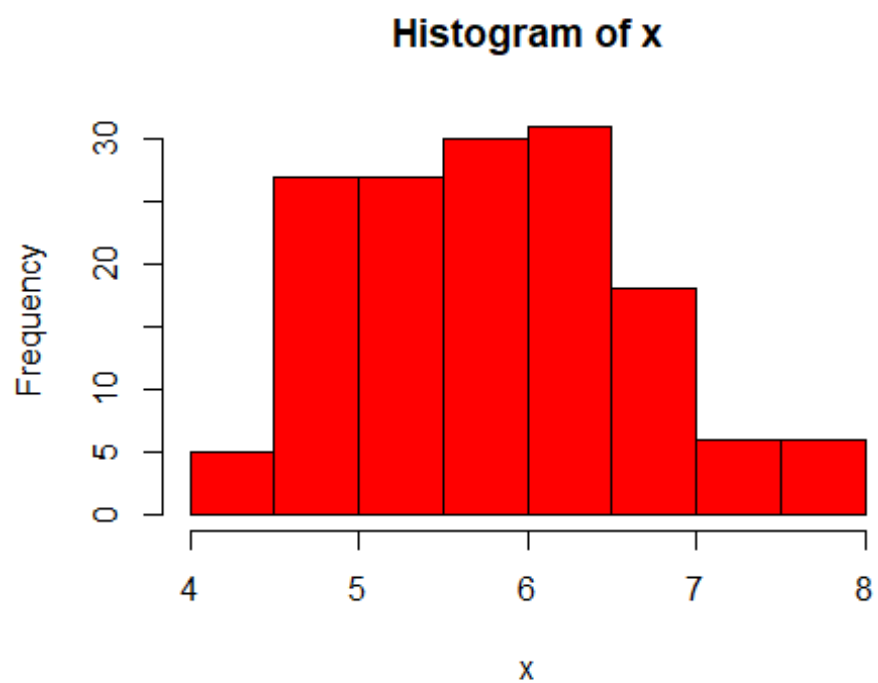
## Assigning Variables and Plotting

```
x <- iris$Sepal.Length
y <- iris$Sepal.Width
z <- iris$Species
```

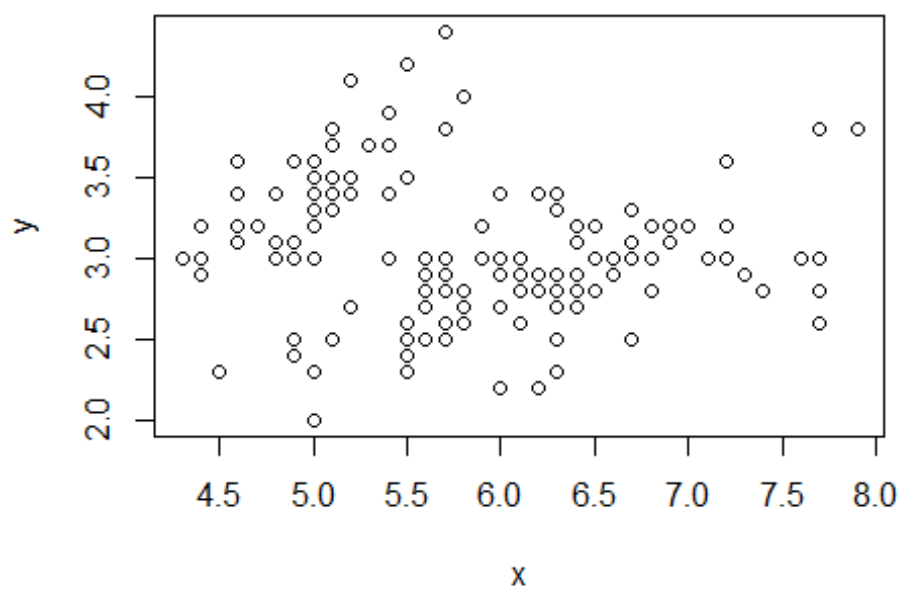
```
plot(x)
```



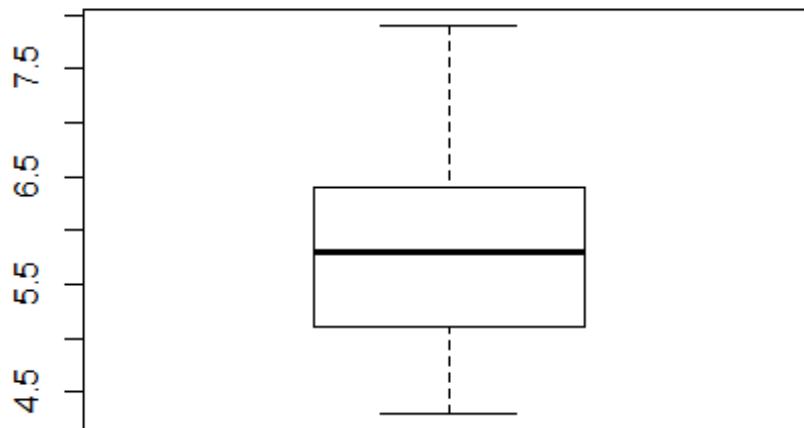
```
hist(x, col = "red")
```



```
plot(x,y)
```



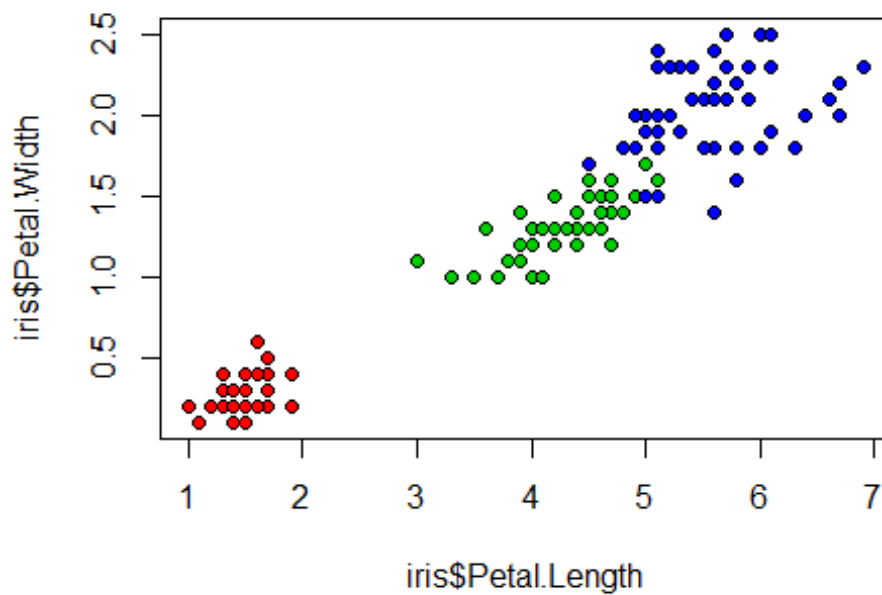
```
boxplot(x)
```



## Looking at all the species in the same scatterplot for Petal Length & Width

```
plot(iris$Petal.Length, iris$Petal.Width, pch=21,  
bg=c("red", "green3", "blue")[unclass(iris$Species)],  
main="Edgar Anderson's Iris Data")
```

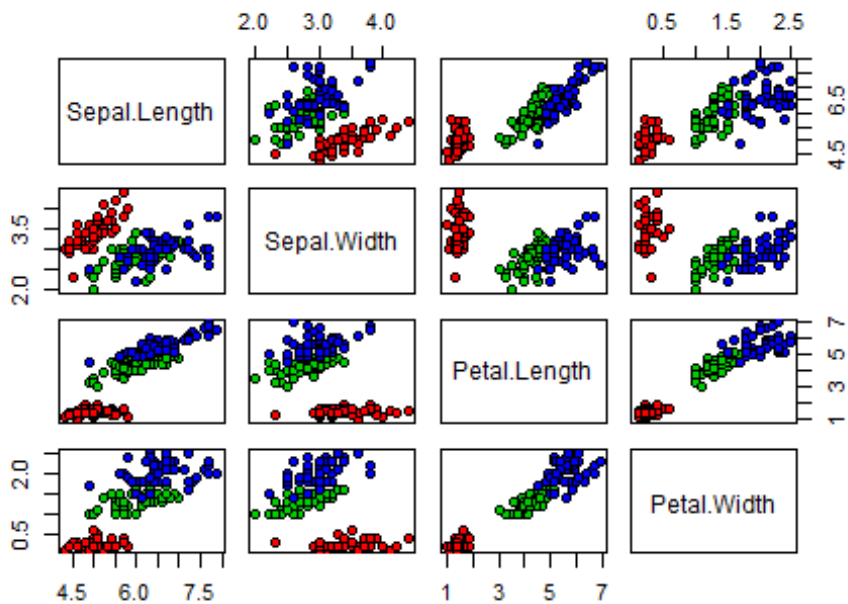
## Edgar Anderson's Iris Data



Looking at the scatterplot of all the variables for each species

```
pairs(iris[1:4], main = "Edgar Anderson's Iris Data", pch = 21,
bg = c("red", "green3", "blue")[unclass(iris$Species)])
```

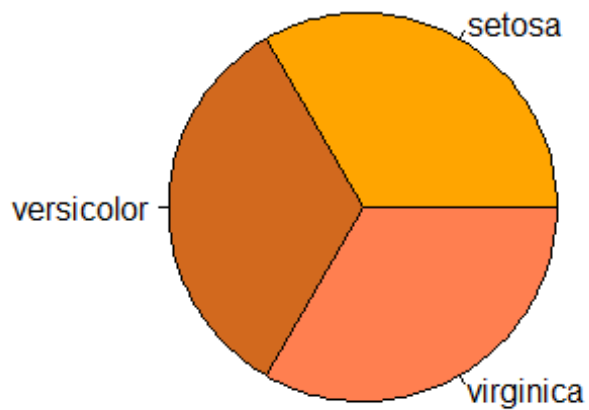
## Edgar Anderson's Iris Data



## Creating pi chart to show the share of each species

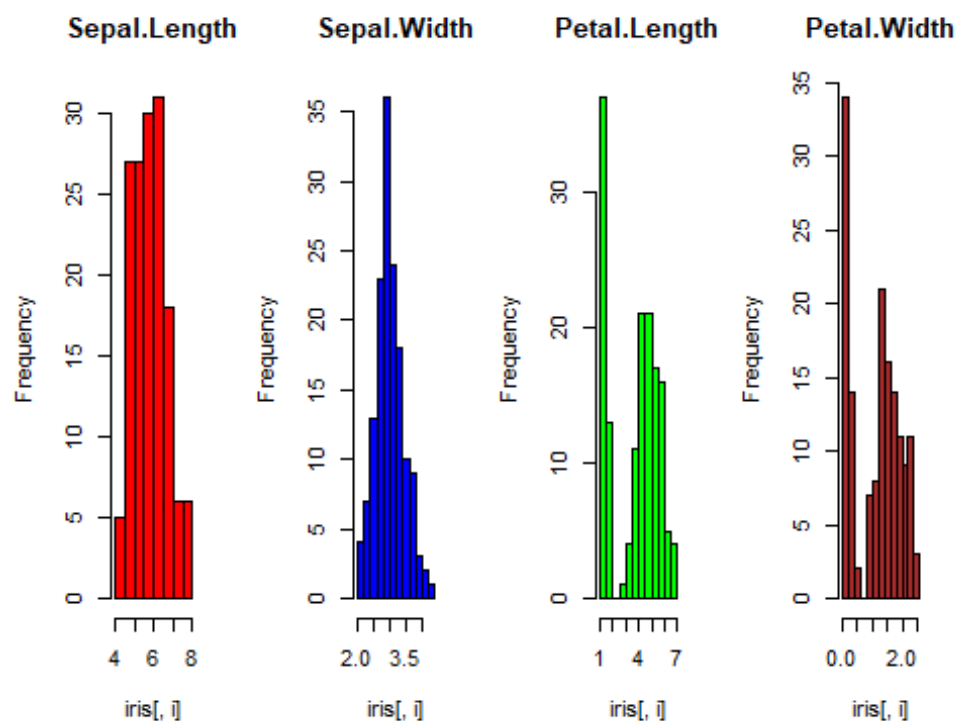
```
pie(table(iris$Species),  
main = "Pie Chart of the Iris data set Species",  
col = c("orange1", "chocolate", "coral"),  
radius = 1)
```

**Pie Chart of the Iris data set Species**



## Using for loop to create multiple plots

```
par(mfrow=c(1,4))  
color <- c("red", "blue", "green", "brown")  
for(i in 1:4) {  
  hist(iris[,i], main=names(iris)[i], col = color[i]) }
```

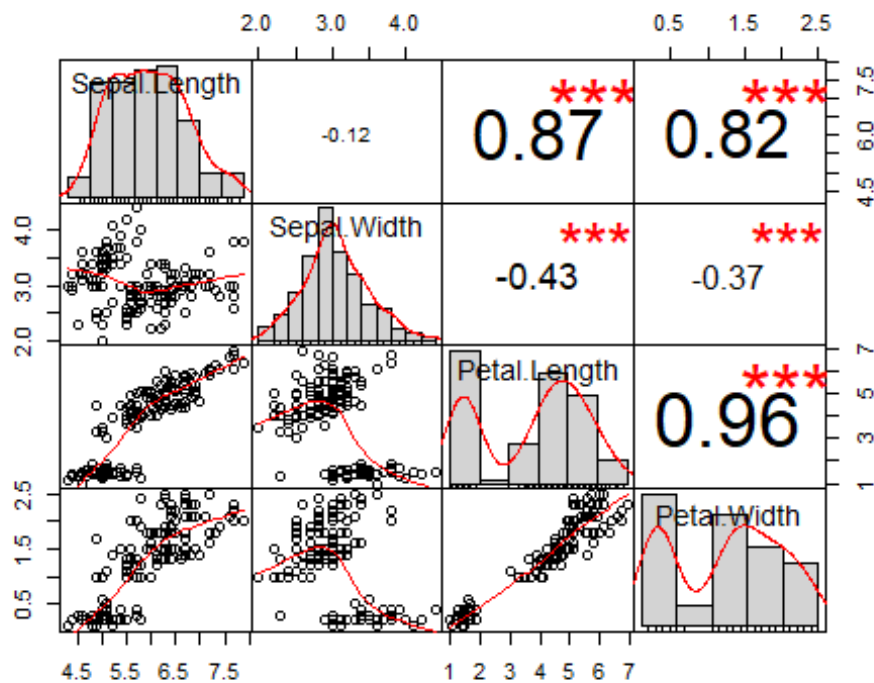


## Finding out the correlation among all the numerical variables

```
cor(iris[,c(1:4)])
```

```
##           Sepal.Length Sepal.Width Petal.Length Petal.Width
## Sepal.Length      1.0000000  -0.1175698   0.8717538   0.8179411
## Sepal.Width      -0.1175698   1.0000000  -0.4284401  -0.3661259
## Petal.Length      0.8717538  -0.4284401   1.0000000   0.9628654
## Petal.Width      0.8179411  -0.3661259   0.9628654   1.0000000
```

```
chart.Correlation(iris[,c(1,2,3,4)], histogram=TRUE, pch=19)
```



## Demostration of K Means Clustering

```
normalize <- function(x){
  return ((x-min(x))/(max(x)-min(x)))
}

iris$Sepal.Length<- normalize(iris$Sepal.Length)
iris$Sepal.Width<- normalize(iris$Sepal.Width)
iris$Petal.Length<- normalize(iris$Petal.Length)
iris$Petal.Width<- normalize(iris$Petal.Width)
head(iris)

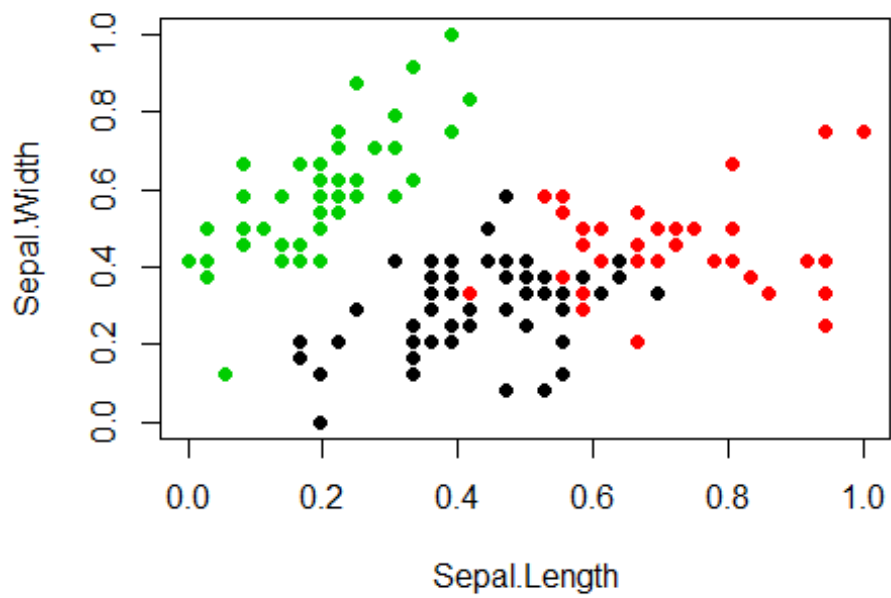
##   Sepal.Length Sepal.Width Petal.Length Petal.Width Species
## 1  0.22222222  0.6250000  0.06779661  0.04166667  setosa
## 2  0.16666667  0.4166667  0.06779661  0.04166667  setosa
## 3  0.11111111  0.5000000  0.05084746  0.04166667  setosa
## 4  0.08333333  0.4583333  0.08474576  0.04166667  setosa
## 5  0.19444444  0.6666667  0.06779661  0.04166667  setosa
## 6  0.30555556  0.7916667  0.11864407  0.12500000  setosa

result<- kmeans(iris[,c(1,2,3,4)],3)

plot(iris[c(1,2)], col=result$cluster, pch = 19, main = " Clusters based on
Sepal Length and Width")
```

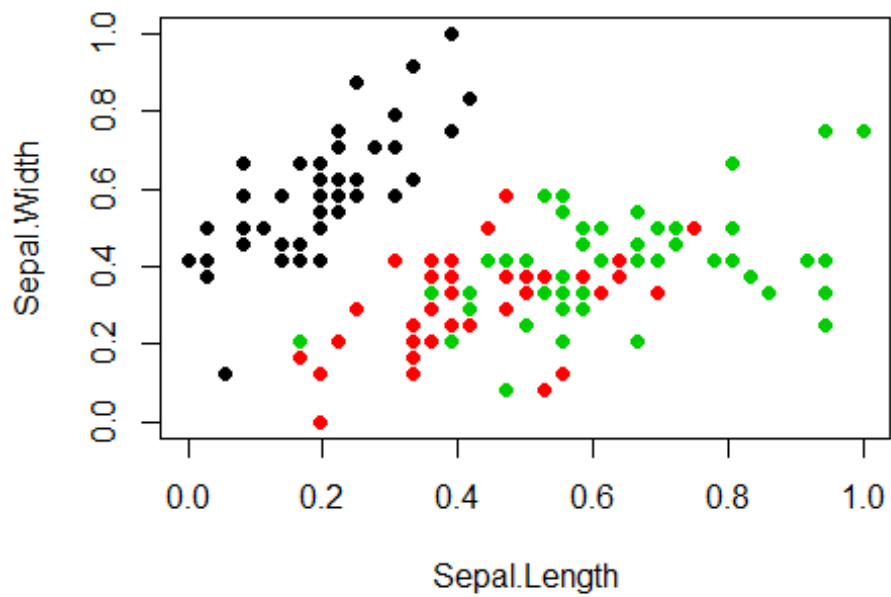


**Clusters based on Sepal Length and Width**

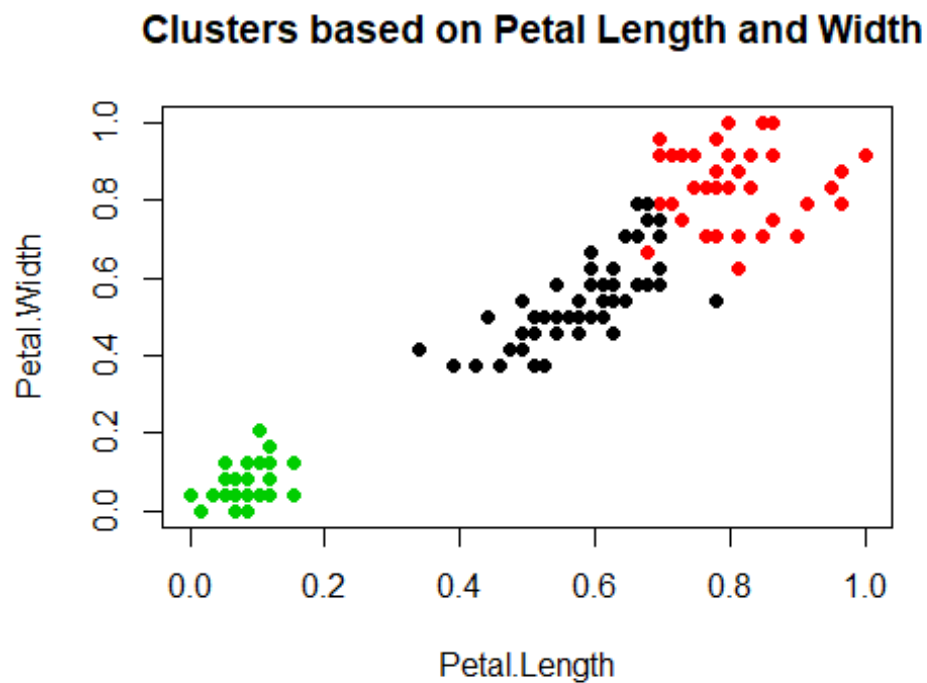


```
plot(iris[c(1,2)], col=iris$Species, pch = 19, main = " Clusters based on  
Flower Species")
```

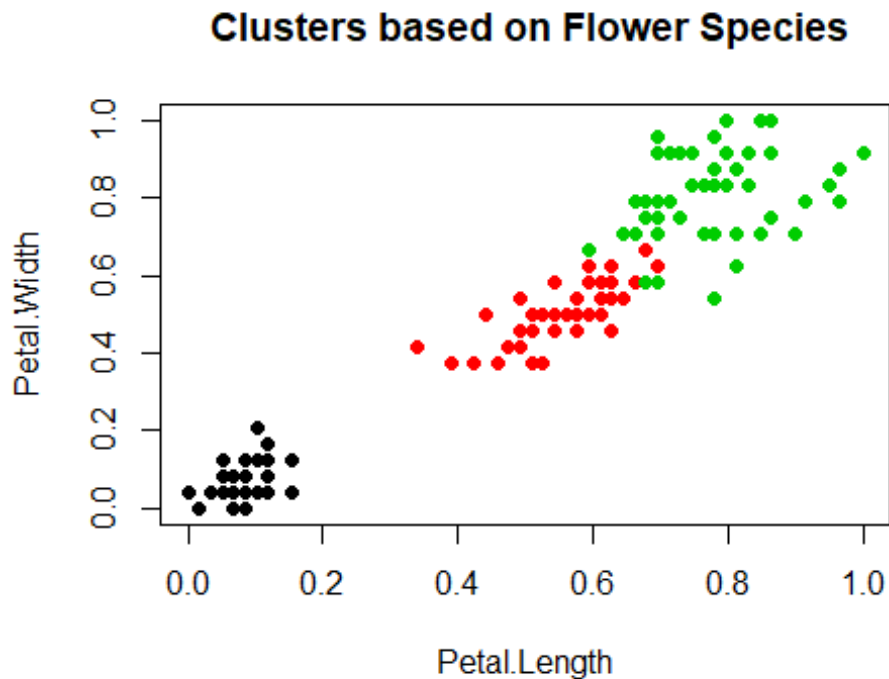
**Clusters based on Flower Species**



```
plot(iris[c(3,4)], col=result$cluster, pch = 19, main = " Clusters based on  
Petal Length and Width")
```



```
plot(iris[c(3,4)], col=iris$Species, pch = 19, main = " Clusters based on  
Flower Species")
```



Create getmode function to obtain mode.

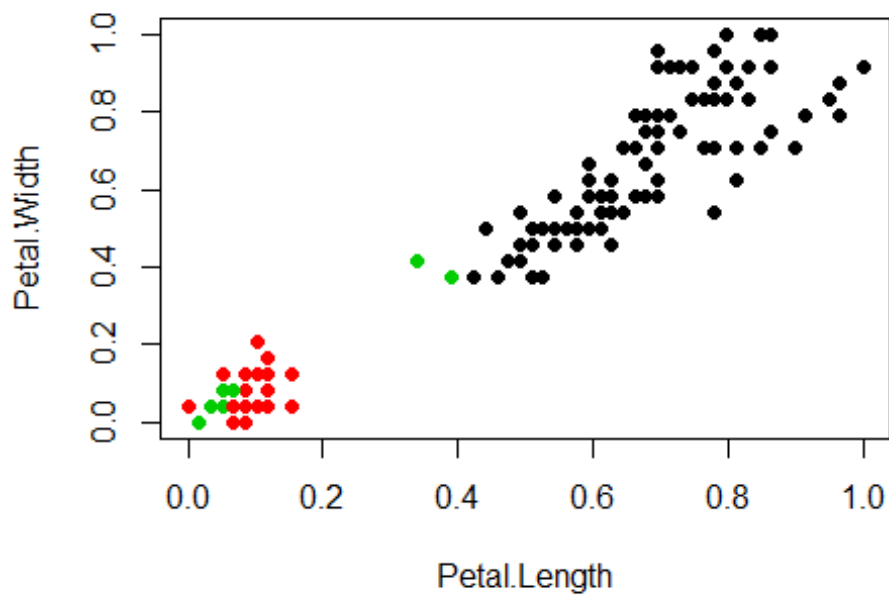
```
getmode <- function(v) {
  uniqv <- unique(v)
  uniqv[which.max(tabulate(match(v, uniqv)))]
}
```

Running the k means algorithms four times on the same dataset

```
avg <- NULL
for (i in 1:10) {
  set.seed(100 + 50*i + i*i)
  result <- kmeans(iris[,c(1,2,3,4)], 3)
  plot(iris[,c(3,4)], col=result$cluster, pch = 19, main = c(" Clusters based on
Petal Length and Width: Iteration ", i))

  avg <- rbind(result$cluster, avg)
  print(avg)
}
```

## Clusters based on Petal Length and Width: Iteratic 1



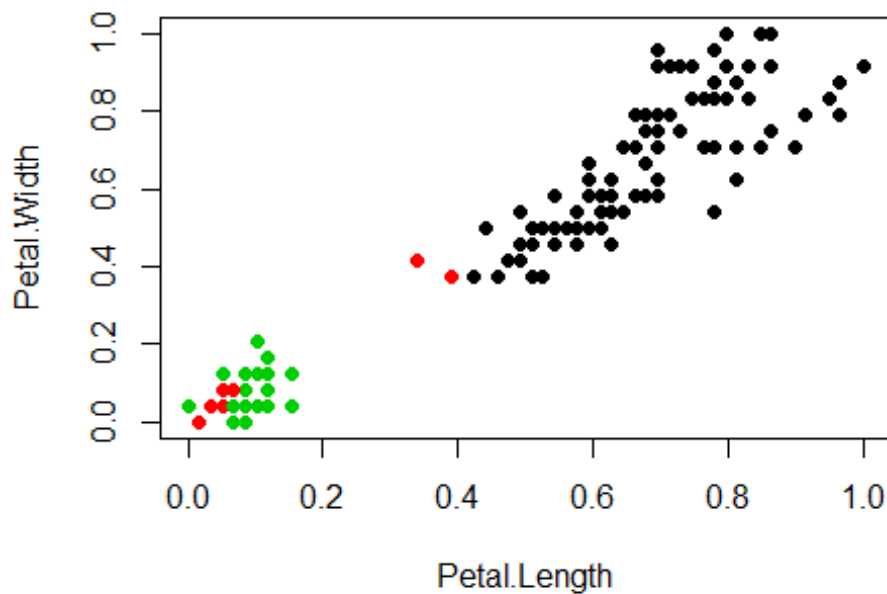
```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
##      [,14]
## [1,]      2      3      3      3      2      2      2      2      3      3      2      2      3
##      [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
##      [,26]
## [1,]      2      2      2      2      2      2      2      2      2      2      2
##      [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37]
##      [,38]
## [1,]      2      2      2      3      3      2      2      2      3      3      2
##      [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49]
##      [,50]
## [1,]      3      2      2      3      3      2      2      3      2      3      2
##      [,51] [,52] [,53] [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61]
##      [,62]
## [1,]      1      1      1      1      1      1      1      3      1      1      3
##      [,63] [,64] [,65] [,66] [,67] [,68] [,69] [,70] [,71] [,72] [,73]
##      [,74]
## [1,]      1      1      1      1      1      1      1      1      1      1      1
##      [,75] [,76] [,77] [,78] [,79] [,80] [,81] [,82] [,83] [,84] [,85]
##      [,86]
## [1,]      1      1      1      1      1      1      1      1      1      1      1
```

```

1
##      [,87] [,88] [,89] [,90] [,91] [,92] [,93] [,94] [,95] [,96] [,97]
[,98]
## [1,]      1      1      1      1      1      1      1      3      1      1      1
1
##      [,99] [,100] [,101] [,102] [,103] [,104] [,105] [,106] [,107] [,108]
## [1,]      3      1      1      1      1      1      1      1      1      1
##      [,109] [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117] [,118]
## [1,]      1      1      1      1      1      1      1      1      1      1
##      [,119] [,120] [,121] [,122] [,123] [,124] [,125] [,126] [,127] [,128]
## [1,]      1      1      1      1      1      1      1      1      1      1
##      [,129] [,130] [,131] [,132] [,133] [,134] [,135] [,136] [,137] [,138]
## [1,]      1      1      1      1      1      1      1      1      1      1
##      [,139] [,140] [,141] [,142] [,143] [,144] [,145] [,146] [,147] [,148]
## [1,]      1      1      1      1      1      1      1      1      1      1
##      [,149] [,150]
## [1,]      1      1

```

## Clusters based on Petal.Length and Width: Iteratic 2



```

##      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
[,14]
## [1,]      3      2      2      2      3      3      3      3      2      2      3      3      2
2
## [2,]      2      3      3      3      2      2      2      2      3      3      2      2      3
3
##      [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
[,26]
## [1,]      3      3      3      3      3      3      3      3      3      3      3

```

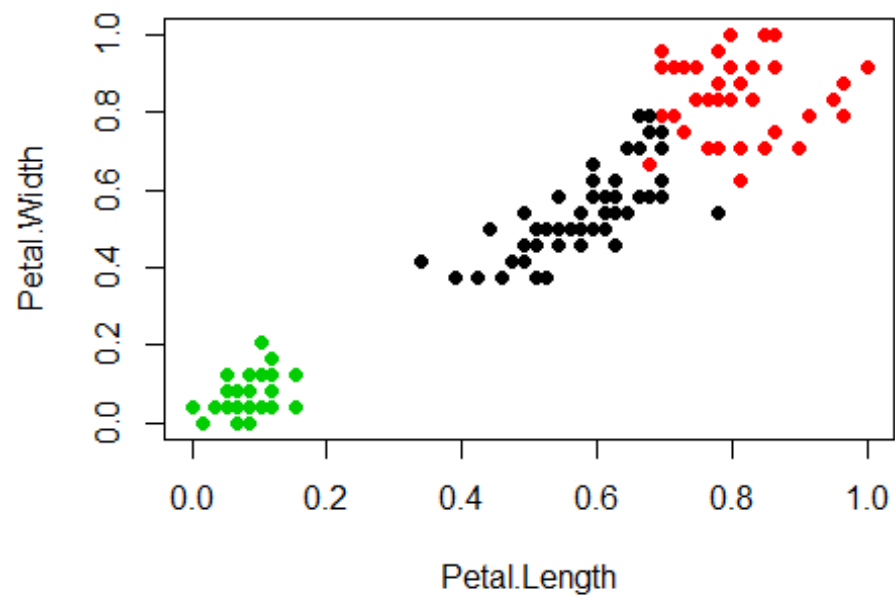
```

2
## [2,]      2      2      2      2      2      2      2      2      2      2      2      2
3
##      [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37]
[,38]
## [1,]      3      3      3      2      2      3      3      3      2      2      3
3
## [2,]      2      2      2      3      3      2      2      2      3      3      2
2
##      [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49]
[,50]
## [1,]      2      3      3      2      2      3      3      2      3      2      3
3
## [2,]      3      2      2      3      3      2      2      3      2      3      2
2
##      [,51] [,52] [,53] [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61]
[,62]
## [1,]      1      1      1      1      1      1      1      2      1      1      2
1
## [2,]      1      1      1      1      1      1      1      3      1      1      3
1
##      [,63] [,64] [,65] [,66] [,67] [,68] [,69] [,70] [,71] [,72] [,73]
[,74]
## [1,]      1      1      1      1      1      1      1      1      1      1      1
1
## [2,]      1      1      1      1      1      1      1      1      1      1      1
1
##      [,75] [,76] [,77] [,78] [,79] [,80] [,81] [,82] [,83] [,84] [,85]
[,86]
## [1,]      1      1      1      1      1      1      1      1      1      1      1
1
## [2,]      1      1      1      1      1      1      1      1      1      1      1
1
##      [,87] [,88] [,89] [,90] [,91] [,92] [,93] [,94] [,95] [,96] [,97]
[,98]
## [1,]      1      1      1      1      1      1      1      2      1      1      1
1
## [2,]      1      1      1      1      1      1      1      3      1      1      1
1
##      [,99] [,100] [,101] [,102] [,103] [,104] [,105] [,106] [,107] [,108]
## [1,]      2      1      1      1      1      1      1      1      1      1
## [2,]      3      1      1      1      1      1      1      1      1      1
##      [,109] [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117] [,118]
## [1,]      1      1      1      1      1      1      1      1      1      1
## [2,]      1      1      1      1      1      1      1      1      1      1
##      [,119] [,120] [,121] [,122] [,123] [,124] [,125] [,126] [,127] [,128]
## [1,]      1      1      1      1      1      1      1      1      1      1
## [2,]      1      1      1      1      1      1      1      1      1      1
##      [,129] [,130] [,131] [,132] [,133] [,134] [,135] [,136] [,137] [,138]
## [1,]      1      1      1      1      1      1      1      1      1      1

```

```
## [2,]      1      1      1      1      1      1      1      1      1      1
##      [,139] [,140] [,141] [,142] [,143] [,144] [,145] [,146] [,147] [,148]
## [1,]      1      1      1      1      1      1      1      1      1      1
## [2,]      1      1      1      1      1      1      1      1      1      1
##      [,149] [,150]
## [1,]      1      1
## [2,]      1      1
```

### Clusters based on Petal Length and Width: Iteratic 3



```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
##      [,14]
## [1,]      3      3      3      3      3      3      3      3      3      3      3      3      3
## [2,]      3      2      2      2      3      3      3      3      2      2      3      3      2
## [3,]      2      3      3      3      2      2      2      2      3      3      2      2      3
##      [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
##      [,26]
## [1,]      3      3      3      3      3      3      3      3      3      3      3
## [2,]      3      3      3      3      3      3      3      3      3      3      3
## [3,]      2      2      2      2      2      2      2      2      2      2      2
##      [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37]
##      [,38]
## [1,]      3      3      3      3      3      3      3      3      3      3      3
```

```

3
## [2,]      3      3      3      2      2      3      3      3      2      2      3
3
## [3,]      2      2      2      3      3      2      2      2      3      3      2
2
##      [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49]
[,50]
## [1,]      3      3      3      3      3      3      3      3      3      3      3
3
## [2,]      2      3      3      2      2      3      3      2      3      2      3
3
## [3,]      3      2      2      3      3      2      2      3      2      3      2
2
##      [,51] [,52] [,53] [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61]
[,62]
## [1,]      2      1      2      1      1      1      1      1      1      1      1
1
## [2,]      1      1      1      1      1      1      1      1      2      1      1      2
1
## [3,]      1      1      1      1      1      1      1      1      3      1      1      3
1
##      [,63] [,64] [,65] [,66] [,67] [,68] [,69] [,70] [,71] [,72] [,73]
[,74]
## [1,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [2,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [3,]      1      1      1      1      1      1      1      1      1      1      1      1
1
##      [,75] [,76] [,77] [,78] [,79] [,80] [,81] [,82] [,83] [,84] [,85]
[,86]
## [1,]      1      1      1      2      1      1      1      1      1      1      1      1
1
## [2,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [3,]      1      1      1      1      1      1      1      1      1      1      1      1
1
##      [,87] [,88] [,89] [,90] [,91] [,92] [,93] [,94] [,95] [,96] [,97]
[,98]
## [1,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [2,]      1      1      1      1      1      1      1      1      2      1      1      1
1
## [3,]      1      1      1      1      1      1      1      1      3      1      1      1
1
##      [,99] [,100] [,101] [,102] [,103] [,104] [,105] [,106] [,107] [,108]
## [1,]      1      1      2      1      2      2      2      2      1      2
## [2,]      2      1      1      1      1      1      1      1      1      1
## [3,]      3      1      1      1      1      1      1      1      1      1
##      [,109] [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117] [,118]

```

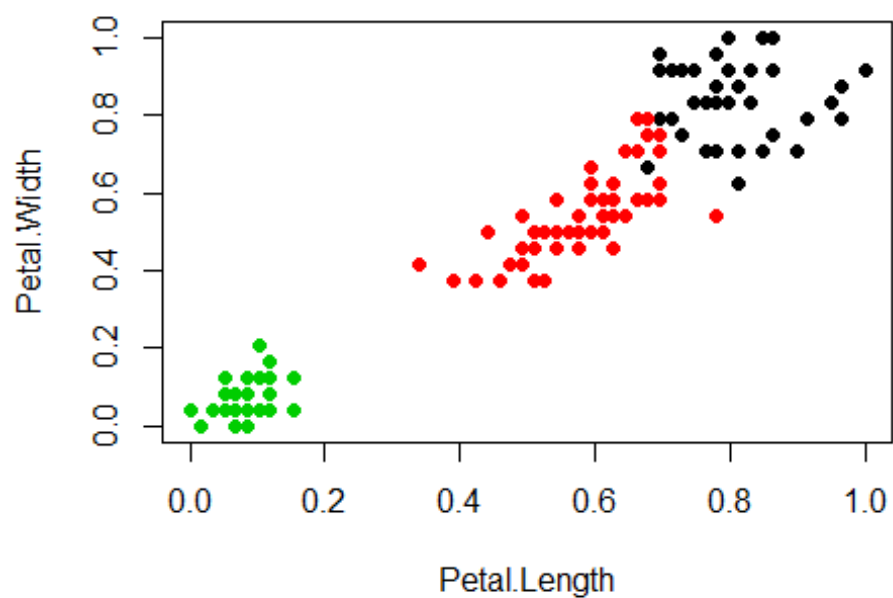


```

## [1,]      2      2      2      2      2      1      2      2      2      2
## [2,]      1      1      1      1      1      1      1      1      1      1
## [3,]      1      1      1      1      1      1      1      1      1      1
##      [,119] [,120] [,121] [,122] [,123] [,124] [,125] [,126] [,127] [,128]
## [1,]      2      1      2      1      2      1      2      2      1      1
## [2,]      1      1      1      1      1      1      1      1      1      1
## [3,]      1      1      1      1      1      1      1      1      1      1
##      [,129] [,130] [,131] [,132] [,133] [,134] [,135] [,136] [,137] [,138]
## [1,]      2      2      2      2      2      1      1      2      2      2
## [2,]      1      1      1      1      1      1      1      1      1      1
## [3,]      1      1      1      1      1      1      1      1      1      1
##      [,139] [,140] [,141] [,142] [,143] [,144] [,145] [,146] [,147] [,148]
## [1,]      1      2      2      2      1      2      2      2      1      2
## [2,]      1      1      1      1      1      1      1      1      1      1
## [3,]      1      1      1      1      1      1      1      1      1      1
##      [,149] [,150]
## [1,]      2      1
## [2,]      1      1
## [3,]      1      1

```

## Clusters based on Petal.Length and Width: Iteratic 4



```

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

```

```

2
## [4,]      2      3      3      3      2      2      2      2      3      3      2      2      3
3
##      [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
[,26]
## [1,]      3      3      3      3      3      3      3      3      3      3      3
3
## [2,]      3      3      3      3      3      3      3      3      3      3      3
3
## [3,]      3      3      3      3      3      3      3      3      3      3      3
2
## [4,]      2      2      2      2      2      2      2      2      2      2      2
3
##      [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37]
[,38]
## [1,]      3      3      3      3      3      3      3      3      3      3      3
3
## [2,]      3      3      3      3      3      3      3      3      3      3      3
3
## [3,]      3      3      3      2      2      3      3      3      2      2      3
3
## [4,]      2      2      2      3      3      2      2      2      3      3      2
2
##      [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49]
[,50]
## [1,]      3      3      3      3      3      3      3      3      3      3      3
3
## [2,]      3      3      3      3      3      3      3      3      3      3      3
3
## [3,]      2      3      3      2      2      3      3      2      3      2      3
3
## [4,]      3      2      2      3      3      2      2      3      2      3      2
2
##      [,51] [,52] [,53] [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61]
[,62]
## [1,]      1      2      1      2      2      2      2      2      2      2      2
2
## [2,]      2      1      2      1      1      1      1      1      1      1      1
1
## [3,]      1      1      1      1      1      1      1      2      1      1      2
1
## [4,]      1      1      1      1      1      1      1      3      1      1      3
1
##      [,63] [,64] [,65] [,66] [,67] [,68] [,69] [,70] [,71] [,72] [,73]
[,74]
## [1,]      2      2      2      2      2      2      2      2      2      2      2
2
## [2,]      1      1      1      1      1      1      1      1      1      1      1
1
## [3,]      1      1      1      1      1      1      1      1      1      1      1

```

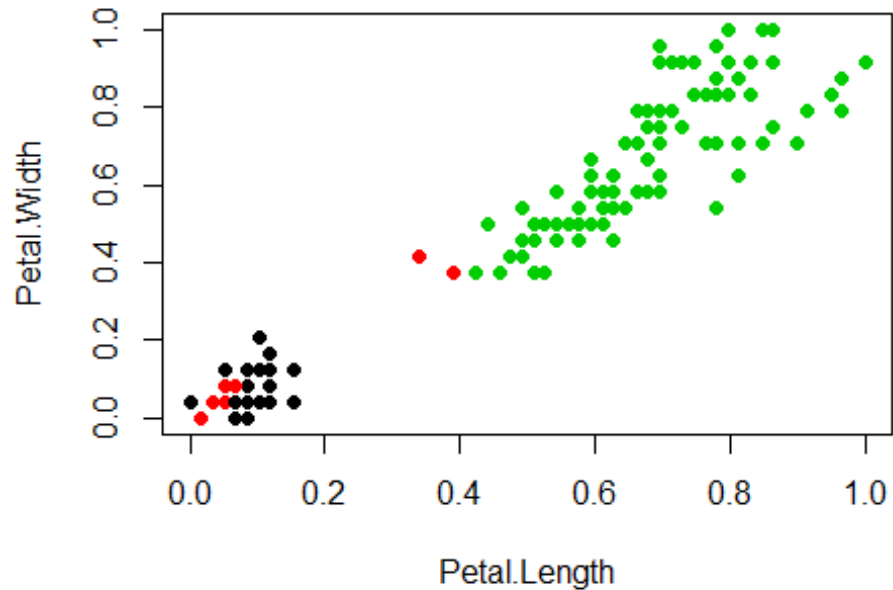
```

1
## [4,]      1      1      1      1      1      1      1      1      1      1      1      1
1
##      [,75] [,76] [,77] [,78] [,79] [,80] [,81] [,82] [,83] [,84] [,85]
[,86]
## [1,]      2      2      2      1      2      2      2      2      2      2      2
2
## [2,]      1      1      1      2      1      1      1      1      1      1      1
1
## [3,]      1      1      1      1      1      1      1      1      1      1      1
1
## [4,]      1      1      1      1      1      1      1      1      1      1      1
1
##      [,87] [,88] [,89] [,90] [,91] [,92] [,93] [,94] [,95] [,96] [,97]
[,98]
## [1,]      2      2      2      2      2      2      2      2      2      2      2
2
## [2,]      1      1      1      1      1      1      1      1      1      1      1
1
## [3,]      1      1      1      1      1      1      1      2      1      1      1
1
## [4,]      1      1      1      1      1      1      1      3      1      1      1
1
##      [,99] [,100] [,101] [,102] [,103] [,104] [,105] [,106] [,107] [,108]
## [1,]      2      2      1      2      1      1      1      1      2      1
## [2,]      1      1      2      1      2      2      2      2      1      2
## [3,]      2      1      1      1      1      1      1      1      1      1
## [4,]      3      1      1      1      1      1      1      1      1      1
##      [,109] [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117] [,118]
## [1,]      1      1      1      1      1      2      1      1      1      1
## [2,]      2      2      2      2      2      1      2      2      2      2
## [3,]      1      1      1      1      1      1      1      1      1      1
## [4,]      1      1      1      1      1      1      1      1      1      1
##      [,119] [,120] [,121] [,122] [,123] [,124] [,125] [,126] [,127] [,128]
## [1,]      1      2      1      2      1      2      1      1      2      2
## [2,]      2      1      2      1      2      1      2      2      1      1
## [3,]      1      1      1      1      1      1      1      1      1      1
## [4,]      1      1      1      1      1      1      1      1      1      1
##      [,129] [,130] [,131] [,132] [,133] [,134] [,135] [,136] [,137] [,138]
## [1,]      1      1      1      1      1      2      2      1      1      1
## [2,]      2      2      2      2      2      1      1      2      2      2
## [3,]      1      1      1      1      1      1      1      1      1      1
## [4,]      1      1      1      1      1      1      1      1      1      1
##      [,139] [,140] [,141] [,142] [,143] [,144] [,145] [,146] [,147] [,148]
## [1,]      2      1      1      1      2      1      1      1      2      1
## [2,]      1      2      2      2      1      2      2      2      1      2
## [3,]      1      1      1      1      1      1      1      1      1      1
## [4,]      1      1      1      1      1      1      1      1      1      1
##      [,149] [,150]
## [1,]      1      2

```

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

## Clusters based on Petal.Length and Width: Iteratic 5



```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
## [1,]      1      2      2      2      1      1      1      1      2      2      1      1      2
## [2,]      3      3      3      3      3      3      3      3      3      3      3      3      3
## [3,]      3      3      3      3      3      3      3      3      3      3      3      3      3
## [4,]      3      2      2      2      3      3      3      3      2      2      3      3      2
## [5,]      2      3      3      3      2      2      2      2      3      3      2      2      3
##      [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
## [1,]      1      1      1      1      1      1      1      1      1      1      1
## [2,]      3      3      3      3      3      3      3      3      3      3      3
## [3,]      3      3      3      3      3      3      3      3      3      3      3
## [4,]      3      3      3      3      3      3      3      3      3      3      3
## [5,]      2      2      2      2      2      2      2      2      2      2      2
```

```

3
##      [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37]
[,38]
## [1,]      1      1      1      2      2      1      1      1      2      2      1
1
## [2,]      3      3      3      3      3      3      3      3      3      3      3
3
## [3,]      3      3      3      3      3      3      3      3      3      3      3
3
## [4,]      3      3      3      2      2      3      3      3      2      2      3
3
## [5,]      2      2      2      3      3      2      2      2      3      3      2
2
##      [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49]
[,50]
## [1,]      2      1      1      2      2      1      1      2      1      2      1
1
## [2,]      3      3      3      3      3      3      3      3      3      3      3
3
## [3,]      3      3      3      3      3      3      3      3      3      3      3
3
## [4,]      2      3      3      2      2      3      3      2      3      2      3
3
## [5,]      3      2      2      3      3      2      2      3      2      3      2
2
##      [,51] [,52] [,53] [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61]
[,62]
## [1,]      3      3      3      3      3      3      3      2      3      3      2
3
## [2,]      1      2      1      2      2      2      2      2      2      2      2
2
## [3,]      2      1      2      1      1      1      1      1      1      1      1
1
## [4,]      1      1      1      1      1      1      1      2      1      1      2
1
## [5,]      1      1      1      1      1      1      1      3      1      1      3
1
##      [,63] [,64] [,65] [,66] [,67] [,68] [,69] [,70] [,71] [,72] [,73]
[,74]
## [1,]      3      3      3      3      3      3      3      3      3      3      3
3
## [2,]      2      2      2      2      2      2      2      2      2      2      2
2
## [3,]      1      1      1      1      1      1      1      1      1      1      1
1
## [4,]      1      1      1      1      1      1      1      1      1      1      1
1
## [5,]      1      1      1      1      1      1      1      1      1      1      1
1
##      [,75] [,76] [,77] [,78] [,79] [,80] [,81] [,82] [,83] [,84] [,85]

```

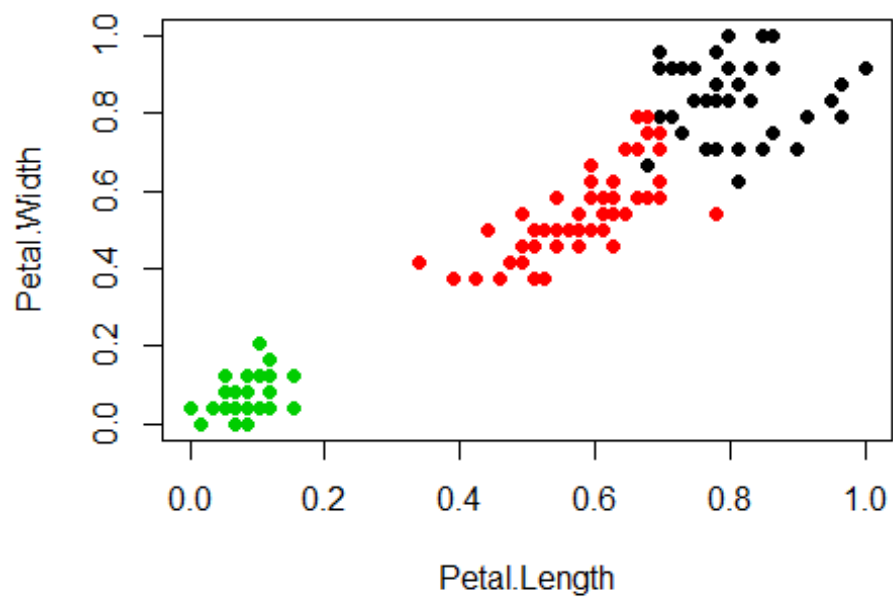
```

[,86]
## [1,] 3 3 3 3 3 3 3 3 3 3 3
3
## [2,] 2 2 2 1 2 2 2 2 2 2 2
2
## [3,] 1 1 1 2 1 1 1 1 1 1 1
1
## [4,] 1 1 1 1 1 1 1 1 1 1 1
1
## [5,] 1 1 1 1 1 1 1 1 1 1 1
1
##      [,87] [,88] [,89] [,90] [,91] [,92] [,93] [,94] [,95] [,96] [,97]
[,98]
## [1,] 3 3 3 3 3 3 3 2 3 3 3
3
## [2,] 2 2 2 2 2 2 2 2 2 2 2
2
## [3,] 1 1 1 1 1 1 1 1 1 1 1
1
## [4,] 1 1 1 1 1 1 1 2 1 1 1
1
## [5,] 1 1 1 1 1 1 1 3 1 1 1
1
##      [,99] [,100] [,101] [,102] [,103] [,104] [,105] [,106] [,107] [,108]
## [1,] 2 3 3 3 3 3 3 3 3 3
## [2,] 2 2 1 2 1 1 1 1 2 1
## [3,] 1 1 2 1 2 2 2 2 1 2
## [4,] 2 1 1 1 1 1 1 1 1 1
## [5,] 3 1 1 1 1 1 1 1 1 1
##      [,109] [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117] [,118]
## [1,] 3 3 3 3 3 3 3 3 3 3
## [2,] 1 1 1 1 1 2 1 1 1 1
## [3,] 2 2 2 2 2 1 2 2 2 2
## [4,] 1 1 1 1 1 1 1 1 1 1
## [5,] 1 1 1 1 1 1 1 1 1 1
##      [,119] [,120] [,121] [,122] [,123] [,124] [,125] [,126] [,127] [,128]
## [1,] 3 3 3 3 3 3 3 3 3 3
## [2,] 1 2 1 2 1 2 1 1 2 2
## [3,] 2 1 2 1 2 1 2 2 1 1
## [4,] 1 1 1 1 1 1 1 1 1 1
## [5,] 1 1 1 1 1 1 1 1 1 1
##      [,129] [,130] [,131] [,132] [,133] [,134] [,135] [,136] [,137] [,138]
## [1,] 3 3 3 3 3 3 3 3 3 3
## [2,] 1 1 1 1 1 2 2 1 1 1
## [3,] 2 2 2 2 2 1 1 2 2 2
## [4,] 1 1 1 1 1 1 1 1 1 1
## [5,] 1 1 1 1 1 1 1 1 1 1
##      [,139] [,140] [,141] [,142] [,143] [,144] [,145] [,146] [,147] [,148]
## [1,] 3 3 3 3 3 3 3 3 3 3
## [2,] 2 1 1 1 2 1 1 1 2 1

```

```
## [3,]      1      2      2      2      1      2      2      2      1      2
## [4,]      1      1      1      1      1      1      1      1      1      1
## [5,]      1      1      1      1      1      1      1      1      1      1
##      [,149] [,150]
## [1,]      3      3
## [2,]      1      2
## [3,]      2      1
## [4,]      1      1
## [5,]      1      1
```

## Clusters based on Petal Length and Width: Iteratic 6



```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
## [1,]      3      3      3      3      3      3      3      3      3      3      3      3      3
## [2,]      1      2      2      2      1      1      1      1      2      2      1      1      2
## [3,]      3      3      3      3      3      3      3      3      3      3      3      3      3
## [4,]      3      3      3      3      3      3      3      3      3      3      3      3      3
## [5,]      3      2      2      2      3      3      3      3      2      2      3      3      2
## [6,]      2      3      3      3      2      2      2      2      3      3      2      2      3
##      [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
## [1,]      3      3      3      3      3      3      3      3      3      3      3
```

```

3
## [2,]      1      1      1      1      1      1      1      1      1      1      1
2
## [3,]      3      3      3      3      3      3      3      3      3      3      3
3
## [4,]      3      3      3      3      3      3      3      3      3      3      3
3
## [5,]      3      3      3      3      3      3      3      3      3      3      3
2
## [6,]      2      2      2      2      2      2      2      2      2      2      2
3
##      [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37]
[,38]
## [1,]      3      3      3      3      3      3      3      3      3      3      3
3
## [2,]      1      1      1      2      2      1      1      1      2      2      1
1
## [3,]      3      3      3      3      3      3      3      3      3      3      3
3
## [4,]      3      3      3      3      3      3      3      3      3      3      3
3
## [5,]      3      3      3      2      2      3      3      3      2      2      3
3
## [6,]      2      2      2      3      3      2      2      2      3      3      2
2
##      [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49]
[,50]
## [1,]      3      3      3      3      3      3      3      3      3      3      3
3
## [2,]      2      1      1      2      2      1      1      2      1      2      1
1
## [3,]      3      3      3      3      3      3      3      3      3      3      3
3
## [4,]      3      3      3      3      3      3      3      3      3      3      3
3
## [5,]      2      3      3      2      2      3      3      2      3      2      3
3
## [6,]      3      2      2      3      3      2      2      3      2      3      2
2
##      [,51] [,52] [,53] [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61]
[,62]
## [1,]      1      2      1      2      2      2      2      2      2      2      2
2
## [2,]      3      3      3      3      3      3      3      2      3      3      2
3
## [3,]      1      2      1      2      2      2      2      2      2      2      2
2
## [4,]      2      1      2      1      1      1      1      1      1      1      1
1
## [5,]      1      1      1      1      1      1      1      2      1      1      2

```



```

1
## [6,]      1      1      1      1      1      1      1      1      3      1      1      3
1
##      [,63] [,64] [,65] [,66] [,67] [,68] [,69] [,70] [,71] [,72] [,73]
[,74]
## [1,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [2,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [3,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [4,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [5,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [6,]      1      1      1      1      1      1      1      1      1      1      1      1
1
##      [,75] [,76] [,77] [,78] [,79] [,80] [,81] [,82] [,83] [,84] [,85]
[,86]
## [1,]      2      2      2      1      2      2      2      2      2      2      2      2
2
## [2,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [3,]      2      2      2      1      2      2      2      2      2      2      2      2
2
## [4,]      1      1      1      2      1      1      1      1      1      1      1      1
1
## [5,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [6,]      1      1      1      1      1      1      1      1      1      1      1      1
1
##      [,87] [,88] [,89] [,90] [,91] [,92] [,93] [,94] [,95] [,96] [,97]
[,98]
## [1,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [2,]      3      3      3      3      3      3      3      2      3      3      3      3
3
## [3,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [4,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [5,]      1      1      1      1      1      1      1      2      1      1      1      1
1
## [6,]      1      1      1      1      1      1      1      3      1      1      1      1
1
##      [,99] [,100] [,101] [,102] [,103] [,104] [,105] [,106] [,107] [,108]
## [1,]      2      2      1      2      1      1      1      1      2      1
## [2,]      2      3      3      3      3      3      3      3      3      3
## [3,]      2      2      1      2      1      1      1      1      2      1
## [4,]      1      1      2      1      2      2      2      2      1      2

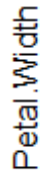
```

```

## [5,]      2      1      1      1      1      1      1      1      1      1
## [6,]      3      1      1      1      1      1      1      1      1      1
##      [,109] [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117] [,118]
## [1,]      1      1      1      1      1      2      1      1      1      1
## [2,]      3      3      3      3      3      3      3      3      3      3
## [3,]      1      1      1      1      1      2      1      1      1      1
## [4,]      2      2      2      2      2      1      2      2      2      2
## [5,]      1      1      1      1      1      1      1      1      1      1
## [6,]      1      1      1      1      1      1      1      1      1      1
##      [,119] [,120] [,121] [,122] [,123] [,124] [,125] [,126] [,127] [,128]
## [1,]      1      2      1      2      1      2      1      1      2      2
## [2,]      3      3      3      3      3      3      3      3      3      3
## [3,]      1      2      1      2      1      2      1      1      2      2
## [4,]      2      1      2      1      2      1      2      2      1      1
## [5,]      1      1      1      1      1      1      1      1      1      1
## [6,]      1      1      1      1      1      1      1      1      1      1
##      [,129] [,130] [,131] [,132] [,133] [,134] [,135] [,136] [,137] [,138]
## [1,]      1      1      1      1      1      2      2      1      1      1
## [2,]      3      3      3      3      3      3      3      3      3      3
## [3,]      1      1      1      1      1      2      2      1      1      1
## [4,]      2      2      2      2      2      1      1      2      2      2
## [5,]      1      1      1      1      1      1      1      1      1      1
## [6,]      1      1      1      1      1      1      1      1      1      1
##      [,139] [,140] [,141] [,142] [,143] [,144] [,145] [,146] [,147] [,148]
## [1,]      2      1      1      1      2      1      1      1      2      1
## [2,]      3      3      3      3      3      3      3      3      3      3
## [3,]      2      1      1      1      2      1      1      1      2      1
## [4,]      1      2      2      2      1      2      2      2      1      2
## [5,]      1      1      1      1      1      1      1      1      1      1
## [6,]      1      1      1      1      1      1      1      1      1      1
##      [,149] [,150]
## [1,]      1      2
## [2,]      3      3
## [3,]      1      2
## [4,]      2      1
## [5,]      1      1
## [6,]      1      1

```

## 7

[illegible]

```

3
## [6,]      3      3      3      3      3      3      3      3      3      3      3      3
2
## [7,]      2      2      2      2      2      2      2      2      2      2      2      2
3
##      [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37]
[,38]
## [1,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [2,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [3,]      1      1      1      2      2      1      1      1      2      2      1
1
## [4,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [5,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [6,]      3      3      3      2      2      3      3      3      2      2      3
3
## [7,]      2      2      2      3      3      2      2      2      3      3      2
2
##      [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49]
[,50]
## [1,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [2,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [3,]      2      1      1      2      2      1      1      2      1      2      1
1
## [4,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [5,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [6,]      2      3      3      2      2      3      3      2      3      2      3
3
## [7,]      3      2      2      3      3      2      2      3      2      3      2
2
##      [,51] [,52] [,53] [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61]
[,62]
## [1,]      1      3      1      3      3      3      3      3      3      3      3
3
## [2,]      1      2      1      2      2      2      2      2      2      2      2
2
## [3,]      3      3      3      3      3      3      3      2      3      3      2
3
## [4,]      1      2      1      2      2      2      2      2      2      2      2
2
## [5,]      2      1      2      1      1      1      1      1      1      1      1
1
## [6,]      1      1      1      1      1      1      1      2      1      1      2

```

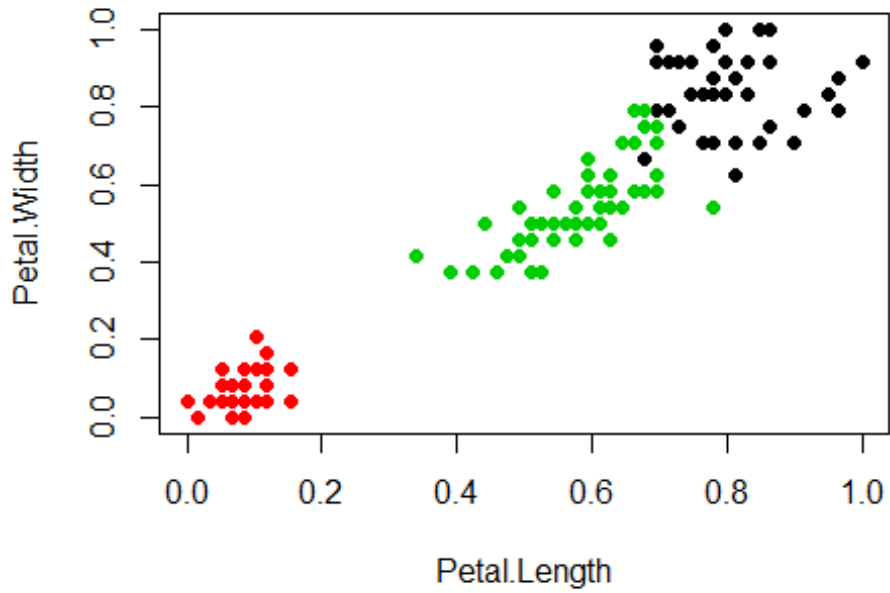
[illegible]

```

1
##      [,99] [,100] [,101] [,102] [,103] [,104] [,105] [,106] [,107] [,108]
## [1,]      3      3      1      3      1      1      1      1      3      1
## [2,]      2      2      1      2      1      1      1      1      2      1
## [3,]      2      3      3      3      3      3      3      3      3      3
## [4,]      2      2      1      2      1      1      1      1      2      1
## [5,]      1      1      2      1      2      2      2      2      1      2
## [6,]      2      1      1      1      1      1      1      1      1      1
## [7,]      3      1      1      1      1      1      1      1      1      1
##      [,109] [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117] [,118]
## [1,]      1      1      1      1      1      3      1      1      1      1
## [2,]      1      1      1      1      1      2      1      1      1      1
## [3,]      3      3      3      3      3      3      3      3      3      3
## [4,]      1      1      1      1      1      2      1      1      1      1
## [5,]      2      2      2      2      2      1      2      2      2      2
## [6,]      1      1      1      1      1      1      1      1      1      1
## [7,]      1      1      1      1      1      1      1      1      1      1
##      [,119] [,120] [,121] [,122] [,123] [,124] [,125] [,126] [,127] [,128]
## [1,]      1      3      1      3      1      3      1      1      3      3
## [2,]      1      2      1      2      1      2      1      1      2      2
## [3,]      3      3      3      3      3      3      3      3      3      3
## [4,]      1      2      1      2      1      2      1      1      2      2
## [5,]      2      1      2      1      2      1      2      2      1      1
## [6,]      1      1      1      1      1      1      1      1      1      1
## [7,]      1      1      1      1      1      1      1      1      1      1
##      [,129] [,130] [,131] [,132] [,133] [,134] [,135] [,136] [,137] [,138]
## [1,]      1      1      1      1      1      3      3      1      1      1
## [2,]      1      1      1      1      1      2      2      1      1      1
## [3,]      3      3      3      3      3      3      3      3      3      3
## [4,]      1      1      1      1      1      2      2      1      1      1
## [5,]      2      2      2      2      2      1      1      2      2      2
## [6,]      1      1      1      1      1      1      1      1      1      1
## [7,]      1      1      1      1      1      1      1      1      1      1
##      [,139] [,140] [,141] [,142] [,143] [,144] [,145] [,146] [,147] [,148]
## [1,]      3      1      1      1      3      1      1      1      3      1
## [2,]      2      1      1      1      2      1      1      1      2      1
## [3,]      3      3      3      3      3      3      3      3      3      3
## [4,]      2      1      1      1      2      1      1      1      2      1
## [5,]      1      2      2      2      1      2      2      2      1      2
## [6,]      1      1      1      1      1      1      1      1      1      1
## [7,]      1      1      1      1      1      1      1      1      1      1
##      [,149] [,150]
## [1,]      1      3
## [2,]      1      2
## [3,]      3      3
## [4,]      1      2
## [5,]      2      1
## [6,]      1      1
## [7,]      1      1

```

## 8

[illegible]

```

2
## [5,]      3      3      3      3      3      3      3      3      3      3      3
3
## [6,]      3      3      3      3      3      3      3      3      3      3      3
3
## [7,]      3      3      3      3      3      3      3      3      3      3      3
2
## [8,]      2      2      2      2      2      2      2      2      2      2      2
3
##      [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37]
[,38]
## [1,]      2      2      2      2      2      2      2      2      2      2      2
2
## [2,]      2      2      2      2      2      2      2      2      2      2      2
2
## [3,]      3      3      3      3      3      3      3      3      3      3      3
3
## [4,]      1      1      1      2      2      1      1      1      2      2      1
1
## [5,]      3      3      3      3      3      3      3      3      3      3      3
3
## [6,]      3      3      3      3      3      3      3      3      3      3      3
3
## [7,]      3      3      3      2      2      3      3      3      2      2      3
3
## [8,]      2      2      2      3      3      2      2      2      3      3      2
2
##      [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49]
[,50]
## [1,]      2      2      2      2      2      2      2      2      2      2      2
2
## [2,]      2      2      2      2      2      2      2      2      2      2      2
2
## [3,]      3      3      3      3      3      3      3      3      3      3      3
3
## [4,]      2      1      1      2      2      1      1      2      1      2      1
1
## [5,]      3      3      3      3      3      3      3      3      3      3      3
3
## [6,]      3      3      3      3      3      3      3      3      3      3      3
3
## [7,]      2      3      3      2      2      3      3      2      3      2      3
3
## [8,]      3      2      2      3      3      2      2      3      2      3      2
2
##      [,51] [,52] [,53] [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61]
[,62]
## [1,]      1      3      1      3      3      3      3      3      3      3      3
3
## [2,]      1      3      1      3      3      3      3      3      3      3      3

```



```

3
## [3,]      1      2      1      2      2      2      2      2      2      2      2
2
## [4,]      3      3      3      3      3      3      3      2      3      3      2
3
## [5,]      1      2      1      2      2      2      2      2      2      2      2
2
## [6,]      2      1      2      1      1      1      1      1      1      1      1
1
## [7,]      1      1      1      1      1      1      1      2      1      1      2
1
## [8,]      1      1      1      1      1      1      1      3      1      1      3
1
##      [,63] [,64] [,65] [,66] [,67] [,68] [,69] [,70] [,71] [,72] [,73]
[,74]
## [1,]      3      3      3      3      3      3      3      3      3      3      3
3
## [2,]      3      3      3      3      3      3      3      3      3      3      3
3
## [3,]      2      2      2      2      2      2      2      2      2      2      2
2
## [4,]      3      3      3      3      3      3      3      3      3      3      3
3
## [5,]      2      2      2      2      2      2      2      2      2      2      2
2
## [6,]      1      1      1      1      1      1      1      1      1      1      1
1
## [7,]      1      1      1      1      1      1      1      1      1      1      1
1
## [8,]      1      1      1      1      1      1      1      1      1      1      1
1
##      [,75] [,76] [,77] [,78] [,79] [,80] [,81] [,82] [,83] [,84] [,85]
[,86]
## [1,]      3      3      3      1      3      3      3      3      3      3      3
3
## [2,]      3      3      3      1      3      3      3      3      3      3      3
3
## [3,]      2      2      2      1      2      2      2      2      2      2      2
2
## [4,]      3      3      3      3      3      3      3      3      3      3      3
3
## [5,]      2      2      2      1      2      2      2      2      2      2      2
2
## [6,]      1      1      1      2      1      1      1      1      1      1      1
1
## [7,]      1      1      1      1      1      1      1      1      1      1      1
1
## [8,]      1      1      1      1      1      1      1      1      1      1      1
1
##      [,87] [,88] [,89] [,90] [,91] [,92] [,93] [,94] [,95] [,96] [,97]

```

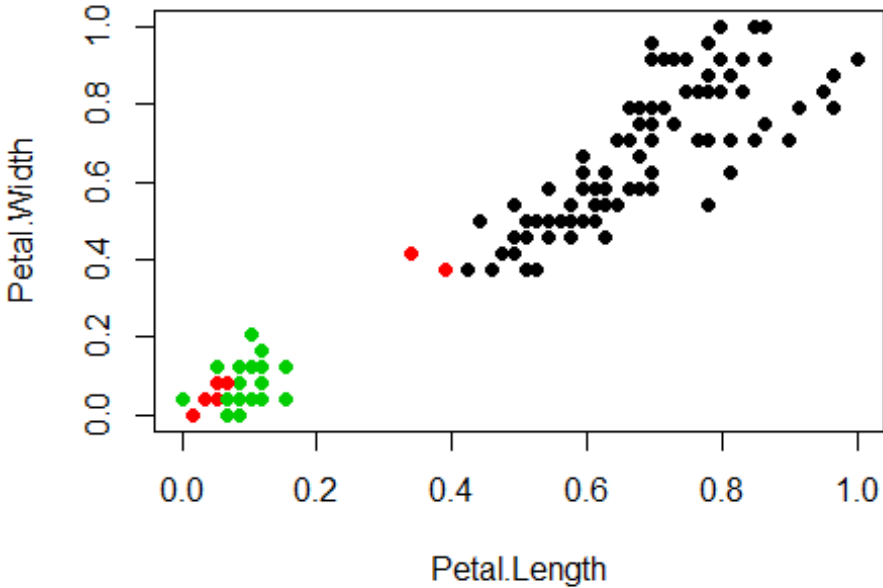
```

[,98]
## [1,] 3 3 3 3 3 3 3 3 3 3 3 3
3
## [2,] 3 3 3 3 3 3 3 3 3 3 3 3
3
## [3,] 2 2 2 2 2 2 2 2 2 2 2 2
2
## [4,] 3 3 3 3 3 3 3 3 2 3 3 3
3
## [5,] 2 2 2 2 2 2 2 2 2 2 2 2
2
## [6,] 1 1 1 1 1 1 1 1 1 1 1 1
1
## [7,] 1 1 1 1 1 1 1 2 1 1 1 1
1
## [8,] 1 1 1 1 1 1 1 3 1 1 1 1
1
##      [,99] [,100] [,101] [,102] [,103] [,104] [,105] [,106] [,107] [,108]
## [1,] 3 3 1 3 1 1 1 1 3 1
## [2,] 3 3 1 3 1 1 1 1 3 1
## [3,] 2 2 1 2 1 1 1 1 2 1
## [4,] 2 3 3 3 3 3 3 3 3 3
## [5,] 2 2 1 2 1 1 1 1 2 1
## [6,] 1 1 2 1 2 2 2 2 1 2
## [7,] 2 1 1 1 1 1 1 1 1 1
## [8,] 3 1 1 1 1 1 1 1 1 1
##      [,109] [,110] [,111] [,112] [,113] [,114] [,115] [,116] [,117] [,118]
## [1,] 1 1 1 1 1 3 1 1 1 1
## [2,] 1 1 1 1 1 3 1 1 1 1
## [3,] 1 1 1 1 1 2 1 1 1 1
## [4,] 3 3 3 3 3 3 3 3 3 3
## [5,] 1 1 1 1 1 2 1 1 1 1
## [6,] 2 2 2 2 2 1 2 2 2 2
## [7,] 1 1 1 1 1 1 1 1 1 1
## [8,] 1 1 1 1 1 1 1 1 1 1
##      [,119] [,120] [,121] [,122] [,123] [,124] [,125] [,126] [,127] [,128]
## [1,] 1 3 1 3 1 3 1 1 3 3
## [2,] 1 3 1 3 1 3 1 1 3 3
## [3,] 1 2 1 2 1 2 1 1 2 2
## [4,] 3 3 3 3 3 3 3 3 3 3
## [5,] 1 2 1 2 1 2 1 1 2 2
## [6,] 2 1 2 1 2 1 2 2 1 1
## [7,] 1 1 1 1 1 1 1 1 1 1
## [8,] 1 1 1 1 1 1 1 1 1 1
##      [,129] [,130] [,131] [,132] [,133] [,134] [,135] [,136] [,137] [,138]
## [1,] 1 1 1 1 1 3 3 1 1 1
## [2,] 1 1 1 1 1 3 3 1 1 1
## [3,] 1 1 1 1 1 2 2 1 1 1
## [4,] 3 3 3 3 3 3 3 3 3 3
## [5,] 1 1 1 1 1 2 2 1 1 1

```

```
## [6,]      2      2      2      2      2      1      1      2      2      2
## [7,]      1      1      1      1      1      1      1      1      1      1
## [8,]      1      1      1      1      1      1      1      1      1      1
##      [,139] [,140] [,141] [,142] [,143] [,144] [,145] [,146] [,147] [,148]
## [1,]      3      1      1      1      3      1      1      1      3      1
## [2,]      3      1      1      1      3      1      1      1      3      1
## [3,]      2      1      1      1      2      1      1      1      2      1
## [4,]      3      3      3      3      3      3      3      3      3      3
## [5,]      2      1      1      1      2      1      1      1      2      1
## [6,]      1      2      2      2      1      2      2      2      1      2
## [7,]      1      1      1      1      1      1      1      1      1      1
## [8,]      1      1      1      1      1      1      1      1      1      1
##      [,149] [,150]
## [1,]      1      3
## [2,]      1      3
## [3,]      1      2
## [4,]      3      3
## [5,]      1      2
## [6,]      2      1
## [7,]      1      1
## [8,]      1      1
```

### Clusters based on Petal Length and Width: Iterative

[illegible]

[illegible]

[illegible]

```

1
## [8,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [9,]      1      1      1      1      1      1      1      1      1      1      1      1
1
##      [,74] [,75] [,76] [,77] [,78] [,79] [,80] [,81] [,82] [,83] [,84]
[,85]
## [1,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [2,]      3      3      3      3      1      3      3      3      3      3      3      3
3
## [3,]      3      3      3      3      1      3      3      3      3      3      3      3
3
## [4,]      2      2      2      2      1      2      2      2      2      2      2      2
2
## [5,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [6,]      2      2      2      2      1      2      2      2      2      2      2      2
2
## [7,]      1      1      1      1      2      1      1      1      1      1      1      1
1
## [8,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [9,]      1      1      1      1      1      1      1      1      1      1      1      1
1
##      [,86] [,87] [,88] [,89] [,90] [,91] [,92] [,93] [,94] [,95] [,96]
[,97]
## [1,]      1      1      1      1      1      1      1      1      1      2      1      1
1
## [2,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [3,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [4,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [5,]      3      3      3      3      3      3      3      3      3      2      3      3
3
## [6,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [7,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [8,]      1      1      1      1      1      1      1      1      1      2      1      1
1
## [9,]      1      1      1      1      1      1      1      1      1      3      1      1
1
##      [,98] [,99] [,100] [,101] [,102] [,103] [,104] [,105] [,106] [,107]
## [1,]      1      2      1      1      1      1      1      1      1      1
## [2,]      3      3      3      1      3      1      1      1      1      3
## [3,]      3      3      3      1      3      1      1      1      1      3
## [4,]      2      2      2      1      2      1      1      1      1      2

```

##	[5,]	3	2	3	3	3	3	3	3	3	3
##	[6,]	2	2	2	1	2	1	1	1	1	2
##	[7,]	1	1	1	2	1	2	2	2	2	1
##	[8,]	1	2	1	1	1	1	1	1	1	1
##	[9,]	1	3	1	1	1	1	1	1	1	1
##		[,108]	[,109]	[,110]	[,111]	[,112]	[,113]	[,114]	[,115]	[,116]	
	[,117]										
##	[1,]	1	1	1	1	1	1	1	1	1	
1											
##	[2,]	1	1	1	1	1	1	3	1	1	
1											
##	[3,]	1	1	1	1	1	1	3	1	1	
1											
##	[4,]	1	1	1	1	1	1	2	1	1	
1											
##	[5,]	3	3	3	3	3	3	3	3	3	
3											
##	[6,]	1	1	1	1	1	1	2	1	1	
1											
##	[7,]	2	2	2	2	2	2	1	2	2	
2											
##	[8,]	1	1	1	1	1	1	1	1	1	
1											
##	[9,]	1	1	1	1	1	1	1	1	1	
1											
##		[,118]	[,119]	[,120]	[,121]	[,122]	[,123]	[,124]	[,125]	[,126]	
	[,127]										
##	[1,]	1	1	1	1	1	1	1	1	1	
1											
##	[2,]	1	1	3	1	3	1	3	1	1	
3											
##	[3,]	1	1	3	1	3	1	3	1	1	
3											
##	[4,]	1	1	2	1	2	1	2	1	1	
2											
##	[5,]	3	3	3	3	3	3	3	3	3	
3											
##	[6,]	1	1	2	1	2	1	2	1	1	
2											
##	[7,]	2	2	1	2	1	2	1	2	2	
1											
##	[8,]	1	1	1	1	1	1	1	1	1	
1											
##	[9,]	1	1	1	1	1	1	1	1	1	
1											
##		[,128]	[,129]	[,130]	[,131]	[,132]	[,133]	[,134]	[,135]	[,136]	
	[,137]										
##	[1,]	1	1	1	1	1	1	1	1	1	
1											
##	[2,]	3	1	1	1	1	1	3	3	1	

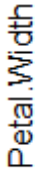
```

1
## [3,]      3      1      1      1      1      1      3      3      1
1
## [4,]      2      1      1      1      1      1      2      2      1
1
## [5,]      3      3      3      3      3      3      3      3      3
3
## [6,]      2      1      1      1      1      1      2      2      1
1
## [7,]      1      2      2      2      2      2      1      1      2
2
## [8,]      1      1      1      1      1      1      1      1      1
1
## [9,]      1      1      1      1      1      1      1      1      1
1
##      [,138] [,139] [,140] [,141] [,142] [,143] [,144] [,145] [,146]
[,147]
## [1,]      1      1      1      1      1      1      1      1      1
1
## [2,]      1      3      1      1      1      3      1      1      1
3
## [3,]      1      3      1      1      1      3      1      1      1
3
## [4,]      1      2      1      1      1      2      1      1      1
2
## [5,]      3      3      3      3      3      3      3      3      3
3
## [6,]      1      2      1      1      1      2      1      1      1
2
## [7,]      2      1      2      2      2      1      2      2      2
1
## [8,]      1      1      1      1      1      1      1      1      1
1
## [9,]      1      1      1      1      1      1      1      1      1
1
##      [,148] [,149] [,150]
## [1,]      1      1      1
## [2,]      1      1      3
## [3,]      1      1      3
## [4,]      1      1      2
## [5,]      3      3      3
## [6,]      1      1      2
## [7,]      2      2      1
## [8,]      1      1      1
## [9,]      1      1      1

```



10

[illegible]

```

## [8,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [9,]      2      3      3      3      3      3      3      3      3      3      3      3
3
## [10,]     3      2      2      2      2      2      2      2      2      2      2      2
2
##          [,26] [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36]
[,37]
## [1,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [2,]      2      3      3      3      2      2      3      3      3      2      2      2
3
## [3,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [4,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [5,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [6,]      2      1      1      1      2      2      1      1      1      2      2      2
1
## [7,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [8,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [9,]      2      3      3      3      2      2      3      3      3      2      2      2
3
## [10,]     3      2      2      2      3      3      2      2      2      3      3      3
2
##          [,38] [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48]
[,49]
## [1,]      1      1      1      1      1      1      1      1      1      1      1      1
1
## [2,]      3      2      3      3      2      2      3      3      2      3      2      2
3
## [3,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [4,]      2      2      2      2      2      2      2      2      2      2      2      2
2
## [5,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [6,]      1      2      1      1      2      2      1      1      2      1      2      2
1
## [7,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [8,]      3      3      3      3      3      3      3      3      3      3      3      3
3
## [9,]      3      2      3      3      2      2      3      3      2      3      2      2
3
## [10,]     2      3      2      2      3      3      2      2      3      2      3      3
2

```

[illegible]

##	[3,]	3	3	3	3	1	3	3	3	3	3	3
3												
##	[4,]	3	3	3	3	1	3	3	3	3	3	3
3												
##	[5,]	2	2	2	2	1	2	2	2	2	2	2
2												
##	[6,]	3	3	3	3	3	3	3	3	3	3	3
3												
##	[7,]	2	2	2	2	1	2	2	2	2	2	2
2												
##	[8,]	1	1	1	1	2	1	1	1	1	1	1
1												
##	[9,]	1	1	1	1	1	1	1	1	1	1	1
1												
##	[10,]	1	1	1	1	1	1	1	1	1	1	1
1												
##		[,86]	[,87]	[,88]	[,89]	[,90]	[,91]	[,92]	[,93]	[,94]	[,95]	[,96]
[,97]												
##	[1,]	2	2	2	2	2	2	2	2	2	2	2
2												
##	[2,]	1	1	1	1	1	1	1	1	2	1	1
1												
##	[3,]	3	3	3	3	3	3	3	3	3	3	3
3												
##	[4,]	3	3	3	3	3	3	3	3	3	3	3
3												
##	[5,]	2	2	2	2	2	2	2	2	2	2	2
2												
##	[6,]	3	3	3	3	3	3	3	3	2	3	3
3												
##	[7,]	2	2	2	2	2	2	2	2	2	2	2
2												
##	[8,]	1	1	1	1	1	1	1	1	1	1	1
1												
##	[9,]	1	1	1	1	1	1	1	1	2	1	1
1												
##	[10,]	1	1	1	1	1	1	1	1	3	1	1
1												
##		[,98]	[,99]	[,100]	[,101]	[,102]	[,103]	[,104]	[,105]	[,106]	[,107]	
##	[1,]	2	2	2	3	2	3	3	3	3	3	2
##	[2,]	1	2	1	1	1	1	1	1	1	1	1
##	[3,]	3	3	3	1	3	1	1	1	1	1	3
##	[4,]	3	3	3	1	3	1	1	1	1	1	3
##	[5,]	2	2	2	1	2	1	1	1	1	1	2
##	[6,]	3	2	3	3	3	3	3	3	3	3	3
##	[7,]	2	2	2	1	2	1	1	1	1	1	2
##	[8,]	1	1	1	2	1	2	2	2	2	2	1
##	[9,]	1	2	1	1	1	1	1	1	1	1	1
##	[10,]	1	3	1	1	1	1	1	1	1	1	1
##		[,108]	[,109]	[,110]	[,111]	[,112]	[,113]	[,114]	[,115]	[,116]		

[,117]										
##	[1,]	3	3	3	3	3	3	2	3	3
3										
##	[2,]	1	1	1	1	1	1	1	1	1
1										
##	[3,]	1	1	1	1	1	1	3	1	1
1										
##	[4,]	1	1	1	1	1	1	3	1	1
1										
##	[5,]	1	1	1	1	1	1	2	1	1
1										
##	[6,]	3	3	3	3	3	3	3	3	3
3										
##	[7,]	1	1	1	1	1	1	2	1	1
1										
##	[8,]	2	2	2	2	2	2	1	2	2
2										
##	[9,]	1	1	1	1	1	1	1	1	1
1										
##	[10,]	1	1	1	1	1	1	1	1	1
1										
##		[,118]	[,119]	[,120]	[,121]	[,122]	[,123]	[,124]	[,125]	[,126]
[,127]										
##	[1,]	3	3	2	3	2	3	2	3	3
2										
##	[2,]	1	1	1	1	1	1	1	1	1
1										
##	[3,]	1	1	3	1	3	1	3	1	1
3										
##	[4,]	1	1	3	1	3	1	3	1	1
3										
##	[5,]	1	1	2	1	2	1	2	1	1
2										
##	[6,]	3	3	3	3	3	3	3	3	3
3										
##	[7,]	1	1	2	1	2	1	2	1	1
2										
##	[8,]	2	2	1	2	1	2	1	2	2
1										
##	[9,]	1	1	1	1	1	1	1	1	1
1										
##	[10,]	1	1	1	1	1	1	1	1	1
1										
##		[,128]	[,129]	[,130]	[,131]	[,132]	[,133]	[,134]	[,135]	[,136]
[,137]										
##	[1,]	2	3	3	3	3	3	2	2	3
3										
##	[2,]	1	1	1	1	1	1	1	1	1
1										
##	[3,]	3	1	1	1	1	1	3	3	1

```

1
## [4,]      3      1      1      1      1      1      3      3      1
1
## [5,]      2      1      1      1      1      1      2      2      1
1
## [6,]      3      3      3      3      3      3      3      3      3
3
## [7,]      2      1      1      1      1      1      2      2      1
1
## [8,]      1      2      2      2      2      2      1      1      2
2
## [9,]      1      1      1      1      1      1      1      1      1
1
## [10,]     1      1      1      1      1      1      1      1      1
1
##      [,138] [,139] [,140] [,141] [,142] [,143] [,144] [,145] [,146]
[,147]
## [1,]      3      2      3      3      3      2      3      3      3
2
## [2,]      1      1      1      1      1      1      1      1      1
1
## [3,]      1      3      1      1      1      3      1      1      1
3
## [4,]      1      3      1      1      1      3      1      1      1
3
## [5,]      1      2      1      1      1      2      1      1      1
2
## [6,]      3      3      3      3      3      3      3      3      3
3
## [7,]      1      2      1      1      1      2      1      1      1
2
## [8,]      2      1      2      2      2      1      2      2      2
1
## [9,]      1      1      1      1      1      1      1      1      1
1
## [10,]     1      1      1      1      1      1      1      1      1
1
##      [,148] [,149] [,150]
## [1,]      3      3      2
## [2,]      1      1      1
## [3,]      1      1      3
## [4,]      1      1      3
## [5,]      1      1      2
## [6,]      3      3      3
## [7,]      1      1      2
## [8,]      2      2      1
## [9,]      1      1      1
## [10,]     1      1      1

```

**It shows the importance of multiple iteration and averaging them**

**End of the Script**