Assignment 4

pharm <- read.csv(file="~/Desktop/Pharmaceuticals.csv", header = TRUE )  
pharm

## 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  
## 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

set.seed(123)

#Part A  
  
head(pharm)

## 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

pharm1 <-pharm[,3:11]  
head(pharm1)

## 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

pharmscale <- scale(pharm1)  
head(pharmscale)

## 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

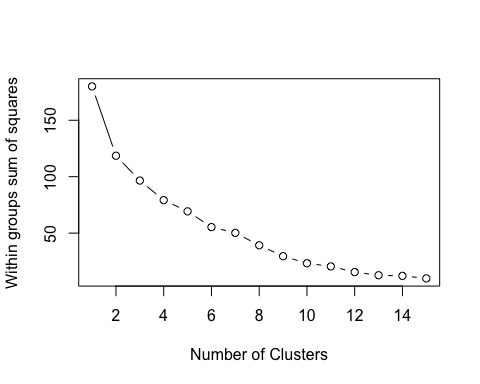
wss <-(nrow(pharmscale)-1)\*sum(apply(pharmscale,2,var))  
wss

## [1] 180

for (i in 2:15) wss[i] <- sum(kmeans(pharmscale,centers=i)$withinss)  
wss

## [1] 180.000000 118.569343 96.585978 79.242279 69.266489 55.365682  
## [7] 50.221396 39.211317 29.556774 23.310806 20.507301 15.472353  
## [13] 12.668848 12.136719 9.879764

plot(1:15,wss,type="b",xlab="Number of Clusters",ylab="Within groups sum of squares")



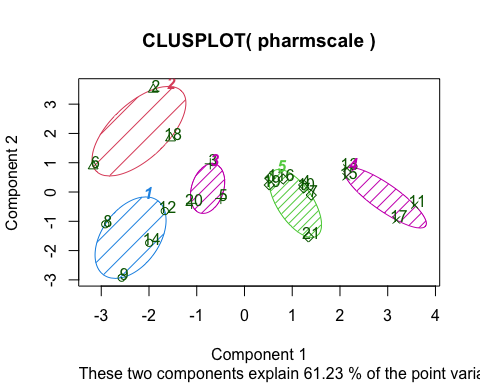
fit <-kmeans(pharmscale,5)  
aggregate(pharmscale,by=list(fit$cluster),FUN=mean)

## Group.1 Market\_Cap Beta PE\_Ratio ROE ROA  
## 1 1 -0.96247577 1.1949250 -0.3639982 -0.5200697 -0.9610792  
## 2 2 -0.52462814 0.4451409 1.8498439 -1.0404550 -1.1865838  
## 3 3 -0.66114002 -0.7233539 -0.3512251 -0.6736441 -0.5915022  
## 4 4 1.69558112 -0.1780563 -0.1984582 1.2349879 1.3503431  
## 5 5 0.08926902 -0.4618336 -0.3208615 0.3260892 0.5396003  
## Asset\_Turnover Leverage Rev\_Growth Net\_Profit\_Margin  
## 1 -1.153164e+00 1.4773718 0.7120120 -0.3688236  
## 2 1.480297e-16 -0.3443544 -0.5769454 -1.6095439  
## 3 -1.537552e-01 -0.4040831 0.6917224 -0.4005718  
## 4 1.153164e+00 -0.4680782 0.4671788 0.5912425  
## 5 6.589509e-02 -0.2559803 -0.7230135 0.7343816

pharm1 <-data.frame(pharmscale,fit$cluster)  
pharm1

## 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 fit.cluster  
## 1 -0.21209793 -0.52776752 0.06168225 5  
## 2 0.01828430 -0.38113909 -1.55366706 2  
## 3 -0.40408312 -0.57211809 -0.68503583 3  
## 4 -0.74965647 0.14744734 0.35122600 5  
## 5 -0.31449003 1.21638667 -0.42597037 3  
## 6 -0.74965647 -1.49714434 -1.99560225 2  
## 7 -0.02011273 -0.96584257 0.74744375 5  
## 8 3.74279705 -0.63276071 -1.24888417 1  
## 9 0.61983791 1.88617085 -0.36501379 1  
## 10 -0.07130879 -0.64814764 1.17413980 5  
## 11 -0.31449003 0.76926048 0.82363947 4  
## 12 1.10620040 0.05603085 -0.71551412 1  
## 13 -0.62166634 -0.36213170 0.33598685 4  
## 14 0.44065173 1.53860717 0.85411776 1  
## 15 -0.39128411 0.36014907 -0.24310064 4  
## 16 -0.67286239 -1.45369888 1.02174835 5  
## 17 -0.54487226 1.10143723 1.44844440 4  
## 18 -0.30169102 0.14744734 -1.27936246 2  
## 19 -0.74965647 -0.43544591 0.29026942 5  
## 20 -0.49367621 1.43089863 -0.09070919 3  
## 21 0.68383297 -1.17763919 1.49416183 5

library(cluster)  
clusplot(pharmscale,fit$cluster,color=TRUE,shade=TRUE,labels=2,lines=0,)

 #Part B #Based on the aggragate(pharmscale, fit$cluster) #Cluster 1- 8,12,14,9 -> has the highest Beta, lowest Market\_Cap, lower Asset\_Turnover, but highest Leverage #Cluster 2 - 2,18,6 -> has the highest PE Ratio, lowest ROE and ROA, and lowest Net Profit Margin #Cluster 3 - 3,20,5 -> has the lowest beta and asset turnover, but one of the higher Revenue Growths #Cluster 4 - 12,15,17,11 -> has the highest Market\_Cap, ROE and ROA, #Cluster 5 - 1,9,16,7,21,4 -> has the highest Asset Turnover and highest profit margin

#Part C #We did not notice a patter with respect to variables 10-12. We found it was random.

#Part D #Cluster 1 - High Beta Cluster, high leverage cluster, low market\_cap cluster #Cluster 2 - Highest PE Ratio cluster, Lowest ROE Cluster, Lowest ROA Cluster, Lowest Net Profit Margin Cluster #Cluster 3 - Lowest Beta cluster, Lowest Asset Turnover Cluster #Cluster 4 - Highest Market\_Cap Cluster, highest ROE Cluster, highest ROA Cluster #Cluster 5 - Highest Asset Turnover Cluster, Highest Profit Margin Cluster