Assignment 4_FML

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```r
library(factoextra)
```

```
## Warning: package 'factoextra' was built under R version 4.3.2

## Loading required package: ggplot2

## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/ve3WBa
```

```r
library(flexclust)
```

```
## Warning: package 'flexclust' was built under R version 4.3.2

## Loading required package: grid

## Loading required package: lattice

## Loading required package: modeltools

## Loading required package: stats4
```

```r
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.3     v readr     2.1.4
## v forcats   1.0.0     v stringr   1.5.0
## v lubridate 1.9.2     v tibble    3.2.1
## v purrr     1.0.2     v tidyr     1.3.0

## -- Conflicts ------------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```r
library(readr)
library(ggplot2)
library(cluster)
```

```
Pharmaceuticals_KP <- read.csv("C:/Users/DELL/Documents/FML/Assignment/Assignment 4/Pharmaceuticals.csv"
summary(Pharmaceuticals_KP)
```

```
##     Symbol              Name              Market_Cap          Beta
## Length:21           Length:21           Min.   :  0.41   Min.   :0.1800
## Class :character    Class :character    1st Qu.:  6.30   1st Qu.:0.3500
## Mode  :character    Mode  :character    Median : 48.19   Median :0.4600
##                                         Mean   : 57.65   Mean   :0.5257
##                                         3rd Qu.: 73.84   3rd Qu.:0.6500
##                                         Max.   :199.47   Max.   :1.1100
##    PE_Ratio          ROE              ROA           Asset_Turnover     Leverage
## Min.   : 3.60   Min.   : 3.9   Min.   : 1.40   Min.   :0.3     Min.   :0.0000
## 1st Qu.:18.90   1st Qu.:14.9   1st Qu.: 5.70   1st Qu.:0.6     1st Qu.:0.1600
## Median :21.50   Median :22.6   Median :11.20   Median :0.6     Median :0.3400
## Mean   :25.46   Mean   :25.8   Mean   :10.51   Mean   :0.7     Mean   :0.5857
## 3rd Qu.:27.90   3rd Qu.:31.0   3rd Qu.:15.00   3rd Qu.:0.9     3rd Qu.:0.6000
## Max.   :82.50   Max.   :62.9   Max.   :20.30   Max.   :1.1     Max.   :3.5100
##   Rev_Growth     Net_Profit_Margin Median_Recommendation   Location
## Min.   :-3.17   Min.   : 2.6       Length:21              Length:21
## 1st Qu.: 6.38   1st Qu.:11.2       Class :character       Class :character
## Median : 9.37   Median :16.1       Mode  :character       Mode  :character
## Mean   :13.37   Mean   :15.7
## 3rd Qu.:21.87   3rd Qu.:21.1
## Max.   :34.21   Max.   :25.5
##   Exchange
## Length:21
## Class :character
## Mode  :character
##
##
##
```

#Question 1-Use only the numerical variables (1 to 9) to cluster the 21 firms. Justify the various choices made in conducting the cluster analysis, such as weights for different variables, the specific clustering algorithm(s) used, the number of clusters formed, and so on.

```
KP <- na.omit(Pharmaceuticals_KP)
KP
```

```
##    Symbol                          Name Market_Cap Beta PE_Ratio  ROE  ROA
## 1     ABT          Abbott Laboratories      68.44 0.32     24.7 26.4 11.8
## 2     AGN               Allergan, Inc.       7.58 0.41     82.5 12.9  5.5
## 3     AHM                  Amersham plc       6.30 0.46     20.7 14.9  7.8
## 4     AZN              AstraZeneca PLC      67.63 0.52     21.5 27.4 15.4
## 5     AVE                      Aventis      47.16 0.32     20.1 21.8  7.5
## 6     BAY                     Bayer AG      16.90 1.11     27.9  3.9  1.4
## 7     BMY  Bristol-Myers Squibb Company      51.33 0.50     13.9 34.8 15.1
## 8    CHTT                 Chattem, Inc       0.41 0.85     26.0 24.1  4.3
## 9     ELN         Elan Corporation, plc       0.78 1.08      3.6 15.1  5.1
## 10    LLY        Eli Lilly and Company      73.84 0.18     27.9 31.0 13.5
## 11    GSK             GlaxoSmithKline plc     122.11 0.35     18.0 62.9 20.3
## 12    IVX              IVAX Corporation       2.60 0.65     19.9 21.4  6.8
```

2

```
## 13       JNJ                  Johnson & Johnson       173.93 0.46      28.4 28.6 16.3
## 14   MRX Medicis Pharmaceutical Corporation             1.20 0.75      28.6 11.2  5.4
## 15       MRK                 Merck & Co., Inc.         132.56 0.46      18.9 40.6 15.0
## 16       NVS                        Novartis AG         96.65 0.19      21.6 17.9 11.2
## 17       PFE                         Pfizer Inc        199.47 0.65      23.6 45.6 19.2
## 18       PHA             Pharmacia Corporation          56.24 0.40      56.5 13.5  5.7
## 19       SGP       Schering-Plough Corporation          34.10 0.51      18.9 22.6 13.3
## 20       WPI        Watson Pharmaceuticals, Inc.         3.26 0.24      18.4 10.2  6.8
## 21       WYE                              Wyeth         48.19 0.63      13.1 54.9 13.4
##    Asset_Turnover Leverage Rev_Growth Net_Profit_Margin Median_Recommendation
## 1             0.7     0.42       7.54              16.1          Moderate Buy
## 2             0.9     0.60       9.16               5.5          Moderate Buy
## 3             0.9     0.27       7.05              11.2            Strong Buy
## 4             0.9     0.00      15.00              18.0         Moderate Sell
## 5             0.6     0.34      26.81              12.9          Moderate Buy
## 6             0.6     0.00      -3.17               2.6                  Hold
## 7             0.9     0.57       2.70              20.6         Moderate Sell
## 8             0.6     3.51       6.38               7.5          Moderate Buy
## 9             0.3     1.07      34.21              13.3         Moderate Sell
## 10            0.6     0.53       6.21              23.4                  Hold
## 11            1.0     0.34      21.87              21.1                  Hold
## 12            0.6     1.45      13.99              11.0                  Hold
## 13            0.9     0.10       9.37              17.9          Moderate Buy
## 14            0.3     0.93      30.37              21.3          Moderate Buy
## 15            1.1     0.28      17.35              14.1                  Hold
## 16            0.5     0.06      -2.69              22.4                  Hold
## 17            0.8     0.16      25.54              25.2          Moderate Buy
## 18            0.6     0.35      15.00               7.3                  Hold
## 19            0.8     0.00       8.56              17.6                  Hold
## 20            0.5     0.20      29.18              15.1         Moderate Sell
## 21            0.6     1.12       0.36              25.5                  Hold
##       Location Exchange
## 1           US     NYSE
## 2       CANADA     NYSE
## 3           UK     NYSE
## 4           UK     NYSE
## 5       FRANCE     NYSE
## 6      GERMANY     NYSE
## 7           US     NYSE
## 8           US   NASDAQ
## 9      IRELAND     NYSE
## 10          US     NYSE
## 11          UK     NYSE
## 12          US     AMEX
## 13          US     NYSE
## 14          US     NYSE
## 15          US     NYSE
## 16 SWITZERLAND     NYSE
## 17          US     NYSE
## 18          US     NYSE
## 19          US     NYSE
## 20          US     NYSE
## 21          US     NYSE
```

```
row.names <- KP[,1]
Pharmaceuticals1 <- KP[,3:11]
head(Pharmaceuticals1)
```

```
##   Market_Cap Beta PE_Ratio  ROE  ROA Asset_Turnover Leverage Rev_Growth
## 1      68.44 0.32     24.7 26.4 11.8            0.7     0.42       7.54
## 2       7.58 0.41     82.5 12.9  5.5            0.9     0.60       9.16
## 3       6.30 0.46     20.7 14.9  7.8            0.9     0.27       7.05
## 4      67.63 0.52     21.5 27.4 15.4            0.9     0.00      15.00
## 5      47.16 0.32     20.1 21.8  7.5            0.6     0.34      26.81
## 6      16.90 1.11     27.9  3.9  1.4            0.6     0.00      -3.17
##   Net_Profit_Margin
## 1              16.1
## 2               5.5
## 3              11.2
## 4              18.0
## 5              12.9
## 6               2.6
```

```
Pharmaceuticals2 <- scale(Pharmaceuticals1)
head(Pharmaceuticals2)
```

```
##     Market_Cap        Beta    PE_Ratio         ROE        ROA Asset_Turnover
## 1   0.1840960 -0.80125356 -0.04671323  0.04009035  0.2416121      0.0000000
## 2  -0.8544181 -0.45070513  3.49706911 -0.85483986 -0.9422871      0.9225312
## 3  -0.8762600 -0.25595600 -0.29195768 -0.72225761 -0.5100700      0.9225312
## 4   0.1702742 -0.02225704 -0.24290879  0.10638147  0.9181259      0.9225312
## 5  -0.1790256 -0.80125356 -0.32874435 -0.26484883 -0.5664461     -0.4612656
## 6  -0.6953818  2.27578267  0.14948233 -1.45146000 -1.7127612     -0.4612656
##      Leverage Rev_Growth Net_Profit_Margin
## 1  -0.2120979 -0.5277675        0.06168225
## 2   0.0182843 -0.3811391       -1.55366706
## 3  -0.4040831 -0.5721181       -0.68503583
## 4  -0.7496565  0.1474473        0.35122600
## 5  -0.3144900  1.2163867       -0.42597037
## 6  -0.7496565 -1.4971443       -1.99560225
```
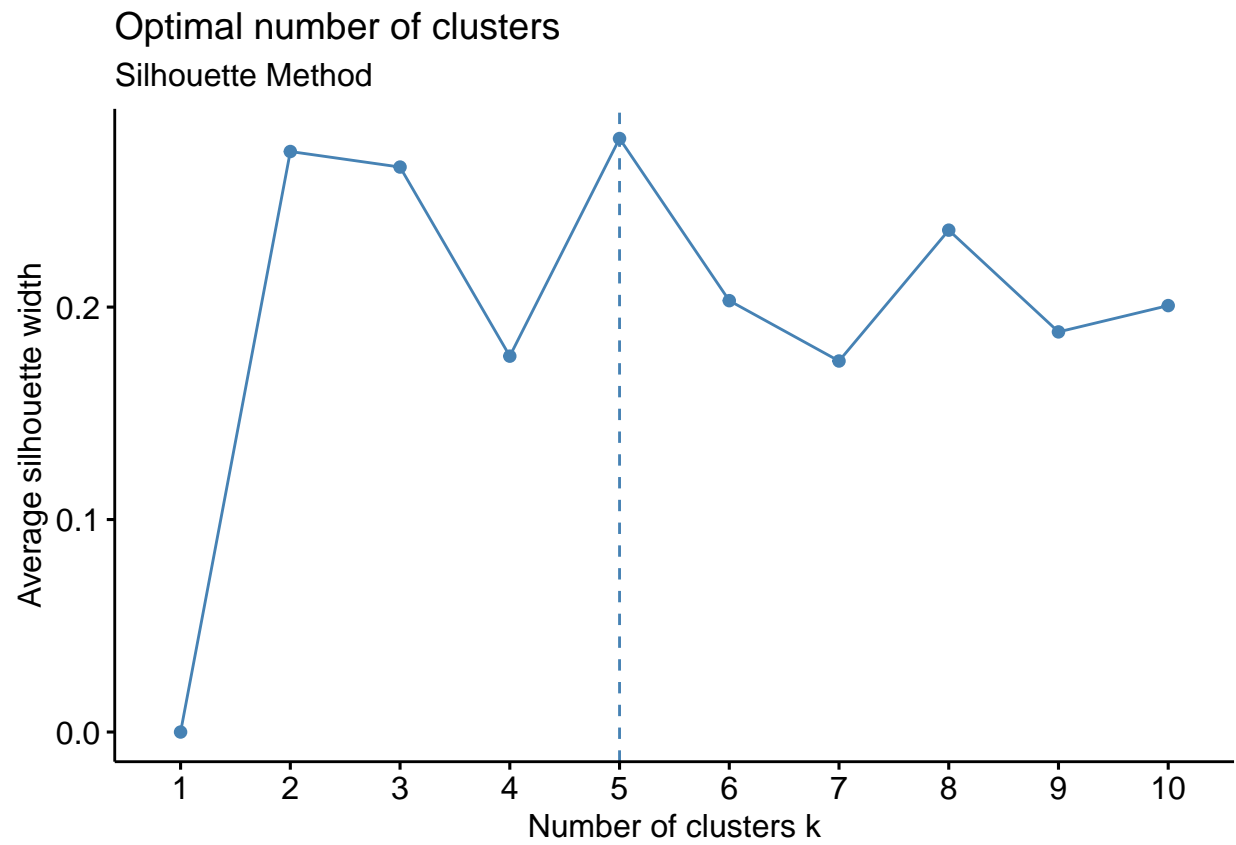
```
fviz_nbclust(Pharmaceuticals2, kmeans, method = "wss") +
  labs(subtitle = "Elbow Method")
```
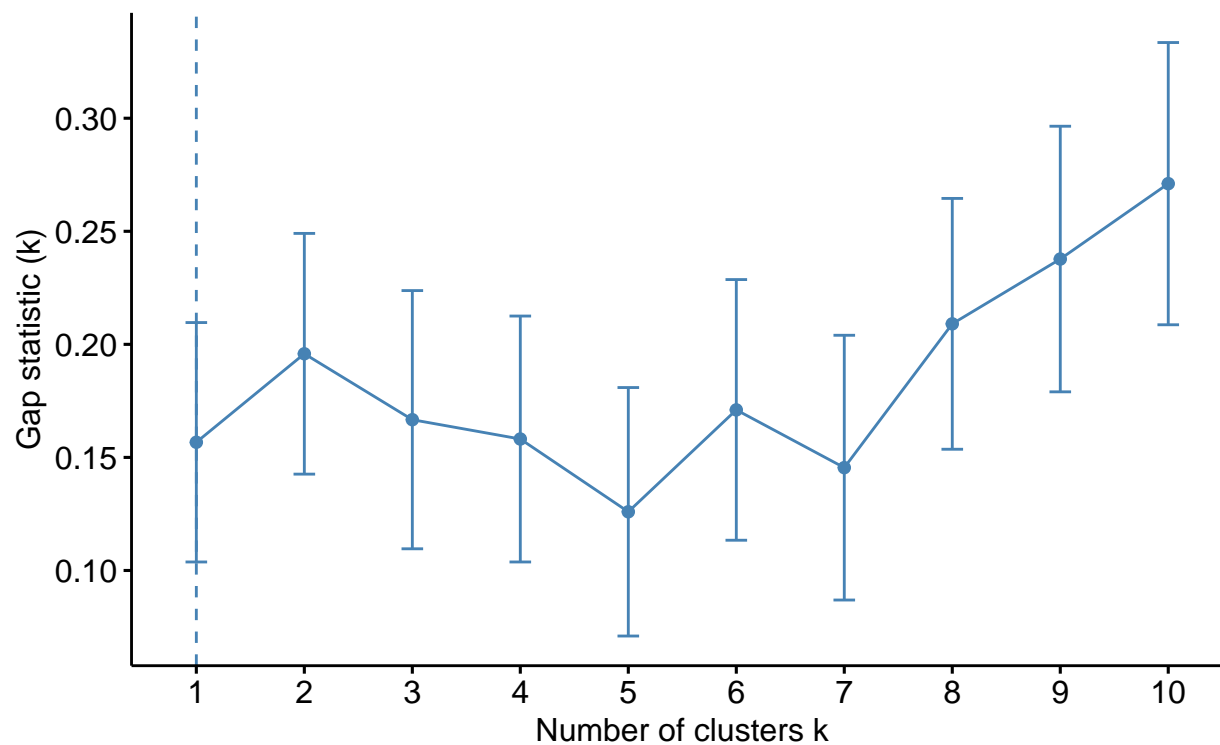
Optimal number of clusters
Elbow Method
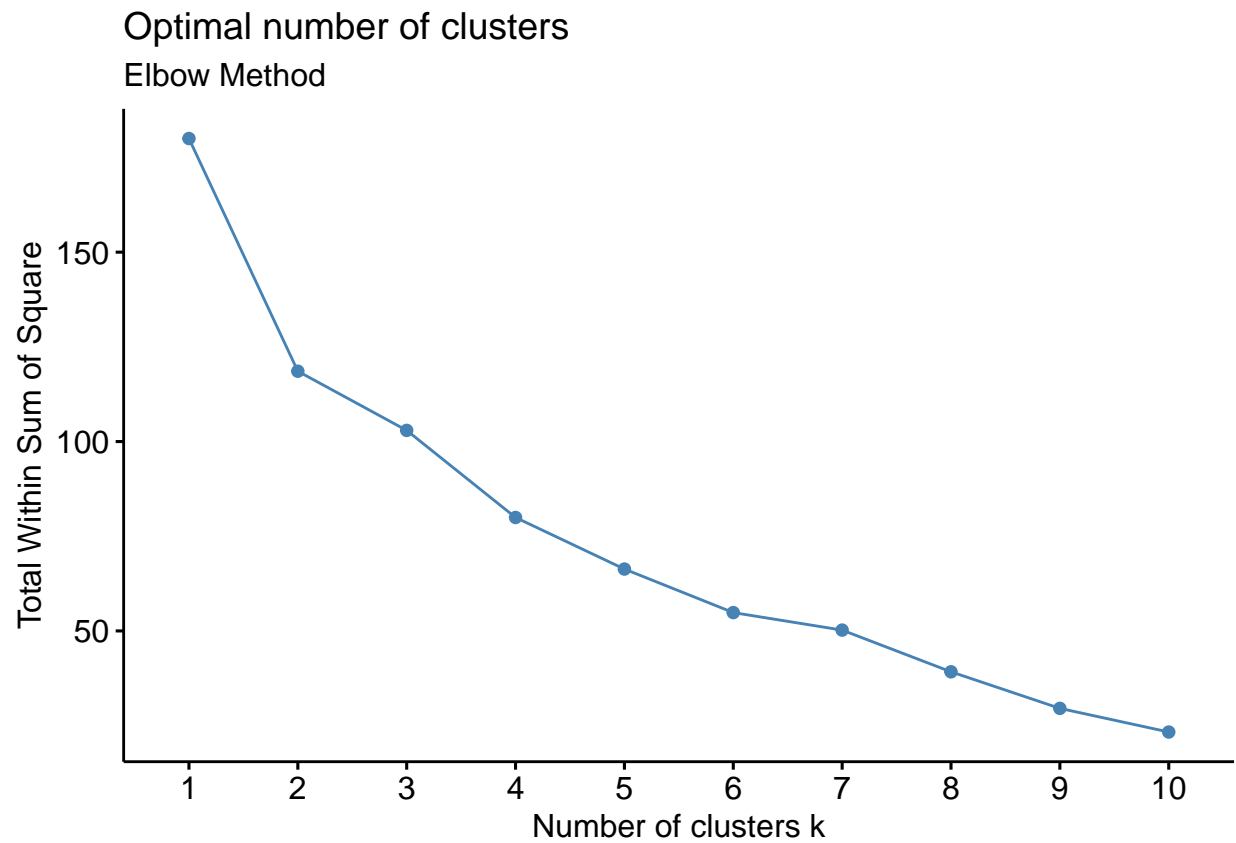

```r
fviz_nbclust(Pharmaceuticals2, kmeans, method = "silhouette") + labs(subtitle = "Silhouette Method")
```

Optimal number of clusters
Silhouette Method

```
fviz_nbclust(Pharmaceuticals2, kmeans, method = "gap_stat") + labs(subtitle = "Gap Stat Method")
```

Optimal number of clusters
Gap Stat Method


```
set.seed(64060)
KP <- kmeans(Pharmaceuticals2, centers = 5, nstart = 25)
KP $centers
```

```
##     Market_Cap        Beta    PE_Ratio         ROE         ROA Asset_Turnover
## 1 -0.87051511  1.3409869 -0.05284434 -0.6184015 -1.1928478     -0.4612656
## 2 -0.43925134 -0.4701800  2.70002464 -0.8349525 -0.9234951      0.2306328
## 3 -0.76022489  0.2796041 -0.47742380 -0.7438022 -0.8107428     -1.2684804
## 4 -0.03142211 -0.4360989 -0.31724852  0.1950459  0.4083915      0.1729746
## 5  1.69558112 -0.1780563 -0.19845823  1.2349879  1.3503431      1.1531640
##       Leverage Rev_Growth Net_Profit_Margin
## 1  1.36644699 -0.6912914      -1.320000179
## 2 -0.14170336 -0.1168459      -1.416514761
## 3  0.06308085  1.5180158      -0.006893899
## 4 -0.27449312 -0.7041516       0.556954446
## 5 -0.46807818  0.4671788       0.591242521
```

```
fviz_cluster(KP, data = Pharmaceuticals2)
```

## Cluster plot
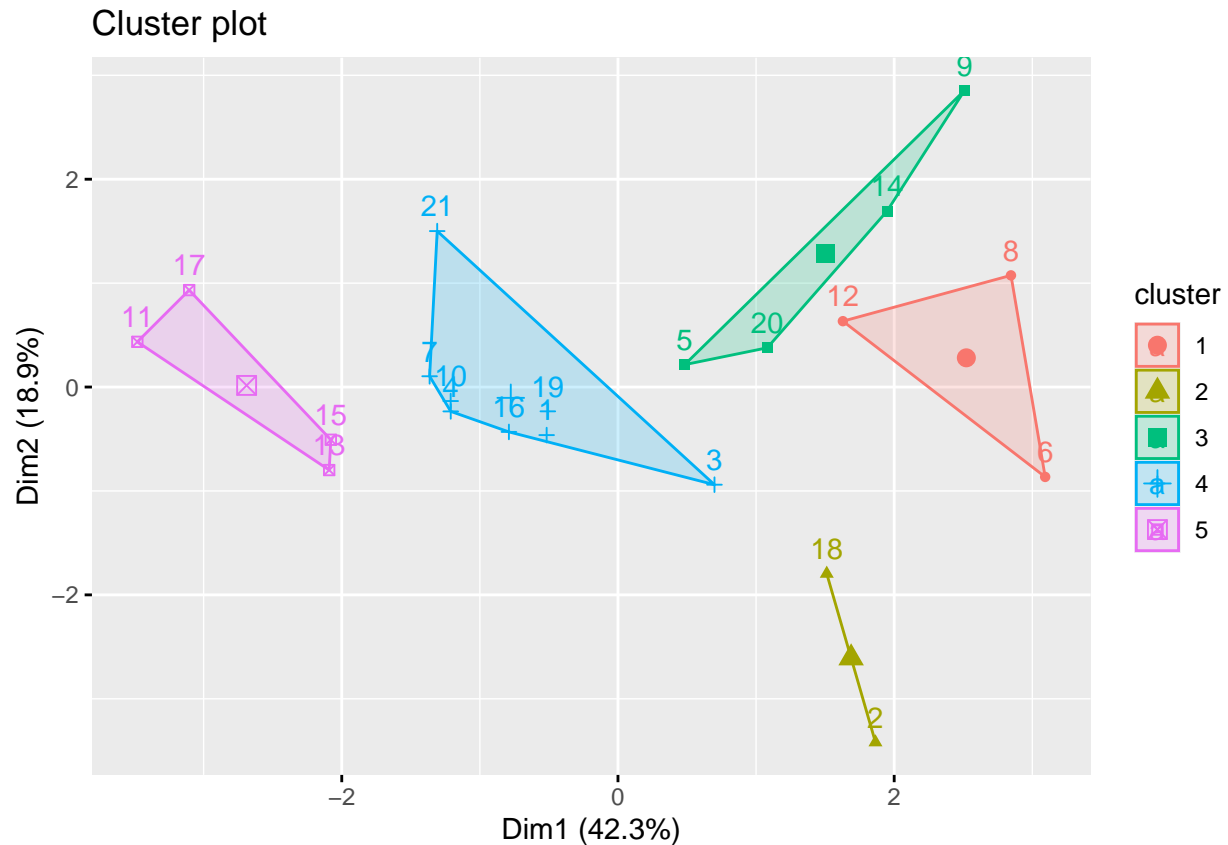
KP

```
## K-means clustering with 5 clusters of sizes 3, 2, 4, 8, 4
##
## Cluster means:
##     Market_Cap        Beta    PE_Ratio         ROE         ROA Asset_Turnover
## 1 -0.87051511  1.3409869 -0.05284434 -0.6184015 -1.1928478     -0.4612656
## 2 -0.43925134 -0.4701800  2.70002464 -0.8349525 -0.9234951      0.2306328
## 3 -0.76022489  0.2796041 -0.47742380 -0.7438022 -0.8107428     -1.2684804
## 4 -0.03142211 -0.4360989 -0.31724852  0.1950459  0.4083915      0.1729746
## 5  1.69558112 -0.1780563 -0.19845823  1.2349879  1.3503431      1.1531640
##       Leverage Rev_Growth Net_Profit_Margin
## 1  1.36644699 -0.6912914      -1.320000179
## 2 -0.14170336 -0.1168459      -1.416514761
## 3  0.06308085  1.5180158      -0.006893899
## 4 -0.27449312 -0.7041516       0.556954446
## 5 -0.46807818  0.4671788       0.591242521
##
## Clustering vector:
##  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21
##  4  2  4  4  3  1  4  1  3  4  5  1  5  3  5  4  5  2  4  3  4
##
## Within cluster sum of squares by cluster:
## [1] 15.595925  2.803505 12.791257 21.879320  9.284424
##  (between_SS / total_SS =  65.4 %)
##
```

```
## Available components:
##
## [1] "cluster"       "centers"       "totss"         "withinss"      "tot.withinss"
## [6] "betweenss"     "size"          "iter"          "ifault"
```

```
Distance <- dist(Pharmaceuticals2, method = "euclidian")
fviz_dist(Distance)
```
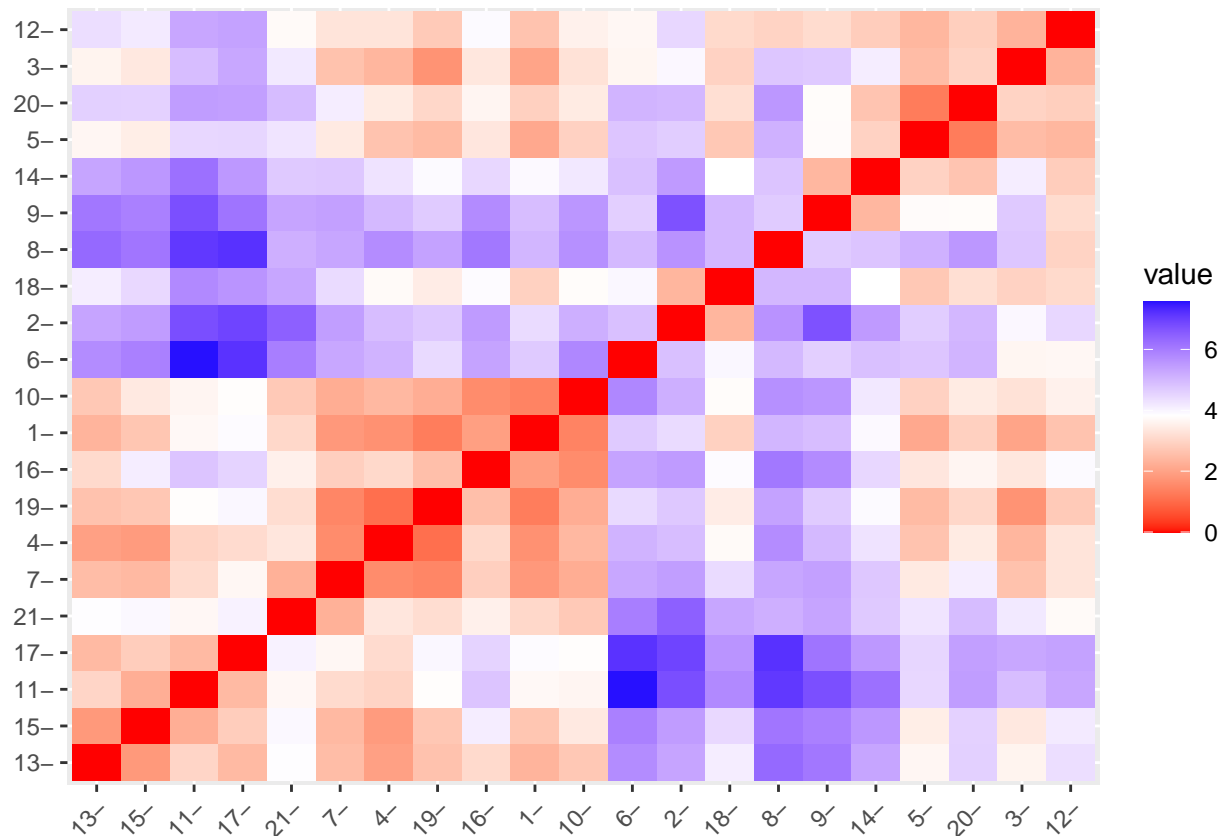


```
Fitting <- kmeans(Pharmaceuticals2,5)
aggregate(Pharmaceuticals2,by = list(Fitting$cluster), FUN = mean)
```
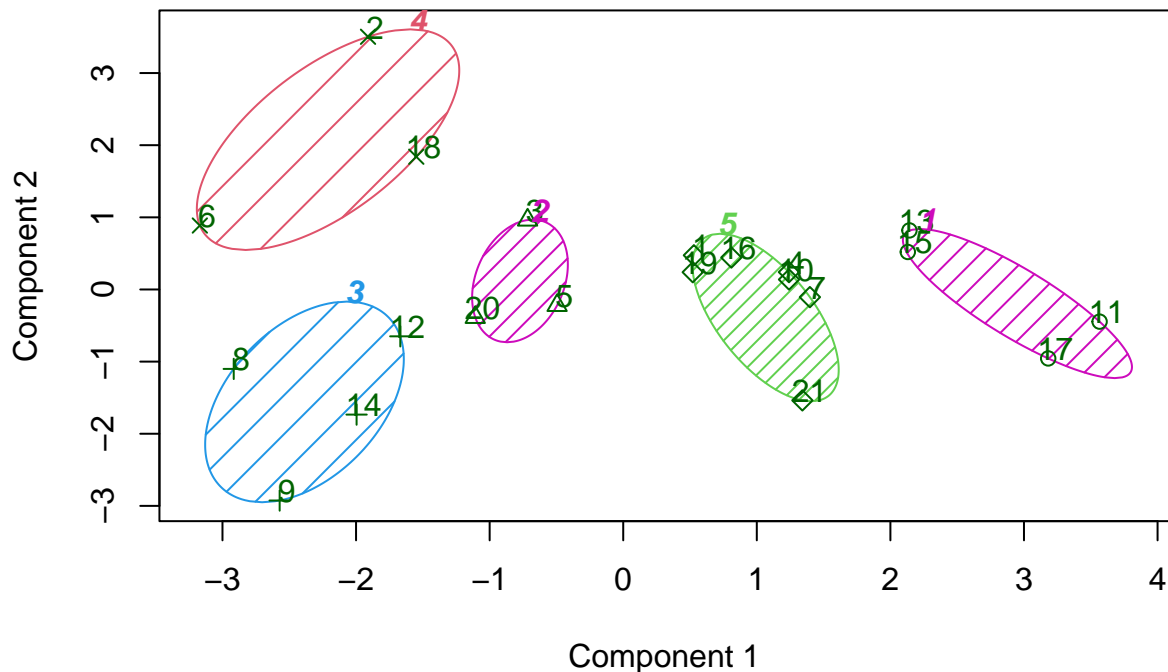
```
##   Group.1  Market_Cap        Beta   PE_Ratio        ROE        ROA
## 1       1  1.69558112 -0.1780563 -0.1984582  1.2349879  1.3503431
## 2       2 -0.66114002 -0.7233539 -0.3512251 -0.6736441 -0.5915022
## 3       3 -0.96247577  1.1949250 -0.3639982 -0.5200697 -0.9610792
## 4       4 -0.52462814  0.4451409  1.8498439 -1.0404550 -1.1865838
## 5       5  0.08926902 -0.4618336 -0.3208615  0.3260892  0.5396003
##   Asset_Turnover    Leverage Rev_Growth Net_Profit_Margin
## 1   1.153164e+00 -0.4680782  0.4671788         0.5912425
## 2  -1.537552e-01 -0.4040831  0.6917224        -0.4005718
## 3  -1.153164e+00  1.4773718  0.7120120        -0.3688236
## 4   1.480297e-16 -0.3443544 -0.5769454        -1.6095439
## 5   6.589509e-02 -0.2559803 -0.7230135         0.7343816
```

```r
Pharmaceuticals3 <- data.frame(Pharmaceuticals2,Fitting$cluster)
Pharmaceuticals3
```

```
##      Market_Cap        Beta    PE_Ratio         ROE         ROA Asset_Turnover
## 1    0.1840960 -0.80125356 -0.04671323  0.04009035  0.2416121      0.0000000
## 2   -0.8544181 -0.45070513  3.49706911 -0.85483986 -0.9422871      0.9225312
## 3   -0.8762600 -0.25595600 -0.29195768 -0.72225761 -0.5100700      0.9225312
## 4    0.1702742 -0.02225704 -0.24290879  0.10638147  0.9181259      0.9225312
## 5   -0.1790256 -0.80125356 -0.32874435 -0.26484883 -0.5664461     -0.4612656
## 6   -0.6953818  2.27578267  0.14948233 -1.45146000 -1.7127612     -0.4612656
## 7   -0.1078688 -0.10015669 -0.70887325  0.59693581  0.8617498      0.9225312
## 8   -0.9767669  1.26308721  0.03299122 -0.11237924 -1.1677918     -0.4612656
## 9   -0.9704532  2.15893320 -1.34037772 -0.70899938 -1.0174553     -1.8450624
## 10   0.2762415 -1.34655112  0.14948233  0.34502953  0.5610770     -0.4612656
## 11   1.0999201 -0.68440408 -0.45749769  2.45971647  1.8389364      1.3837968
## 12  -0.9393967  0.48409069 -0.34100657 -0.29136529 -0.6979905     -0.4612656
## 13   1.9841758 -0.25595600  0.18013789  0.18593083  1.0872544      0.9225312
## 14  -0.9632863  0.87358895  0.19240011 -0.96753478 -0.9610792     -1.8450624
## 15   1.2782387 -0.25595600 -0.40231769  0.98142435  0.8429577      1.8450624
## 16   0.6654710 -1.30760129 -0.23677768 -0.52338423  0.1288598     -0.9225312
## 17   2.4199899  0.48409069 -0.11415545  1.31287998  1.6322239      0.4612656
## 18  -0.0240846 -0.48965495  1.90298017 -0.81506519 -0.9047030     -0.4612656
## 19  -0.4018812 -0.06120687 -0.40231769 -0.21181593  0.5234929      0.4612656
## 20  -0.9281345 -1.11285216 -0.43297324 -1.03382590 -0.6979905     -0.9225312
## 21  -0.1614497  0.40619104 -0.75792214  1.92938746  0.5422849     -0.4612656
##        Leverage  Rev_Growth Net_Profit_Margin Fitting.cluster
## 1   -0.21209793 -0.52776752        0.06168225               5
## 2    0.01828430 -0.38113909       -1.55366706               4
## 3   -0.40408312 -0.57211809       -0.68503583               2
## 4   -0.74965647  0.14744734        0.35122600               5
## 5   -0.31449003  1.21638667       -0.42597037               2
## 6   -0.74965647 -1.49714434       -1.99560225               4
## 7   -0.02011273 -0.96584257        0.74744375               5
## 8    3.74279705 -0.63276071       -1.24888417               3
## 9    0.61983791  1.88617085       -0.36501379               3
## 10  -0.07130879 -0.64814764        1.17413980               5
## 11  -0.31449003  0.76926048        0.82363947               1
## 12   1.10620040  0.05603085       -0.71551412               3
## 13  -0.62166634 -0.36213170        0.33598685               1
## 14   0.44065173  1.53860717        0.85411776               3
## 15  -0.39128411  0.36014907       -0.24310064               1
## 16  -0.67286239 -1.45369888        1.02174835               5
## 17  -0.54487226  1.10143723        1.44844440               1
## 18  -0.30169102  0.14744734       -1.27936246               4
## 19  -0.74965647 -0.43544591        0.29026942               5
## 20  -0.49367621  1.43089863       -0.09070919               2
## 21   0.68383297 -1.17763919        1.49416183               5
```

```r
clusplot(Pharmaceuticals2,Fitting$cluster, color = TRUE, shade = TRUE,
         labels = 2,
         lines = 0)
```

CLUSPLOT(Pharmaceuticals2)

Component 1
These two components explain 61.23 % of the point variability.

#Question 2-Interpret the clusters with respect to the numerical variables used in forming the clusters.

```
aggregate(Pharmaceuticals2, by = list(Fitting$cluster), FUN = mean)
```

```
##   Group.1  Market_Cap        Beta    PE_Ratio         ROE         ROA
## 1       1  1.69558112 -0.1780563 -0.1984582  1.2349879  1.3503431
## 2       2 -0.66114002 -0.7233539 -0.3512251 -0.6736441 -0.5915022
## 3       3 -0.96247577  1.1949250 -0.3639982 -0.5200697 -0.9610792
## 4       4 -0.52462814  0.4451409  1.8498439 -1.0404550 -1.1865838
## 5       5  0.08926902 -0.4618336 -0.3208615  0.3260892  0.5396003
##   Asset_Turnover   Leverage Rev_Growth Net_Profit_Margin
## 1   1.153164e+00 -0.4680782  0.4671788          0.5912425
## 2  -1.537552e-01 -0.4040831  0.6917224         -0.4005718
## 3  -1.153164e+00  1.4773718  0.7120120         -0.3688236
## 4   1.480297e-16 -0.3443544 -0.5769454         -1.6095439
## 5   6.589509e-02 -0.2559803 -0.7230135          0.7343816
```

```
Pharmacy1 <- data.frame(Pharmaceuticals2,KP$cluster)
Pharmacy1
```

```
##    Market_Cap        Beta    PE_Ratio         ROE         ROA Asset_Turnover
## 1   0.1840960 -0.80125356 -0.04671323  0.04009035  0.2416121      0.0000000
## 2  -0.8544181 -0.45070513  3.49706911 -0.85483986 -0.9422871      0.9225312
## 3  -0.8762600 -0.25595600 -0.29195768 -0.72225761 -0.5100700      0.9225312
## 4   0.1702742 -0.02225704 -0.24290879  0.10638147  0.9181259      0.9225312
```

```
## 5  -0.1790256 -0.80125356 -0.32874435 -0.26484883 -0.5664461    -0.4612656
## 6  -0.6953818  2.27578267  0.14948233 -1.45146000 -1.7127612    -0.4612656
## 7  -0.1078688 -0.10015669 -0.70887325  0.59693581  0.8617498     0.9225312
## 8  -0.9767669  1.26308721  0.03299122 -0.11237924 -1.1677918    -0.4612656
## 9  -0.9704532  2.15893320 -1.34037772 -0.70899938 -1.0174553    -1.8450624
## 10  0.2762415 -1.34655112  0.14948233  0.34502953  0.5610770    -0.4612656
## 11  1.0999201 -0.68440408 -0.45749769  2.45971647  1.8389364     1.3837968
## 12 -0.9393967  0.48409069 -0.34100657 -0.29136529 -0.6979905    -0.4612656
## 13  1.9841758 -0.25595600  0.18013789  0.18593083  1.0872544     0.9225312
## 14 -0.9632863  0.87358895  0.19240011 -0.96753478 -0.9610792    -1.8450624
## 15  1.2782387 -0.25595600 -0.40231769  0.98142435  0.8429577     1.8450624
## 16  0.6654710 -1.30760129 -0.23677768 -0.52338423  0.1288598    -0.9225312
## 17  2.4199899  0.48409069 -0.11415545  1.31287998  1.6322239     0.4612656
## 18 -0.0240846 -0.48965495  1.90298017 -0.81506519 -0.9047030    -0.4612656
## 19 -0.4018812 -0.06120687 -0.40231769 -0.21181593  0.5234929     0.4612656
## 20 -0.9281345 -1.11285216 -0.43297324 -1.03382590 -0.6979905    -0.9225312
## 21 -0.1614497  0.40619104 -0.75792214  1.92938746  0.5422849    -0.4612656
##        Leverage  Rev_Growth Net_Profit_Margin KP.cluster
## 1  -0.21209793 -0.52776752        0.06168225          4
## 2   0.01828430 -0.38113909       -1.55366706          2
## 3  -0.40408312 -0.57211809       -0.68503583          4
## 4  -0.74965647  0.14744734        0.35122600          4
## 5  -0.31449003  1.21638667       -0.42597037          3
## 6  -0.74965647 -1.49714434       -1.99560225          1
## 7  -0.02011273 -0.96584257        0.74744375          4
## 8   3.74279705 -0.63276071       -1.24888417          1
## 9   0.61983791  1.88617085       -0.36501379          3
## 10 -0.07130879 -0.64814764        1.17413980          4
## 11 -0.31449003  0.76926048        0.82363947          5
## 12  1.10620040  0.05603085       -0.71551412          1
## 13 -0.62166634 -0.36213170        0.33598685          5
## 14  0.44065173  1.53860717        0.85411776          3
## 15 -0.39128411  0.36014907       -0.24310064          5
## 16 -0.67286239 -1.45369888        1.02174835          4
## 17 -0.54487226  1.10143723        1.44844440          5
## 18 -0.30169102  0.14744734       -1.27936246          2
## 19 -0.74965647 -0.43544591        0.29026942          4
## 20 -0.49367621  1.43089863       -0.09070919          3
## 21  0.68383297 -1.17763919        1.49416183          4
```

```
#Cluster 1:- JNJ, MRK, GSK, PFE
#Cluster 1: Highest Market_Cap and lowest Beta/PE Ratio
#Cluster 2:- AHM, WPI, AVE
#Cluster 2: Highest Revenue Growth and lowest PE/Asset Turnover Ratio
#Cluster 3:- CHTT, IVX, MRX, ELN
#Cluster 3: Highest Beta/leverage/Asset Turnover Ratio and lowest
#Net_Profit_Margin, PE ratio and Market#Cluster
#Cluster 4:- AGN,BAY, PHA
#Cluster 4: Highest PE ratio and lowest Leverage/Asset_Turnover
#Cluster 5:- ABT, WYE, AZN, SGP, BMY, NVS, LLY
#Cluster 5: Highest Net_Profit_Margin and lowest Leverage
```

#Question 3-Is there a pattern in the clusters with respect to the numerical variables (10 to 12)? (those not used in forming the clusters.
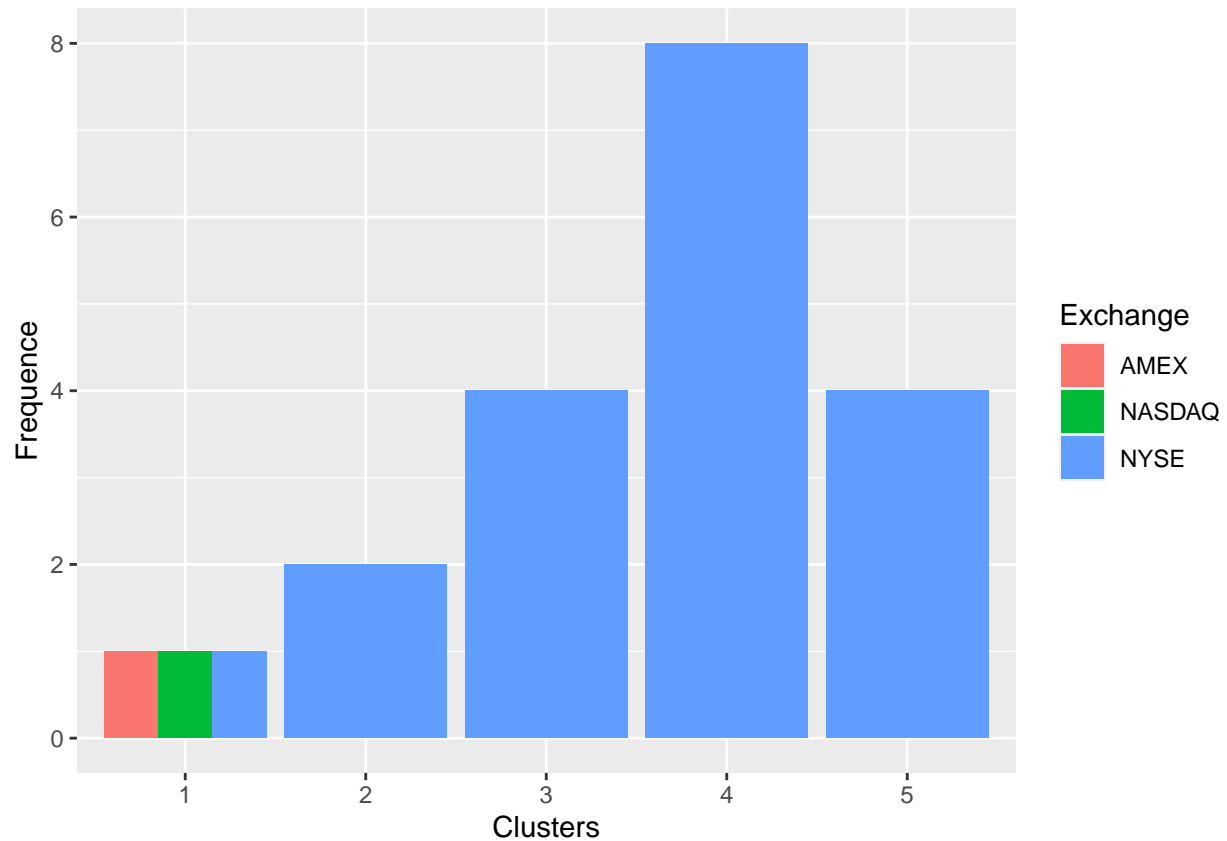
```
S1 <- Pharmaceuticals_KP[12:14] %>% mutate(Clusters=KP$cluster)
ggplot(S1, mapping = aes(factor(Clusters), fill =Median_Recommendation))+geom_bar(position='dodge')+lab
```
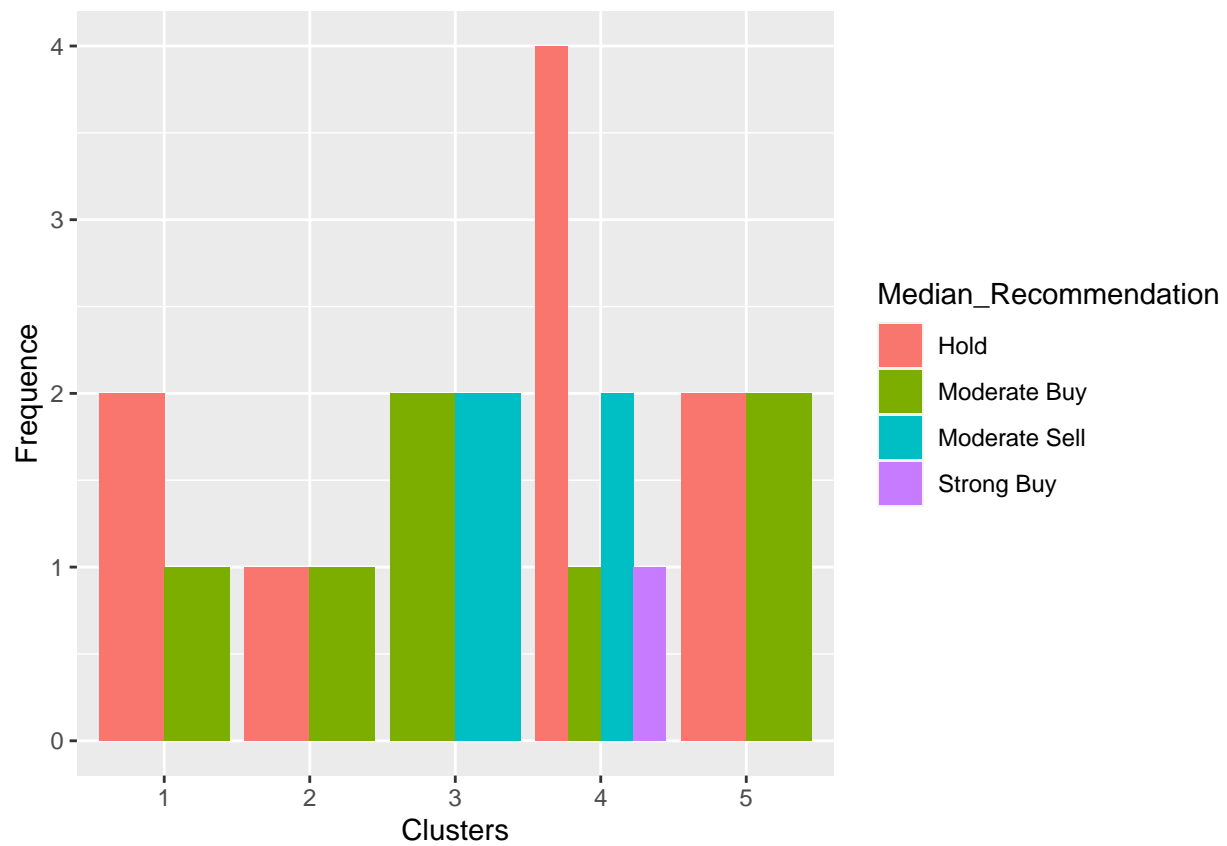


```
ggplot(S1, mapping = aes(factor(Clusters),fill = Location))+
  geom_bar(position = 'dodge')+labs(x ='Clusters',y = 'Frequence')
```
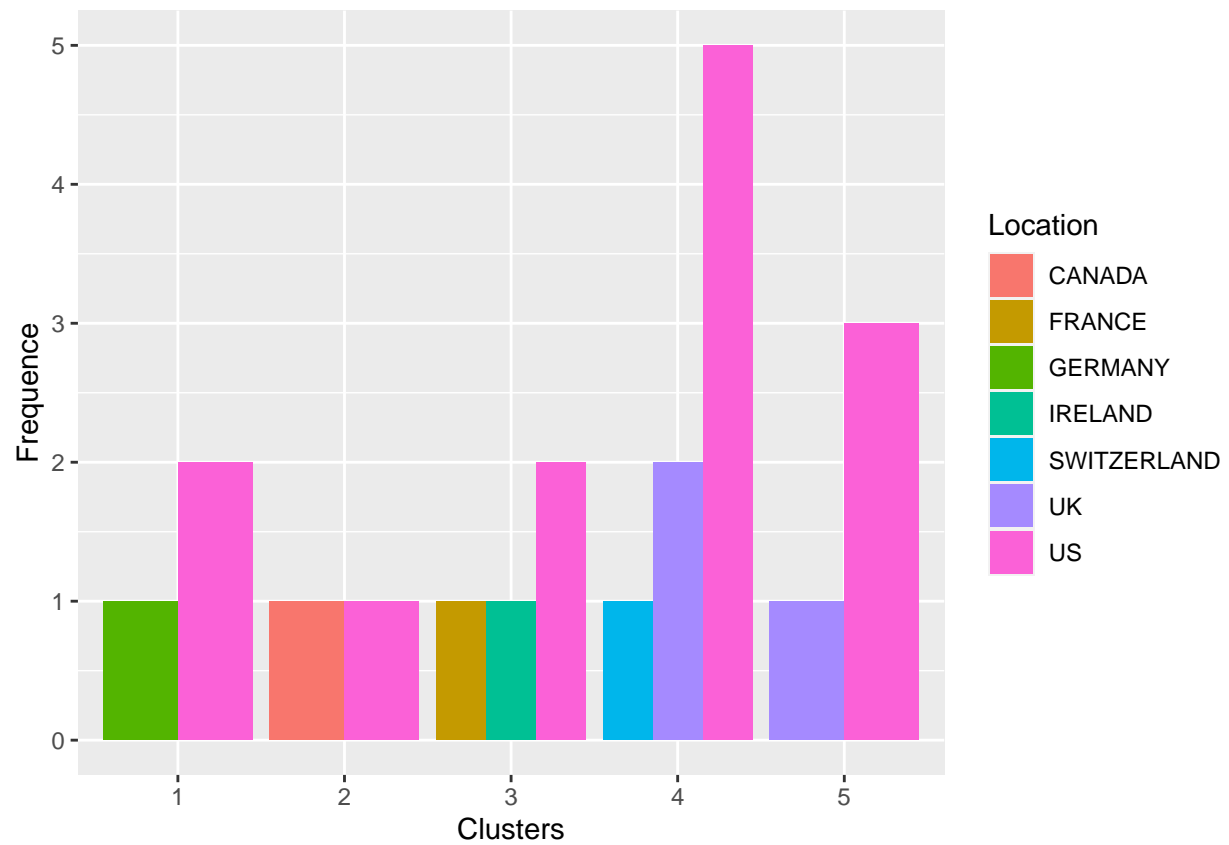
```
ggplot(S1, mapping = aes(factor(Clusters),fill = Exchange))+geom_bar(position = 'dodge')+
  labs(x ='Clusters',y = 'Frequence')
```

#Question 4-Provide an appropriate name for each cluster using any or all of the variables in the dataset.

#Cluster 1 :- Buy Cluster #Cluster 2 :- Sceptical Cluster #Cluster 3 :- Moderate Buy Cluster #Cluster 4 :- Hold Cluster #Cluster 5 :- High Hold Cluster