

schhabr1-FML-Assignment4

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```
Pharmacueticals <- read.csv("/Users/sharonchhabra/Downloads/Pharmaceuticals.csv")
head(Pharmacueticals)
```

##	Symbol	Name	Market_Cap	Beta	PE_Ratio	ROE	ROA	Asset_Turnover
## 1	ABT	Abbott Laboratories	68.44	0.32	24.7	26.4	11.8	0.7
## 2	AGN	Allergan, Inc.	7.58	0.41	82.5	12.9	5.5	0.9
## 3	AHM	Amersham plc	6.30	0.46	20.7	14.9	7.8	0.9
## 4	AZN	AstraZeneca PLC	67.63	0.52	21.5	27.4	15.4	0.9
## 5	AVE	Aventis	47.16	0.32	20.1	21.8	7.5	0.6
## 6	BAY	Bayer AG	16.90	1.11	27.9	3.9	1.4	0.6
##	Leverage	Rev_Growth	Net_Profit_Margin	Median_Recommendation	Location	Exchange		
## 1	0.42	7.54	16.1	Moderate Buy	US	NYSE		
## 2	0.60	9.16	5.5	Moderate Buy	CANADA	NYSE		
## 3	0.27	7.05	11.2	Strong Buy	UK	NYSE		
## 4	0.00	15.00	18.0	Moderate Sell	UK	NYSE		
## 5	0.34	26.81	12.9	Moderate Buy	FRANCE	NYSE		
## 6	0.00	-3.17	2.6	Hold	GERMANY	NYSE		

```
numerical_variable <- Pharmacueticals[,3:11]
print(numerical_variable)
```

##	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
## 7	51.33	0.50	13.9	34.8	15.1	0.9	0.57	2.70
## 8	0.41	0.85	26.0	24.1	4.3	0.6	3.51	6.38
## 9	0.78	1.08	3.6	15.1	5.1	0.3	1.07	34.21
## 10	73.84	0.18	27.9	31.0	13.5	0.6	0.53	6.21
## 11	122.11	0.35	18.0	62.9	20.3	1.0	0.34	21.87
## 12	2.60	0.65	19.9	21.4	6.8	0.6	1.45	13.99
## 13	173.93	0.46	28.4	28.6	16.3	0.9	0.10	9.37
## 14	1.20	0.75	28.6	11.2	5.4	0.3	0.93	30.37
## 15	132.56	0.46	18.9	40.6	15.0	1.1	0.28	17.35
## 16	96.65	0.19	21.6	17.9	11.2	0.5	0.06	-2.69
## 17	199.47	0.65	23.6	45.6	19.2	0.8	0.16	25.54
## 18	56.24	0.40	56.5	13.5	5.7	0.6	0.35	15.00
## 19	34.10	0.51	18.9	22.6	13.3	0.8	0.00	8.56

```
## 20      3.26 0.24      18.4 10.2  6.8      0.5      0.20      29.18
## 21      48.19 0.63      13.1 54.9 13.4      0.6      1.12      0.36
##      Net_Profit_Margin
## 1      16.1
## 2      5.5
## 3      11.2
## 4      18.0
## 5      12.9
## 6      2.6
## 7      20.6
## 8      7.5
## 9      13.3
## 10     23.4
## 11     21.1
## 12     11.0
## 13     17.9
## 14     21.3
## 15     14.1
## 16     22.4
## 17     25.2
## 18     7.3
## 19     17.6
## 20     15.1
## 21     25.5
```

```
standard_data <- scale(numerical_variable)
print(standard_data)
```

```
##      Market_Cap      Beta      PE_Ratio      ROE      ROA      Asset_Turnover
## [1,]  0.1840960 -0.80125356 -0.04671323  0.04009035  0.2416121 -5.121077e-16
## [2,] -0.8544181 -0.45070513  3.49706911 -0.85483986 -0.9422871  9.225312e-01
## [3,] -0.8762600 -0.25595600 -0.29195768 -0.72225761 -0.5100700  9.225312e-01
## [4,]  0.1702742 -0.02225704 -0.24290879  0.10638147  0.9181259  9.225312e-01
## [5,] -0.1790256 -0.80125356 -0.32874435 -0.26484883 -0.5664461 -4.612656e-01
## [6,] -0.6953818  2.27578267  0.14948233 -1.45146000 -1.7127612 -4.612656e-01
## [7,] -0.1078688 -0.10015669 -0.70887325  0.59693581  0.8617498  9.225312e-01
## [8,] -0.9767669  1.26308721  0.03299122 -0.11237924 -1.1677918 -4.612656e-01
## [9,] -0.9704532  2.15893320 -1.34037772 -0.70899938 -1.0174553 -1.845062e+00
## [10,] 0.2762415 -1.34655112  0.14948233  0.34502953  0.5610770 -4.612656e-01
## [11,] 1.0999201 -0.68440408 -0.45749769  2.45971647  1.8389364  1.383797e+00
## [12,] -0.9393967  0.48409069 -0.34100657 -0.29136529 -0.6979905 -4.612656e-01
## [13,] 1.9841758 -0.25595600  0.18013789  0.18593083  1.0872544  9.225312e-01
## [14,] -0.9632863  0.87358895  0.19240011 -0.96753478 -0.9610792 -1.845062e+00
## [15,] 1.2782387 -0.25595600 -0.40231769  0.98142435  0.8429577  1.845062e+00
## [16,] 0.6654710 -1.30760129 -0.23677768 -0.52338423  0.1288598 -9.225312e-01
## [17,] 2.4199899  0.48409069 -0.11415545  1.31287998  1.6322239  4.612656e-01
## [18,] -0.0240846 -0.48965495  1.90298017 -0.81506519 -0.9047030 -4.612656e-01
## [19,] -0.4018812 -0.06120687 -0.40231769 -0.21181593  0.5234929  4.612656e-01
## [20,] -0.9281345 -1.11285216 -0.43297324 -1.03382590 -0.6979905 -9.225312e-01
## [21,] -0.1614497  0.40619104 -0.75792214  1.92938746  0.5422849 -4.612656e-01
##      Leverage      Rev_Growth      Net_Profit_Margin
## [1,] -0.21209793 -0.52776752      0.06168225
## [2,]  0.01828430 -0.38113909     -1.55366706
## [3,] -0.40408312 -0.57211809     -0.68503583
```

```
## [4,] -0.74965647 0.14744734 0.35122600
## [5,] -0.31449003 1.21638667 -0.42597037
## [6,] -0.74965647 -1.49714434 -1.99560225
## [7,] -0.02011273 -0.96584257 0.74744375
## [8,] 3.74279705 -0.63276071 -1.24888417
## [9,] 0.61983791 1.88617085 -0.36501379
## [10,] -0.07130879 -0.64814764 1.17413980
## [11,] -0.31449003 0.76926048 0.82363947
## [12,] 1.10620040 0.05603085 -0.71551412
## [13,] -0.62166634 -0.36213170 0.33598685
## [14,] 0.44065173 1.53860717 0.85411776
## [15,] -0.39128411 0.36014907 -0.24310064
## [16,] -0.67286239 -1.45369888 1.02174835
## [17,] -0.54487226 1.10143723 1.44844440
## [18,] -0.30169102 0.14744734 -1.27936246
## [19,] -0.74965647 -0.43544591 0.29026942
## [20,] -0.49367621 1.43089863 -0.09070919
## [21,] 0.68383297 -1.17763919 1.49416183
## attr(,"scaled:center")
##      Market_Cap      Beta      PE_Ratio      ROE
##      57.6514286      0.5257143      25.4619048      25.7952381
##      ROA      Asset_Turnover      Leverage      Rev_Growth
##      10.5142857      0.7000000      0.5857143      13.3709524
## Net_Profit_Margin
##      15.6952381
## attr(,"scaled:scale")
##      Market_Cap      Beta      PE_Ratio      ROE
##      58.6029595      0.2567406      16.3102568      15.0849752
##      ROA      Asset_Turnover      Leverage      Rev_Growth
##      5.3213988      0.2167948      0.7813103      11.0483351
## Net_Profit_Margin
##      6.5620482
```

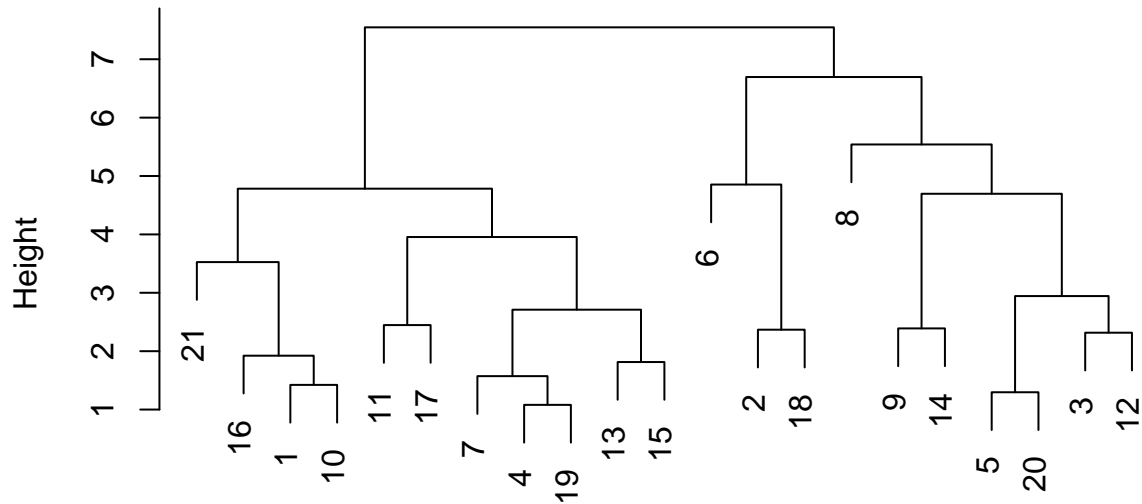
#Using Hierarchical Clustering

```
hrc <- hclust(dist(standard_data), method = "complete")
```

##Plotting the Dendrogram

```
plot(hrc, main = "Dendrogram for Hierarchical Clustering")
```

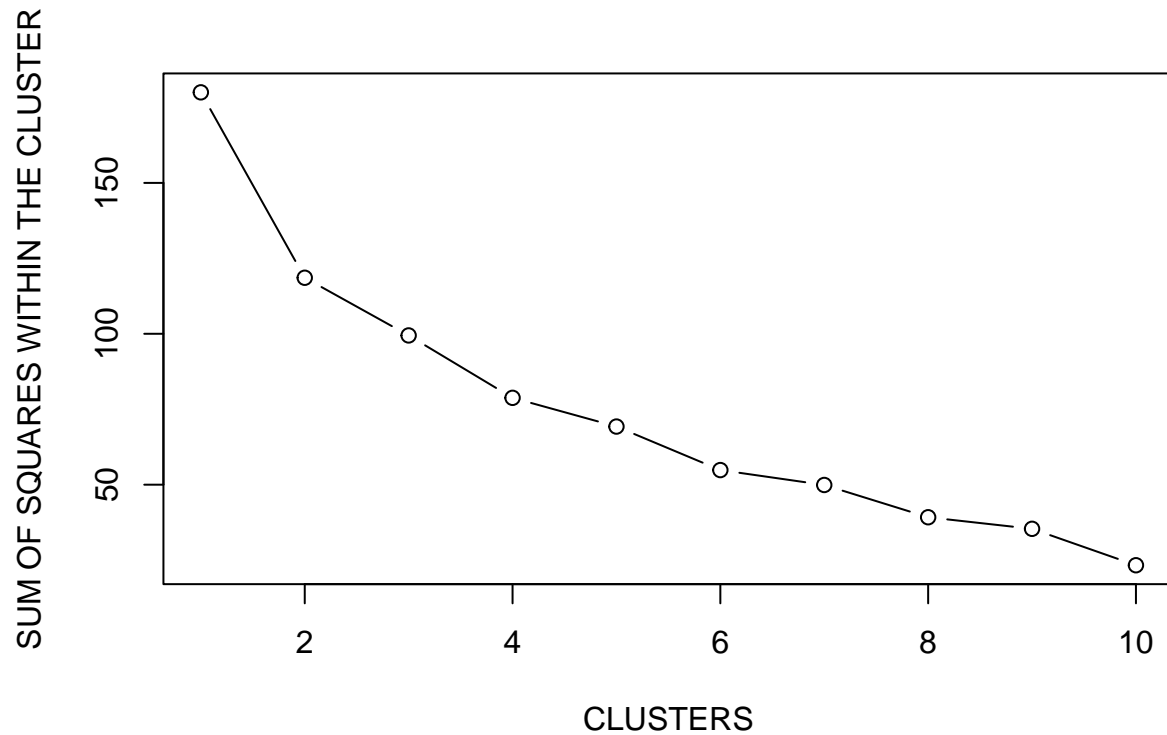
Dendrogram for Hierarchical Clustering



```
dist(standard_data)
hclust (*, "complete")
```

###using elbow method for determining no. of clusters

```
wss <- (nrow(standard_data) - 1) *
  sum(apply(standard_data, 2, var))
for (i in 2:10) wss[i] <- sum(kmeans(standard_data, centers = i)$withinss)
plot(1:10, wss, type = "b", xlab = "CLUSTERS", ylab = "SUM OF SQUARES WITHIN THE CLUSTER")
```



##Assigning the clusters

```
clusters <- cutree(hrc, k = 3)
```

##summarizing the cluster statistics

```
aggregate(standard_data, by = list(cluster = clusters), mean)
```

```
##   cluster Market_Cap      Beta  PE_Ratio      ROE      ROA Asset_Turnover
## 1      1  0.6733825 -0.3586419 -0.2763512  0.6565978  0.8344159  4.612656e-01
## 2      2 -0.5246281  0.4451409  1.8498439 -1.0404550 -1.1865838 -3.330669e-16
## 3      3 -0.8333319  0.3728055 -0.3585240 -0.5858873 -0.8026890 -7.248459e-01
##   Leverage Rev_Growth Net_Profit_Margin
## 1 -0.3331068 -0.2902163      0.682331
## 2 -0.3443544 -0.5769454     -1.609544
## 3  0.6710340  0.7033165     -0.382430
```

Creating a table for the variables

```
table_data <- table(Pharmacueticals$Median_Recommendation, Pharmacueticals$Location, Pharmacueticals$Ex
```

Creating a mosaic plot

```
mosaicplot(table_data, main = "Mosaic Plot for Median Recommendation, Location, and Stock Exchange")
```

Mosaic Plot for Median Recommendation, Location, and Stock Exchange

