

# Assignment 4

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```
library(readr)
Pharmaceuticals_RD <- read.csv("~/Downloads/Pharmaceuticals (1).csv")
View(Pharmaceuticals_RD)

library(ggplot2)
library(factoextra)

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

## Loading required package: grid
## Loading required package: lattice
## Loading required package: modeltools
## Loading required package: stats4

library(cluster)
library(tidyverse)

## -- Attaching packages ----- tidyverse 1.3.2 --
## v tibble 3.1.8      v dplyr 1.0.10
## v tidyr 1.2.1      v stringr 1.4.1
## v purrr 0.3.5      v forcats 0.5.2
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()

summary(Pharmaceuticals_RD)

##      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
##
##
##
```

### #Task 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.*

```
R <- na.omit(Pharmaceuticals_RD)
R
```

##	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	BMJ	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
## 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 <- R[,1]
Pharmaceuticals1 <- R[,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

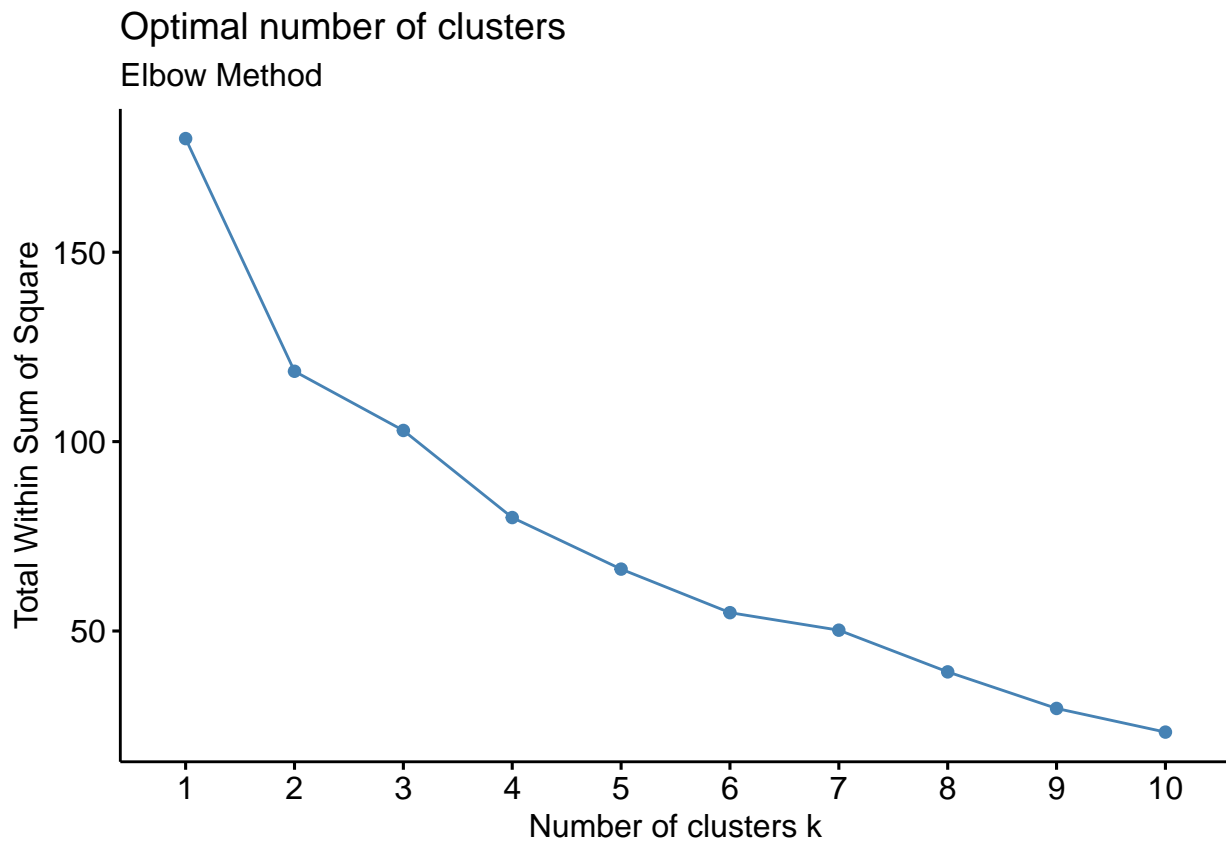
  

##	Net_Profit_Margin
## 1	16.1
## 2	5.5
## 3	11.2
## 4	18.0
## 5	12.9
## 6	2.6

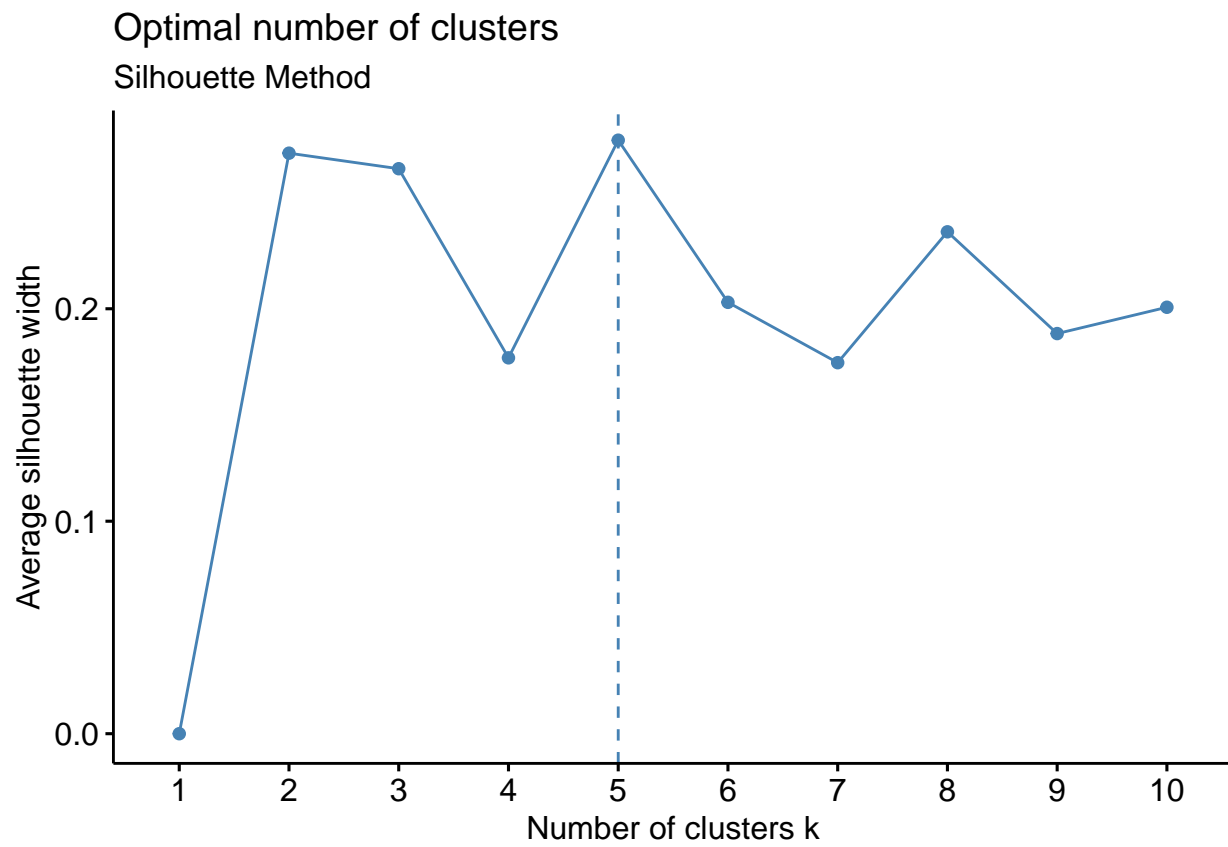
```
Pharmaceuticals2 <- scale(Pharmaceuticals1)
head(Pharmaceuticals2)
```

```
##   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")
```



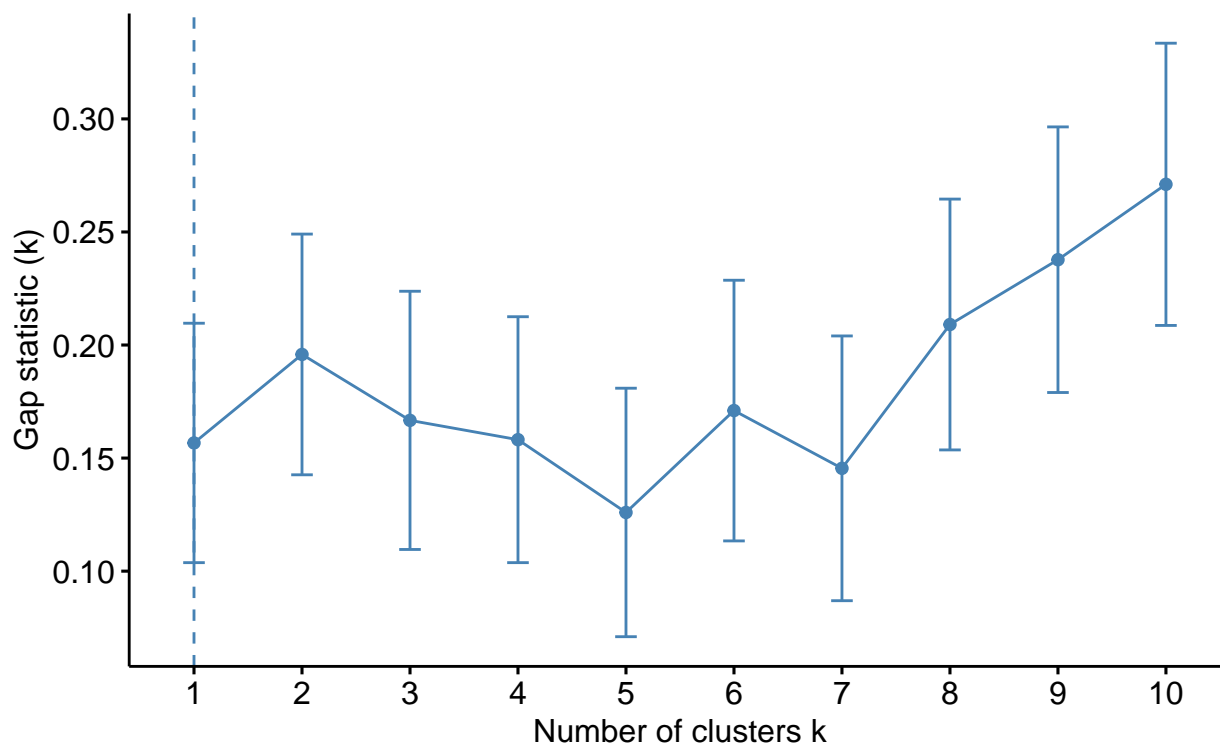
```
fviz_nbclust(Pharmaceuticals2, kmeans, method = "silhouette") + labs(subtitle = "Silhouette Method")
```



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

## Optimal number of clusters

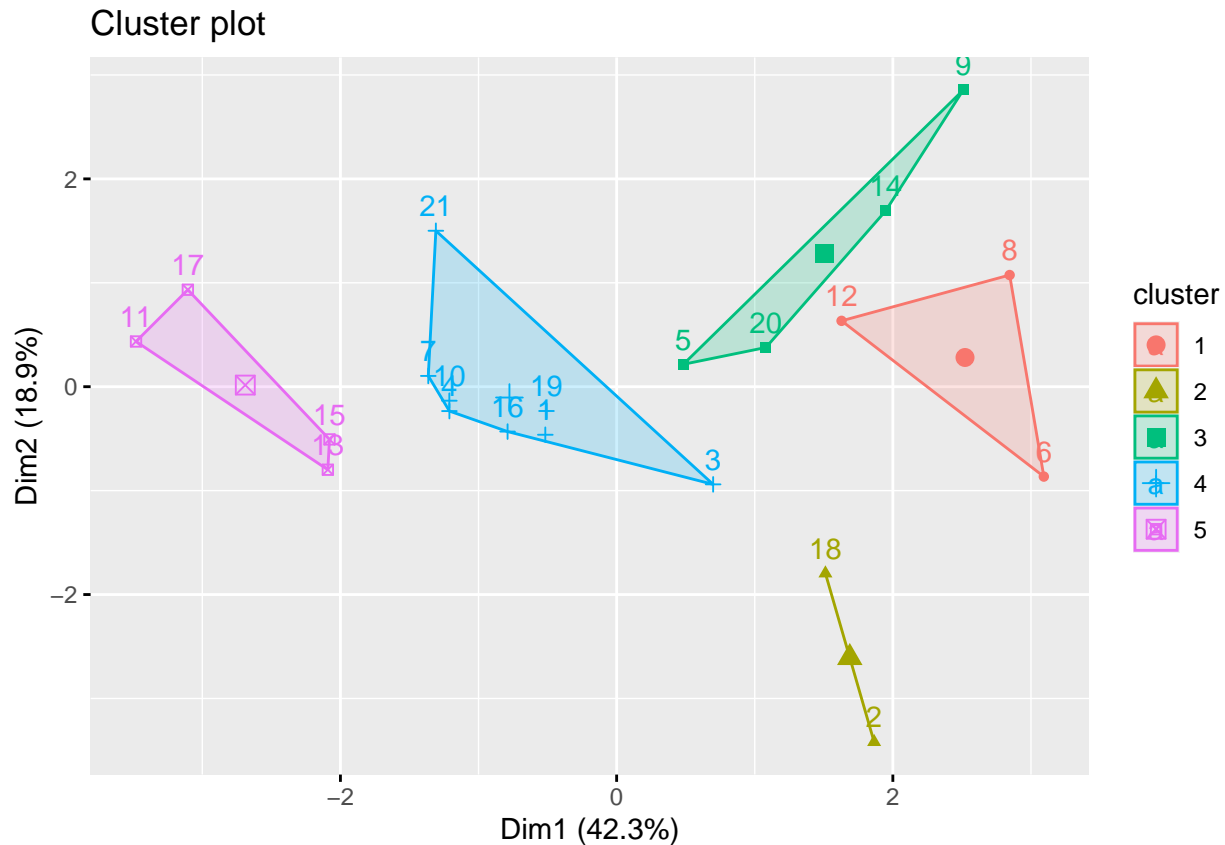
Gap Stat Method



```
set.seed(64060)
k5 <- kmeans(Pharmaceuticals2, centers = 5, nstart = 25)
k5$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(k5, data = Pharmaceuticals2)
```

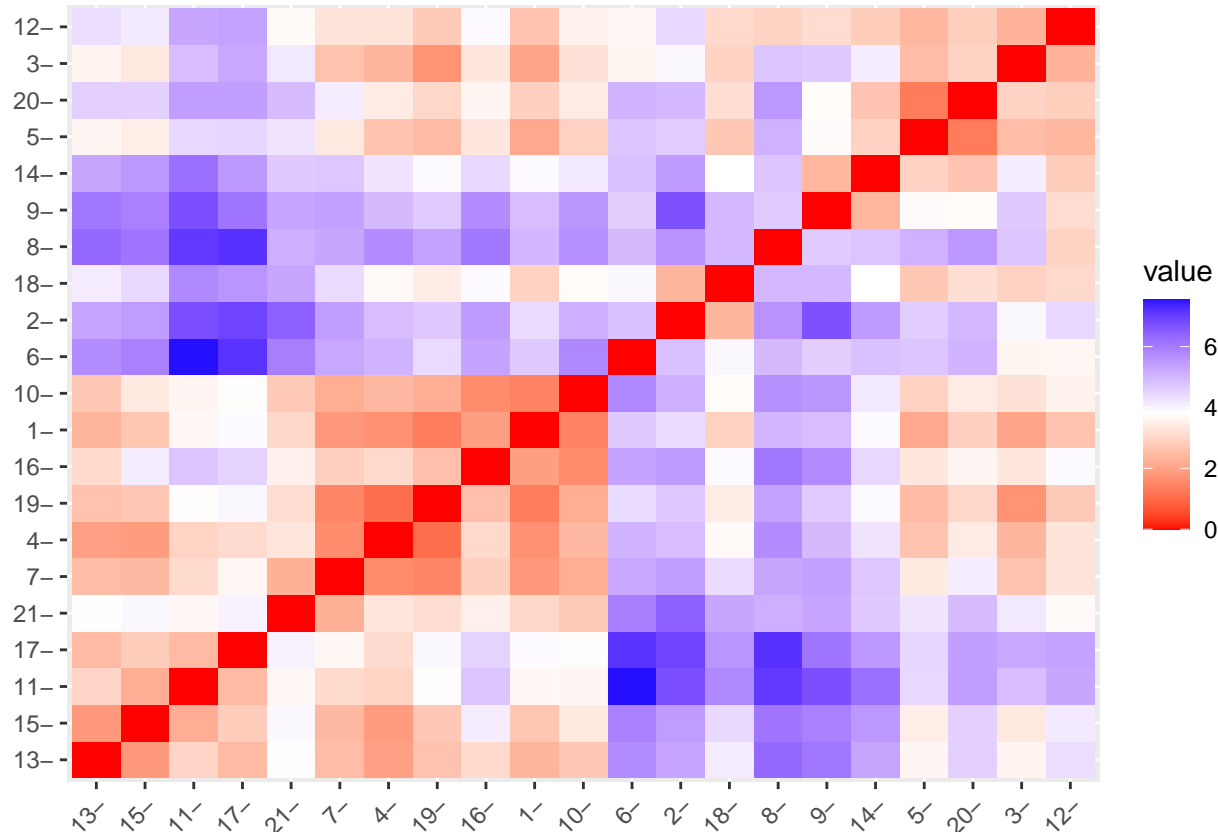


k5

```
## 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
```

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

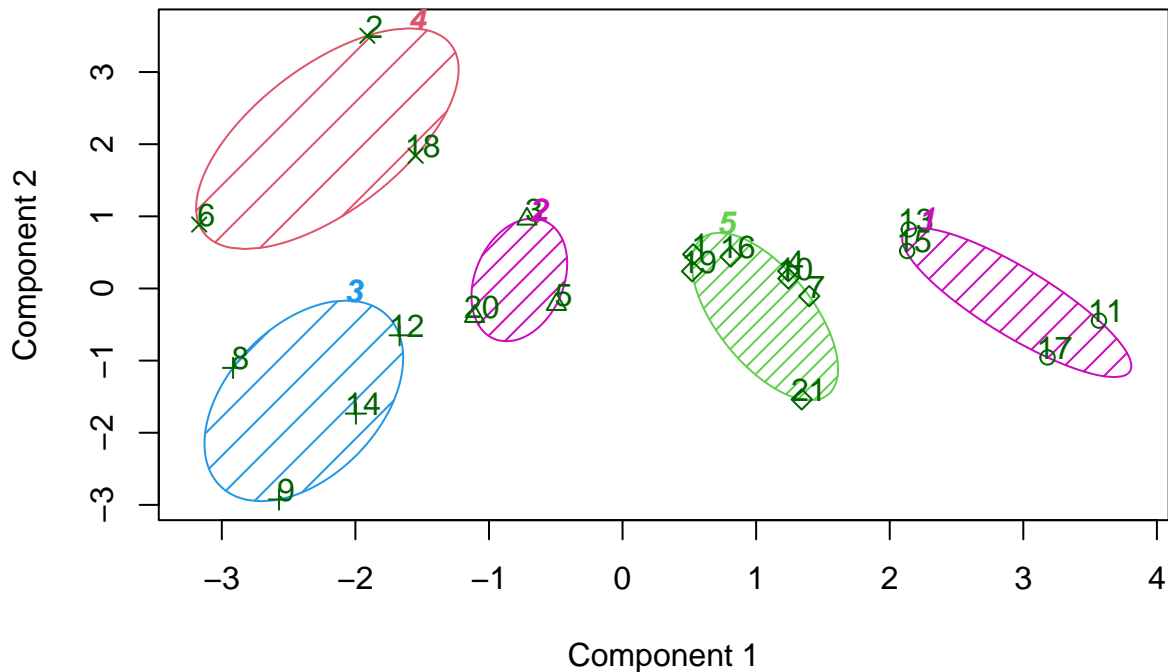
```
##   Market_Cap      Beta  PE_Ratio      ROE      ROA Asset_Turnover
## 1  0.1840960 -0.80125356 -0.04671323  0.04009035  0.2416121  0.0000000
## 2 -0.8544181 -0.45070513  3.49706911 -0.85483986 -0.9422871  0.9225312
```



```
## 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
```

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

## CLUSPLOT( Pharmaceuticals2 )



These two components explain 61.23 % of the point variability.

### #Task 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
```

```
Pharmacy <- data.frame(Pharmaceuticals2,k5$cluster)
Pharmacy
```

```
##   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
```

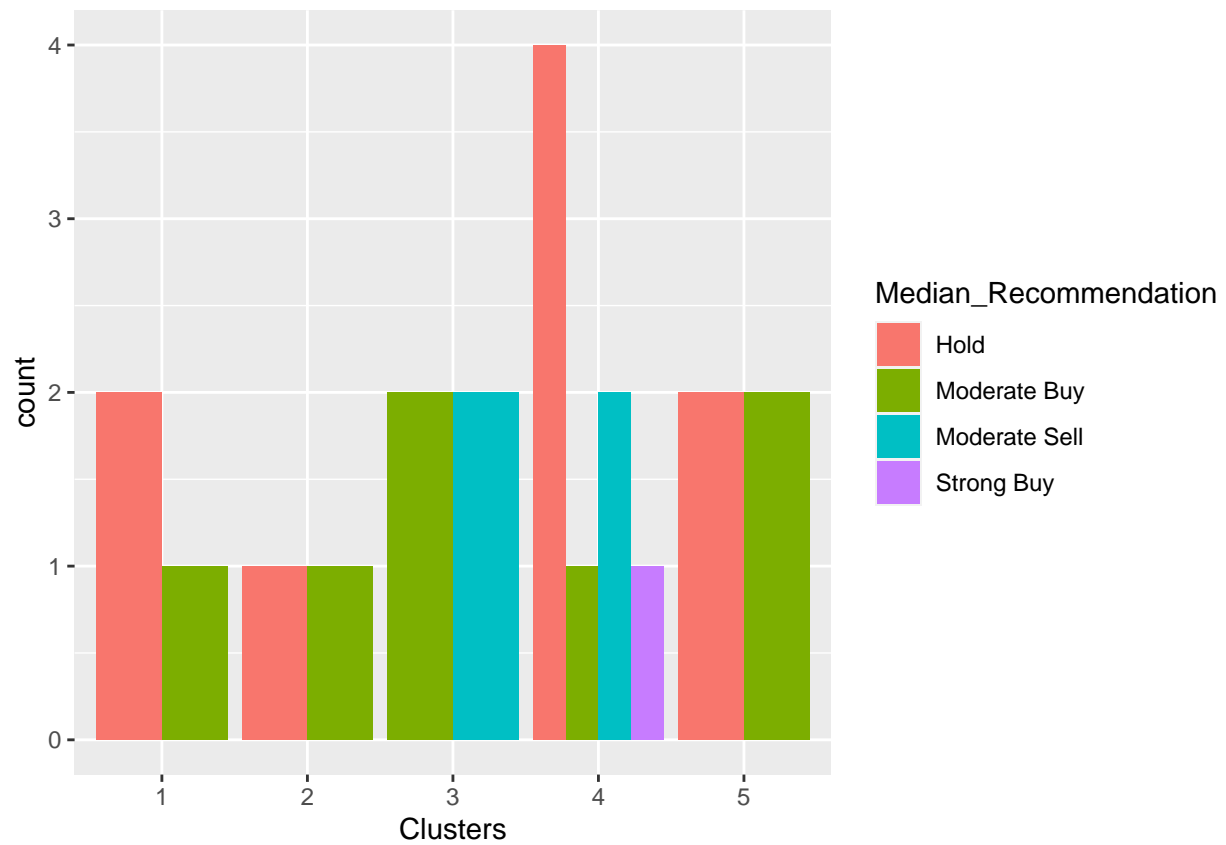
```
## 8 -0.9767669 1.26308721 0.03299122 -0.11237924 -1.1677918 -0.4612656
## 9 -0.9704532 2.15893320 -1.34037772 -0.70899938 -1.0174553 -1.8450624
## 10 0.2762415 -1.34655112 0.14948233 0.34502953 0.5610770 -0.4612656
## 11 1.0999201 -0.68440408 -0.45749769 2.45971647 1.8389364 1.3837968
## 12 -0.9393967 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 k5.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 Marke#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_Proft_Margin and lowest Leverage
```

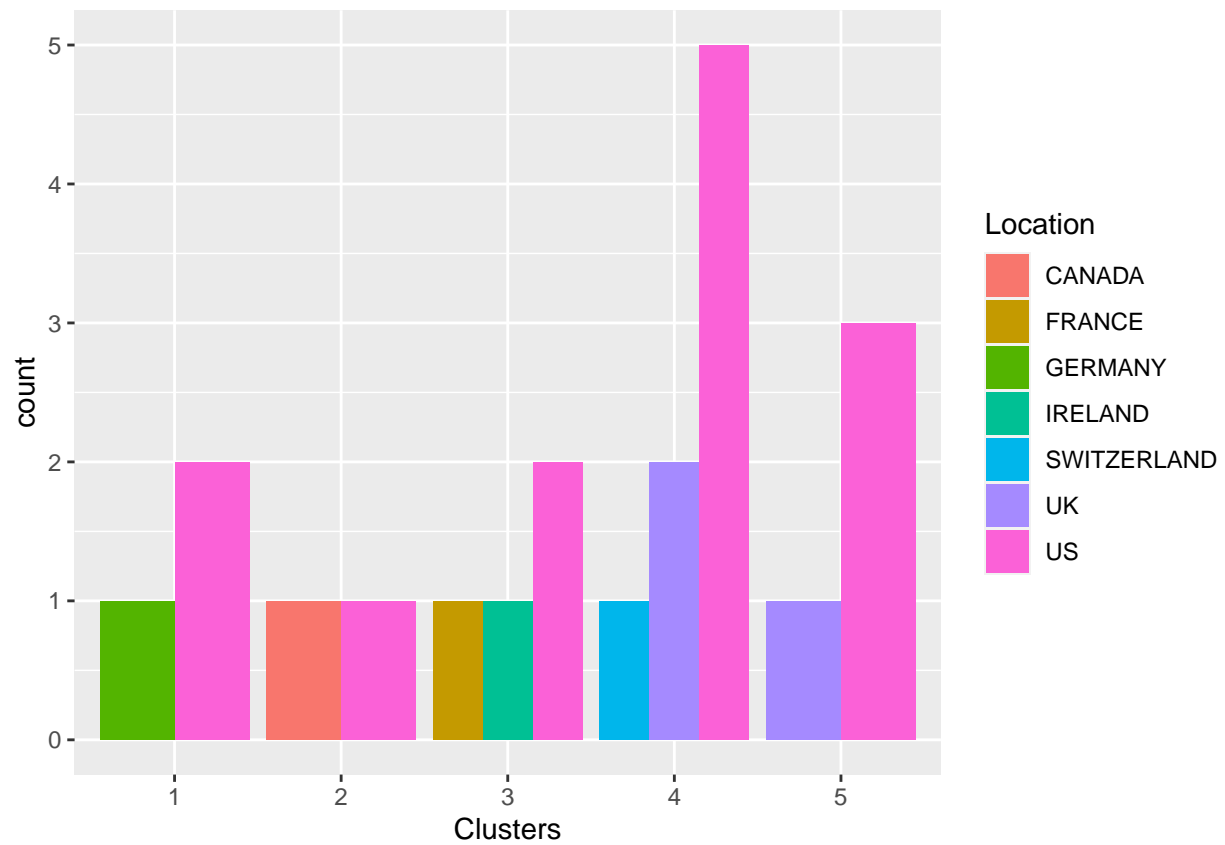
```
#Task3
```

```
#Is there a pattern in the clusters with respect to the numerical
#variables (10 to 12)? (those \n #not used in forming the clusters)
```

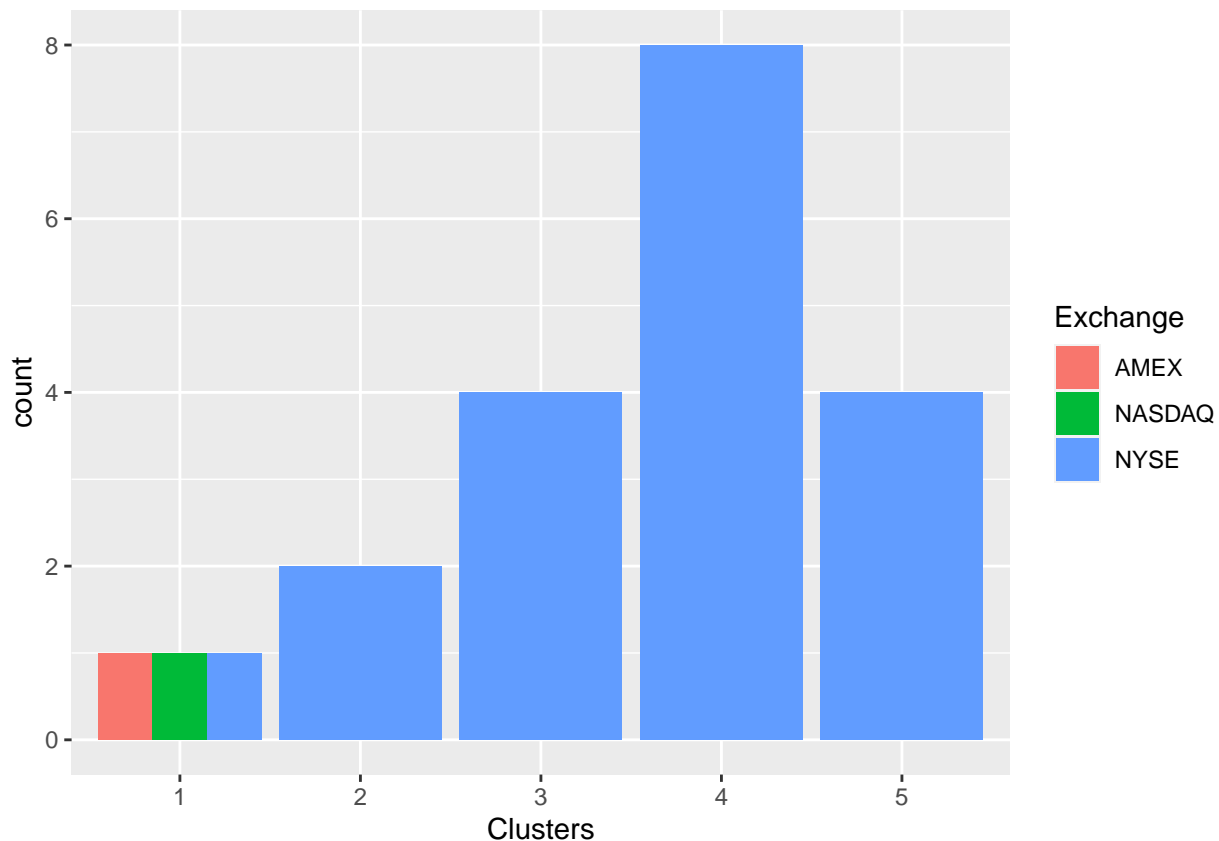
```
RD <- Pharmaceuticals_RD[12:14] %>% mutate(Clusters=k5$cluster)
ggplot(RD, mapping = aes(factor(Clusters), fill =Median_Recommendation))+geom_bar(position='dodge')+labs
```



```
ggplot(RD, mapping = aes(factor(Clusters), fill = Location)) +  
  geom_bar(position = 'dodge') + labs(x = 'Clusters')
```



```
ggplot(RD, mapping = aes(factor(Clusters), fill = Exchange)) + geom_bar(position = 'dodge') +
  labs(x = 'Clusters')
```



*#The above graphs indicate that there is a slim pattern in the clusters.*

*#Although the cluster 1 has a different Hold and Moderate Buy median, a different count from the US and Germany, and a different country count, the firms are evenly divided among AMEX, NASDAQ and NYSE.*

*#The cluster 2 is only listed on the NYSE, has equal Hold and Moderate Buy medians, and is evenly divided across the US and Canada.*

*#The Cluster 3 is listed on the NYSE and has equal Moderate Buy and Sell medians as well as a separate count from France, Ireland, and the US.*

*#The Hold median in Cluster 4 is the highest, followed by Moderate Buy, Strong Buy, and Hold medians. They come from the US, the UK, and Switzerland, and they are listed on the NYSE.*

*#The Cluster 5 is scattered throughout the US and the UK, has the same hold and moderate buy medians, and is likewise listed on the NYSE.*

#### *#TASK 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*