ASSIGNMENT 5

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#Reading the directory

getwd()

## [1] "/Users/ishika/Desktop"

#Reading the file

Assign <-read.csv("Cereals.csv")

#Required packages

library(dplyr)

##   
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':  
##   
## filter, lag

## The following objects are masked from 'package:base':  
##   
## intersect, setdiff, setequal, union

library(cluster)  
library(fpc)  
library(caret)

## Loading required package: ggplot2

## Loading required package: lattice

library(dendextend)

##   
## ---------------------  
## Welcome to dendextend version 1.15.2  
## Type citation('dendextend') for how to cite the package.  
##   
## Type browseVignettes(package = 'dendextend') for the package vignette.  
## The github page is: https://github.com/talgalili/dendextend/  
##   
## Suggestions and bug-reports can be submitted at: https://github.com/talgalili/dendextend/issues  
## You may ask questions at stackoverflow, use the r and dendextend tags:   
## https://stackoverflow.com/questions/tagged/dendextend  
##   
## To suppress this message use: suppressPackageStartupMessages(library(dendextend))  
## ---------------------

##   
## Attaching package: 'dendextend'

## The following object is masked from 'package:stats':  
##   
## cutree

library(knitr)  
library(factoextra)

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

library(tidytext)

#Data in brief

summary(Assign)

## name mfr type calories   
## Length:77 Length:77 Length:77 Min. : 50.0   
## Class :character Class :character Class :character 1st Qu.:100.0   
## Mode :character Mode :character Mode :character Median :110.0   
## Mean :106.9   
## 3rd Qu.:110.0   
## Max. :160.0   
##   
## protein fat sodium fiber   
## Min. :1.000 Min. :0.000 Min. : 0.0 Min. : 0.000   
## 1st Qu.:2.000 1st Qu.:0.000 1st Qu.:130.0 1st Qu.: 1.000   
## Median :3.000 Median :1.000 Median :180.0 Median : 2.000   
## Mean :2.545 Mean :1.013 Mean :159.7 Mean : 2.152   
## 3rd Qu.:3.000 3rd Qu.:2.000 3rd Qu.:210.0 3rd Qu.: 3.000   
## Max. :6.000 Max. :5.000 Max. :320.0 Max. :14.000   
##   
## carbo sugars potass vitamins   
## Min. : 5.0 Min. : 0.000 Min. : 15.00 Min. : 0.00   
## 1st Qu.:12.0 1st Qu.: 3.000 1st Qu.: 42.50 1st Qu.: 25.00   
## Median :14.5 Median : 7.000 Median : 90.00 Median : 25.00   
## Mean :14.8 Mean : 7.026 Mean : 98.67 Mean : 28.25   
## 3rd Qu.:17.0 3rd Qu.:11.000 3rd Qu.:120.00 3rd Qu.: 25.00   
## Max. :23.0 Max. :15.000 Max. :330.00 Max. :100.00   
## NA's :1 NA's :1 NA's :2   
## shelf weight cups rating   
## Min. :1.000 Min. :0.50 Min. :0.250 Min. :18.04   
## 1st Qu.:1.000 1st Qu.:1.00 1st Qu.:0.670 1st Qu.:33.17   
## Median :2.000 Median :1.00 Median :0.750 Median :40.40   
## Mean :2.208 Mean :1.03 Mean :0.821 Mean :42.67   
## 3rd Qu.:3.000 3rd Qu.:1.00 3rd Qu.:1.000 3rd Qu.:50.83   
## Max. :3.000 Max. :1.50 Max. :1.500 Max. :93.70   
##

head(Assign)

## name mfr type calories protein fat sodium fiber carbo  
## 1 100%\_Bran N C 70 4 1 130 10.0 5.0  
## 2 100%\_Natural\_Bran Q C 120 3 5 15 2.0 8.0  
## 3 All-Bran K C 70 4 1 260 9.0 7.0  
## 4 All-Bran\_with\_Extra\_Fiber K C 50 4 0 140 14.0 8.0  
## 5 Almond\_Delight R C 110 2 2 200 1.0 14.0  
## 6 Apple\_Cinnamon\_Cheerios G C 110 2 2 180 1.5 10.5  
## sugars potass vitamins shelf weight cups rating  
## 1 6 280 25 3 1 0.33 68.40297  
## 2 8 135 0 3 1 1.00 33.98368  
## 3 5 320 25 3 1 0.33 59.42551  
## 4 0 330 25 3 1 0.50 93.70491  
## 5 8 NA 25 3 1 0.75 34.38484  
## 6 10 70 25 1 1 0.75 29.50954

#Eliminating mrf and type from the dataset(character data)

Assign\_New <-select(Assign,-c('mfr','type'))

#Cheacking the new dataset after eliminating the data

head(Assign\_New)

## name calories protein fat sodium fiber carbo sugars  
## 1 100%\_Bran 70 4 1 130 10.0 5.0 6  
## 2 100%\_Natural\_Bran 120 3 5 15 2.0 8.0 8  
## 3 All-Bran 70 4 1 260 9.0 7.0 5  
## 4 All-Bran\_with\_Extra\_Fiber 50 4 0 140 14.0 8.0 0  
## 5 Almond\_Delight 110 2 2 200 1.0 14.0 8  
## 6 Apple\_Cinnamon\_Cheerios 110 2 2 180 1.5 10.5 10  
## potass vitamins shelf weight cups rating  
## 1 280 25 3 1 0.33 68.40297  
## 2 135 0 3 1 1.00 33.98368  
## 3 320 25 3 1 0.33 59.42551  
## 4 330 25 3 1 0.50 93.70491  
## 5 NA 25 3 1 0.75 34.38484  
## 6 70 25 1 1 0.75 29.50954

#Eliminating name from dataset and changing row number as name to avoid duplication

rownames(Assign\_New)<-Assign\_New$name  
Assign\_New$name=NULL

#Normalizing the data

Assign\_New<-as.data.frame(scale(Assign\_New))

#Preprocessing the data

sum(is.na(Assign\_New))

## [1] 4

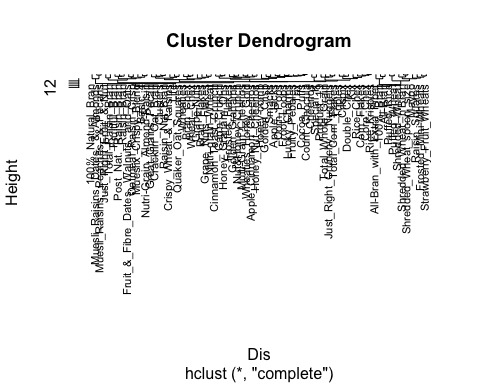
Assign\_New<-na.omit(Assign\_New)

#Calculation of Dissimilarity Matrix and performing Hierarchial Clustering

Dis <- dist(Assign\_New, method = "euclidean")  
H\_clust <- hclust(Dis, method = "complete")

#Plotting the dendogram

plot(H\_clust, cex = 0.7, hang = -1)



#Q1. Apply hierarchical clustering to the data using Euclidean distance to the normalized measurements. Use Agnes to compare the clustering from single linkage, complete linkage, average linkage, and Ward. Choose the best method.

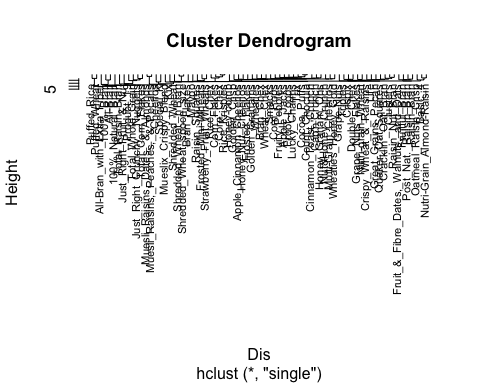
#Single linkage: computes the minimum distance between clusters before merging them.

#Complete linkage: computes the maximum distance between clusters before merging them.

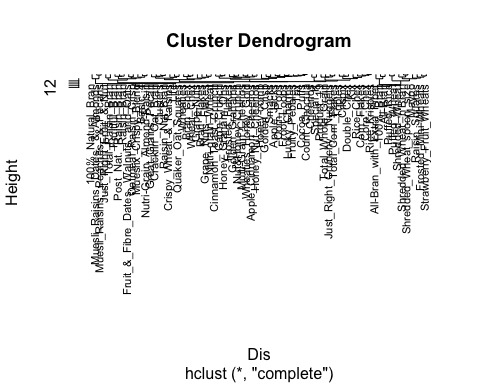
#Average linkage: computes the average distance between clusters before merging them.

#Ward’s (minimum variance) criterion: minimizes the total within-cluster variance and find the pair of clusters that leads to minimum increase in total within-cluster variance after merging.

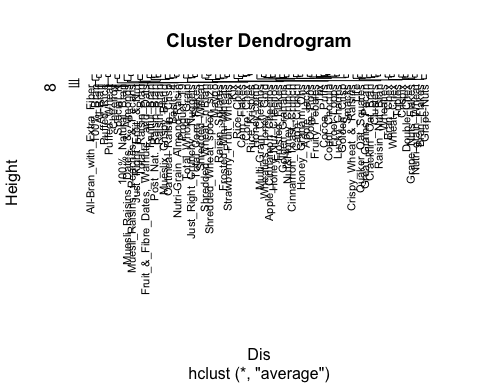
hc\_S <- hclust(Dis,method="single")  
plot(hc\_S,cex=0.7,hang=-1)



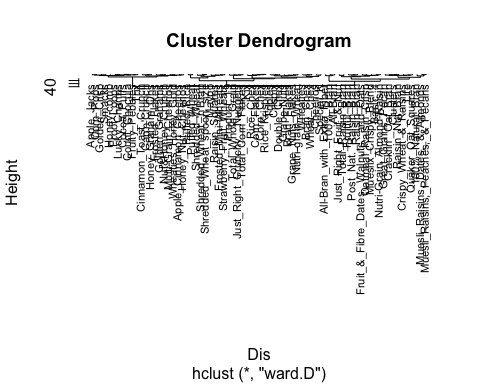
hc\_C<- hclust(Dis,method="complete")  
plot(hc\_C,cex=0.7,hang=-1)



hc\_A <- hclust(Dis,method="average")  
plot(hc\_A,cex=0.7,hang=-1)



hc\_W <- hclust(Dis,method="ward.D")  
plot(hc\_W,cex=0.7,hang=-1)



#Computation with Agnes and Single Linkage vs Complete Linkage vs Average Linkage vs Ward

hc\_S <- agnes(Dis,method="single")  
print(hc\_S$ac)

## [1] 0.6094447

hc\_C <- agnes(Dis,method="complete")  
print(hc\_C$ac)

## [1] 0.8413498

hc\_A <- agnes(Dis,method="average")  
print(hc\_A$ac)

## [1] 0.7814484

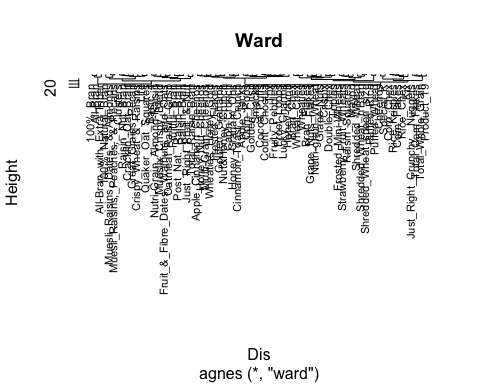
hc\_W <- agnes(Dis,method="ward")  
print(hc\_W$ac)

## [1] 0.9049881

#The Best Linkage method is Ward with Agglomerative coefficient of 0.9049881.

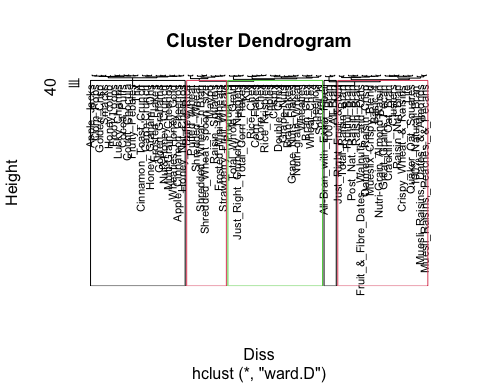
#Dendrogram of Ward

pltree(hc\_W,cex=0.7,hang=-1,main="Ward")



#Q2 Choosing the number of clusters

Diss <-dist(Assign\_New,method="euclidean")  
hc\_W<- hclust(Diss,method="ward.D")  
plot(hc\_W,cex=0.7)  
rect.hclust(hc\_W,k=5,border=1:3)



cluster1<-cutree(hc\_W,k=5)  
dataframe2 <- as.data.frame(cbind(Assign\_New,cluster1))

#The optimal number of clusters is 3 by the longest distance and the partition.

#Q3. Stability of clusters #Comment on the structure of the clusters and on their stability. Hint: To check stability,partition the data and see how well clusters formed based on one part apply to the other part. To do this:

● Cluster partition A

● Use the cluster centroids from A to assign each record in partition B (each record is assigned to the cluster with the closest centroid).

● Assess how consistent the cluster assignments are compared to the assignments based on all the data.

set.seed(123)  
kmeans\_clust <- kmeans(Assign\_New,3,nstart=10)  
km\_data <- kmeans\_clust$cluster  
cereal\_cluster <- as.data.frame(cbind(kmeans\_clust$cluster,Assign\_New))  
colnames(cereal\_cluster)[1]<-"cluster"  
print\_clusters <-function(labels,k)  
{  
 for(i in 1:3)  
 {  
 print(paste("cluster", i))  
 print(cereal\_cluster[labels==i,c("cluster","calories" ,"protein" , "fat" , "sodium" , "fiber" , "carbo" , "sugars" , "potass" , "vitamins" ,"shelf" , "weight" , "cups" , "rating" )])  
   
 }  
}  
groups <- cutree(hc\_W, k=5)  
print\_clusters(groups,5)

## [1] "cluster 1"  
## cluster calories protein fat sodium  
## 100%\_Bran 3 -1.892984 1.328607 -0.01290349 -0.3539844  
## All-Bran 3 -1.892984 1.328607 -0.01290349 1.1967306  
## All-Bran\_with\_Extra\_Fiber 3 -2.919461 1.328607 -1.00647256 -0.2346986  
## fiber carbo sugars potass vitamins  
## 100%\_Bran 3.292847 -2.508783 -0.2343906 2.575368 -0.1453172  
## All-Bran 2.873272 -1.996924 -0.4627711 3.143464 -0.1453172  
## All-Bran\_with\_Extra\_Fiber 4.971147 -1.740994 -1.6046739 3.285488 -0.1453172  
## shelf weight cups rating  
## 100%\_Bran 0.9515734 -0.1967771 -2.110034 1.832188  
## All-Bran 0.9515734 -0.1967771 -2.110034 1.193099  
## All-Bran\_with\_Extra\_Fiber 0.9515734 -0.1967771 -1.379530 3.633385  
## [1] "cluster 2"  
## cluster calories protein  
## 100%\_Natural\_Bran 1 0.6732089 0.4151897  
## Basic\_4 1 1.1864474 0.4151897  
## Clusters 1 0.1599704 0.4151897  
## Cracklin'\_Oat\_Bran 1 0.1599704 0.4151897  
## Crispy\_Wheat\_&\_Raisins 2 -0.3532681 -0.4982277  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats 1 0.6732089 0.4151897  
## Fruitful\_Bran 1 0.6732089 0.4151897  
## Great\_Grains\_Pecan 1 0.6732089 0.4151897  
## Just\_Right\_Fruit\_&\_Nut 1 1.6996859 0.4151897  
## Life 3 -0.3532681 1.3286071  
## Muesli\_Raisins,\_Dates,\_&\_Almonds 1 2.2129244 1.3286071  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans 1 2.2129244 1.3286071  
## Mueslix\_Crispy\_Blend 1 2.7261629 0.4151897  
## Nutri-Grain\_Almond-Raisin 1 1.6996859 0.4151897  
## Oatmeal\_Raisin\_Crisp 1 1.1864474 0.4151897  
## Post\_Nat.\_Raisin\_Bran 1 0.6732089 0.4151897  
## Quaker\_Oat\_Squares 3 -0.3532681 1.3286071  
## Raisin\_Bran 1 0.6732089 0.4151897  
## Raisin\_Nut\_Bran 1 -0.3532681 0.4151897  
## Total\_Raisin\_Bran 1 1.6996859 0.4151897  
## fat sodium fiber  
## 100%\_Natural\_Bran 3.96137277 -1.725770770 -0.06375361  
## Basic\_4 0.98066557 0.600301771 -0.06375361  
## Clusters 0.98066557 -0.234698628 -0.06375361  
## Cracklin'\_Oat\_Bran 1.97423464 -0.234698628 0.77539645  
## Crispy\_Wheat\_&\_Raisins -0.01290349 -0.234698628 -0.06375361  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats 0.98066557 0.003872915 1.19497147  
## Fruitful\_Bran -1.00647256 0.958159085 1.19497147  
## Great\_Grains\_Pecan 1.97423464 -1.010056142 0.35582142  
## Just\_Right\_Fruit\_&\_Nut -0.01290349 0.123158686 -0.06375361  
## Life 0.98066557 -0.115412857 -0.06375361  
## Muesli\_Raisins,\_Dates,\_&\_Almonds 1.97423464 -0.771484599 0.35582142  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans 1.97423464 -0.115412857 0.35582142  
## Mueslix\_Crispy\_Blend 0.98066557 -0.115412857 0.35582142  
## Nutri-Grain\_Almond-Raisin 0.98066557 0.719587543 0.35582142  
## Oatmeal\_Raisin\_Crisp 0.98066557 0.123158686 -0.27354112  
## Post\_Nat.\_Raisin\_Bran -0.01290349 0.481016000 1.61454650  
## Quaker\_Oat\_Squares -0.01290349 -0.294341514 -0.06375361  
## Raisin\_Bran -0.01290349 0.600301771 1.19497147  
## Raisin\_Nut\_Bran 0.98066557 -0.234698628 0.14603391  
## Total\_Raisin\_Bran -0.01290349 0.361730229 0.77539645  
## carbo sugars potass  
## 100%\_Natural\_Bran -1.74099432 0.222370547 0.51602052  
## Basic\_4 0.81830100 0.222370547 0.01893653  
## Clusters -0.46134666 -0.006010015 0.08994853  
## Cracklin'\_Oat\_Bran -1.22913525 -0.006010015 0.87108052  
## Crispy\_Wheat\_&\_Raisins -0.97320572 0.679131670 0.30298453  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats -0.71727619 0.679131670 1.43917651  
## Fruitful\_Bran -0.20541712 1.135892793 1.29715251  
## Great\_Grains\_Pecan -0.46134666 -0.691151699 0.01893653  
## Just\_Right\_Fruit\_&\_Nut 1.33016007 0.450751108 -0.05207547  
## Life -0.71727619 -0.234390576 -0.05207547  
## Muesli\_Raisins,\_Dates,\_&\_Almonds 0.30644194 0.907512232 1.01310452  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans 0.30644194 0.907512232 1.01310452  
## Mueslix\_Crispy\_Blend 0.56237147 1.364273355 0.87108052  
## Nutri-Grain\_Almond-Raisin 1.58608960 -0.006010015 0.44500853  
## Oatmeal\_Raisin\_Crisp -0.33338189 0.679131670 0.30298453  
## Post\_Nat.\_Raisin\_Bran -0.97320572 1.592653916 2.29132050  
## Quaker\_Oat\_Squares -0.20541712 -0.234390576 0.16096053  
## Raisin\_Bran -0.20541712 1.135892793 2.00727250  
## Raisin\_Nut\_Bran -1.10117049 0.222370547 0.58703252  
## Total\_Raisin\_Bran 0.05051241 1.592653916 1.86524850  
## vitamins shelf weight  
## 100%\_Natural\_Bran -1.2642598 0.9515734 -0.1967771  
## Basic\_4 -0.1453172 0.9515734 1.9962520  
## Clusters -0.1453172 0.9515734 -0.1967771  
## Cracklin'\_Oat\_Bran -0.1453172 0.9515734 -0.1967771  
## Crispy\_Wheat\_&\_Raisins -0.1453172 0.9515734 -0.1967771  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats -0.1453172 0.9515734 1.4646086  
## Fruitful\_Bran -0.1453172 0.9515734 1.9962520  
## Great\_Grains\_Pecan -0.1453172 0.9515734 -0.1967771  
## Just\_Right\_Fruit\_&\_Nut 3.2115106 0.9515734 1.7968857  
## Life -0.1453172 -0.2495930 -0.1967771  
## Muesli\_Raisins,\_Dates,\_&\_Almonds -0.1453172 0.9515734 -0.1967771  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans -0.1453172 0.9515734 -0.1967771  
## Mueslix\_Crispy\_Blend -0.1453172 0.9515734 3.1259942  
## Nutri-Grain\_Almond-Raisin -0.1453172 0.9515734 1.9962520  
## Oatmeal\_Raisin\_Crisp -0.1453172 0.9515734 1.4646086  
## Post\_Nat.\_Raisin\_Bran -0.1453172 0.9515734 1.9962520  
## Quaker\_Oat\_Squares -0.1453172 0.9515734 -0.1967771  
## Raisin\_Bran -0.1453172 -0.2495930 1.9962520  
## Raisin\_Nut\_Bran -0.1453172 0.9515734 -0.1967771  
## Total\_Raisin\_Bran 3.2115106 0.9515734 3.1259942  
## cups rating  
## 100%\_Natural\_Bran 0.7690100 -0.6180571  
## Basic\_4 -0.3052601 -0.4005857  
## Clusters -1.3795303 -0.1612765  
## Cracklin'\_Oat\_Bran -1.3795303 -0.1578193  
## Crispy\_Wheat\_&\_Raisins -0.3052601 -0.4619759  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats -0.6490266 -0.1244837  
## Fruitful\_Bran -0.6490266 -0.1174756  
## Great\_Grains\_Pecan -2.1100340 0.2239586  
## Just\_Right\_Fruit\_&\_Nut -0.3052601 -0.4409529  
## Life -0.6490266 0.1895290  
## Muesli\_Raisins,\_Dates,\_&\_Almonds 0.7690100 -0.3935878  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans 0.7690100 -0.6069456  
## Mueslix\_Crispy\_Blend -0.6490266 -0.8793408  
## Nutri-Grain\_Almond-Raisin -0.6490266 -0.1404816  
## Oatmeal\_Raisin\_Crisp -1.3795303 -0.8695530  
## Post\_Nat.\_Raisin\_Bran -0.6490266 -0.3434906  
## Quaker\_Oat\_Squares -1.3795303 0.4873659  
## Raisin\_Bran -0.3052601 -0.2425029  
## Raisin\_Nut\_Bran -1.3795303 -0.2108809  
## Total\_Raisin\_Bran 0.7690100 -1.0018246  
## [1] "cluster 3"  
## cluster calories protein fat sodium  
## Apple\_Cinnamon\_Cheerios 2 0.1599704 -0.4982277 0.98066557 0.2424445  
## Apple\_Jacks 2 0.1599704 -0.4982277 -1.00647256 -0.4136273  
## Cap'n'Crunch 2 0.6732089 -1.4116451 0.98066557 0.7195875  
## Cinnamon\_Toast\_Crunch 2 0.6732089 -1.4116451 1.97423464 0.6003018  
## Cocoa\_Puffs 2 0.1599704 -1.4116451 -0.01290349 0.2424445  
## Corn\_Pops 2 0.1599704 -1.4116451 -1.00647256 -0.8311275  
## Count\_Chocula 2 0.1599704 -1.4116451 -0.01290349 0.2424445  
## Froot\_Loops 2 0.1599704 -0.4982277 -0.01290349 -0.4136273  
## Frosted\_Flakes 2 0.1599704 -1.4116451 -1.00647256 0.4810160  
## Fruity\_Pebbles 2 0.1599704 -1.4116451 -0.01290349 -0.2943415  
## Golden\_Crisp 2 -0.3532681 -0.4982277 -1.00647256 -1.3679135  
## Golden\_Grahams 2 0.1599704 -1.4116451 -0.01290349 1.4353022  
## Honey\_Graham\_Ohs 2 0.6732089 -1.4116451 0.98066557 0.7195875  
## Honey\_Nut\_Cheerios 2 0.1599704 0.4151897 -0.01290349 1.0774449  
## Honey-comb 2 0.1599704 -1.4116451 -1.00647256 0.2424445  
## Lucky\_Charms 2 0.1599704 -0.4982277 -0.01290349 0.2424445  
## Multi-Grain\_Cheerios 2 -0.3532681 -0.4982277 -0.01290349 0.7195875  
## Nut&Honey\_Crunch 2 0.6732089 -0.4982277 -0.01290349 0.3617302  
## Smacks 2 0.1599704 -0.4982277 -0.01290349 -1.0696990  
## Trix 2 0.1599704 -1.4116451 -0.01290349 -0.2346986  
## Wheaties\_Honey\_Gold 2 0.1599704 -0.4982277 -0.01290349 0.4810160  
## fiber carbo sugars potass  
## Apple\_Cinnamon\_Cheerios -0.27354112 -1.10117049 0.6791317 -0.4071355  
## Apple\_Jacks -0.48332864 -0.97320572 1.5926539 -0.9752315  
## Cap'n'Crunch -0.90290366 -0.71727619 1.1358928 -0.9042195  
## Cinnamon\_Toast\_Crunch -0.90290366 -0.46134666 0.4507511 -0.7621955  
## Cocoa\_Puffs -0.90290366 -0.71727619 1.3642734 -0.6201715  
## Corn\_Pops -0.48332864 -0.46134666 1.1358928 -1.1172554  
## Count\_Chocula -0.90290366 -0.71727619 1.3642734 -0.4781475  
## Froot\_Loops -0.48332864 -0.97320572 1.3642734 -0.9752315  
## Frosted\_Flakes -0.48332864 -0.20541712 0.9075122 -1.0462434  
## Fruity\_Pebbles -0.90290366 -0.46134666 1.1358928 -1.0462434  
## Golden\_Crisp -0.90290366 -0.97320572 1.8210345 -0.8332075  
## Golden\_Grahams -0.90290366 0.05051241 0.4507511 -0.7621955  
## Honey\_Graham\_Ohs -0.48332864 -0.71727619 0.9075122 -0.7621955  
## Honey\_Nut\_Cheerios -0.27354112 -0.84524095 0.6791317 -0.1230875  
## Honey-comb -0.90290366 -0.20541712 0.9075122 -0.9042195  
## Lucky\_Charms -0.90290366 -0.71727619 1.1358928 -0.6201715  
## Multi-Grain\_Cheerios -0.06375361 0.05051241 -0.2343906 -0.1230875  
## Nut&Honey\_Crunch -0.90290366 0.05051241 0.4507511 -0.8332075  
## Smacks -0.48332864 -1.48506478 1.8210345 -0.8332075  
## Trix -0.90290366 -0.46134666 1.1358928 -1.0462434  
## Wheaties\_Honey\_Gold -0.48332864 0.30644194 0.2223705 -0.5491595  
## vitamins shelf weight cups rating  
## Apple\_Cinnamon\_Cheerios -0.1453172 -1.450759 -0.1967771 -0.3052601 -0.9365625  
## Apple\_Jacks -0.1453172 -0.249593 -0.1967771 0.7690100 -0.6756899  
## Cap'n'Crunch -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.7528545  
## Cinnamon\_Toast\_Crunch -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.6260883  
## Cocoa\_Puffs -0.1453172 -0.249593 -0.1967771 0.7690100 -1.4187264  
## Corn\_Pops -0.1453172 -0.249593 -0.1967771 0.7690100 -0.4899817  
## Count\_Chocula -0.1453172 -0.249593 -0.1967771 0.7690100 -1.4429256  
## Froot\_Loops -0.1453172 -0.249593 -0.1967771 0.7690100 -0.7444941  
## Frosted\_Flakes -0.1453172 -1.450759 -0.1967771 -0.3052601 -0.7994234  
## Fruity\_Pebbles -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.0421897  
## Golden\_Crisp -0.1453172 -1.450759 -0.1967771 0.2533603 -0.5277361  
## Golden\_Grahams -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.3427262  
## Honey\_Graham\_Ohs -0.1453172 -0.249593 -0.1967771 0.7690100 -1.4803151  
## Honey\_Nut\_Cheerios -0.1453172 -1.450759 -0.1967771 -0.3052601 -0.8253186  
## Honey-comb -0.1453172 -1.450759 -0.1967771 2.1870466 -0.9911728  
## Lucky\_Charms -0.1453172 -0.249593 -0.1967771 0.7690100 -1.1341114  
## Multi-Grain\_Cheerios -0.1453172 -1.450759 -0.1967771 0.7690100 -0.1822231  
## Nut&Honey\_Crunch -0.1453172 -0.249593 -0.1967771 -0.6490266 -0.9070377  
## Smacks -0.1453172 -0.249593 -0.1967771 -0.3052601 -0.8140824  
## Trix -0.1453172 -0.249593 -0.1967771 0.7690100 -1.0615859  
## Wheaties\_Honey\_Gold -0.1453172 -1.450759 -0.1967771 -0.3052601 -0.4611670

kbest.p<- 5   
cboot.hclust <- clusterboot(Assign\_New,clustermethod=hclustCBI,method="ward.D", k=kbest.p)

## boot 1   
## boot 2   
## boot 3   
## boot 4   
## boot 5   
## boot 6   
## boot 7   
## boot 8   
## boot 9   
## boot 10   
## boot 11   
## boot 12   
## boot 13   
## boot 14   
## boot 15   
## boot 16   
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## boot 74   
## boot 75   
## boot 76   
## boot 77   
## boot 78   
## boot 79   
## boot 80   
## boot 81   
## boot 82   
## boot 83   
## boot 84   
## boot 85   
## boot 86   
## boot 87   
## boot 88   
## boot 89   
## boot 90   
## boot 91   
## boot 92   
## boot 93   
## boot 94   
## boot 95   
## boot 96   
## boot 97   
## boot 98   
## boot 99   
## boot 100

groups<-cboot.hclust$result$partition   
cboot.hclust$bootmean

## [1] 0.6212579 0.7200205 0.8899924 0.6045410 0.6140795

which.max(cboot.hclust$bootmean)

## [1] 3

#Cluster 3 has highest stability(cluster stability) amongst all. # or #It could also be done in the following way

#Creating Partitions

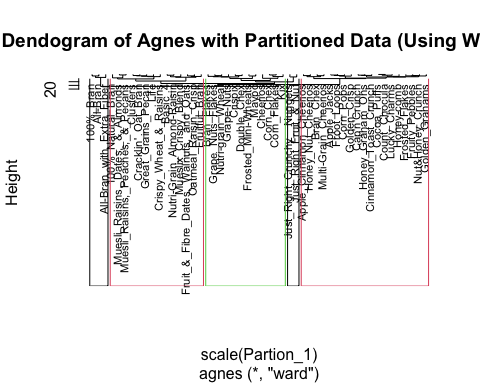
Partion\_1 <- Assign\_New[1:50,]  
Partion\_2 <- Assign\_New[51:74,]

#Performing Hierarchial Clustering, plotting dendogram and then cutting the dendogram by taking k = 5 .

ag\_single <- agnes(scale(Partion\_1), method = "single")  
ag\_complete <- agnes(scale(Partion\_1), method = "complete")  
ag\_average <- agnes(scale(Partion\_1), method = "average")  
ag\_ward <- agnes(scale(Partion\_1), method = "ward")  
cbind(single=ag\_single$ac , complete=ag\_complete$ac , average= ag\_average$ac , ward= ag\_ward$ac)

## single complete average ward  
## [1,] 0.6393338 0.8138238 0.7408904 0.8764323

pltree(ag\_ward, cex = 0.7, hang = -1, main = "Dendogram of Agnes with Partitioned Data (Using Ward)")  
rect.hclust(ag\_ward, k = 5, border = 1:3)



cut\_2 <- cutree(ag\_ward, k = 5)

#Calculating the centeroids.

result <- as.data.frame(cbind(Partion\_1, cut\_2))  
result[result$cut\_2==1,]

## calories protein fat sodium fiber  
## 100%\_Bran -1.892984 1.328607 -0.01290349 -0.3539844 3.292847  
## All-Bran -1.892984 1.328607 -0.01290349 1.1967306 2.873272  
## All-Bran\_with\_Extra\_Fiber -2.919461 1.328607 -1.00647256 -0.2346986 4.971147  
## carbo sugars potass vitamins shelf  
## 100%\_Bran -2.508783 -0.2343906 2.575368 -0.1453172 0.9515734  
## All-Bran -1.996924 -0.4627711 3.143464 -0.1453172 0.9515734  
## All-Bran\_with\_Extra\_Fiber -1.740994 -1.6046739 3.285488 -0.1453172 0.9515734  
## weight cups rating cut\_2  
## 100%\_Bran -0.1967771 -2.110034 1.832188 1  
## All-Bran -0.1967771 -2.110034 1.193099 1  
## All-Bran\_with\_Extra\_Fiber -0.1967771 -1.379530 3.633385 1

centroid\_1 <- colMeans(result[result$cut\_2==1,])  
result[result$cut\_2==2,]

## calories protein fat  
## 100%\_Natural\_Bran 0.6732089 0.4151897 3.96137277  
## Basic\_4 1.1864474 0.4151897 0.98066557  
## Clusters 0.1599704 0.4151897 0.98066557  
## Cracklin'\_Oat\_Bran 0.1599704 0.4151897 1.97423464  
## Crispy\_Wheat\_&\_Raisins -0.3532681 -0.4982277 -0.01290349  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats 0.6732089 0.4151897 0.98066557  
## Fruitful\_Bran 0.6732089 0.4151897 -1.00647256  
## Great\_Grains\_Pecan 0.6732089 0.4151897 1.97423464  
## Life -0.3532681 1.3286071 0.98066557  
## Muesli\_Raisins,\_Dates,\_&\_Almonds 2.2129244 1.3286071 1.97423464  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans 2.2129244 1.3286071 1.97423464  
## Mueslix\_Crispy\_Blend 2.7261629 0.4151897 0.98066557  
## Nutri-Grain\_Almond-Raisin 1.6996859 0.4151897 0.98066557  
## Oatmeal\_Raisin\_Crisp 1.1864474 0.4151897 0.98066557  
## sodium fiber carbo  
## 100%\_Natural\_Bran -1.725770770 -0.06375361 -1.7409943  
## Basic\_4 0.600301771 -0.06375361 0.8183010  
## Clusters -0.234698628 -0.06375361 -0.4613467  
## Cracklin'\_Oat\_Bran -0.234698628 0.77539645 -1.2291353  
## Crispy\_Wheat\_&\_Raisins -0.234698628 -0.06375361 -0.9732057  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats 0.003872915 1.19497147 -0.7172762  
## Fruitful\_Bran 0.958159085 1.19497147 -0.2054171  
## Great\_Grains\_Pecan -1.010056142 0.35582142 -0.4613467  
## Life -0.115412857 -0.06375361 -0.7172762  
## Muesli\_Raisins,\_Dates,\_&\_Almonds -0.771484599 0.35582142 0.3064419  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans -0.115412857 0.35582142 0.3064419  
## Mueslix\_Crispy\_Blend -0.115412857 0.35582142 0.5623715  
## Nutri-Grain\_Almond-Raisin 0.719587543 0.35582142 1.5860896  
## Oatmeal\_Raisin\_Crisp 0.123158686 -0.27354112 -0.3333819  
## sugars potass vitamins  
## 100%\_Natural\_Bran 0.222370547 0.51602052 -1.2642598  
## Basic\_4 0.222370547 0.01893653 -0.1453172  
## Clusters -0.006010015 0.08994853 -0.1453172  
## Cracklin'\_Oat\_Bran -0.006010015 0.87108052 -0.1453172  
## Crispy\_Wheat\_&\_Raisins 0.679131670 0.30298453 -0.1453172  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats 0.679131670 1.43917651 -0.1453172  
## Fruitful\_Bran 1.135892793 1.29715251 -0.1453172  
## Great\_Grains\_Pecan -0.691151699 0.01893653 -0.1453172  
## Life -0.234390576 -0.05207547 -0.1453172  
## Muesli\_Raisins,\_Dates,\_&\_Almonds 0.907512232 1.01310452 -0.1453172  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans 0.907512232 1.01310452 -0.1453172  
## Mueslix\_Crispy\_Blend 1.364273355 0.87108052 -0.1453172  
## Nutri-Grain\_Almond-Raisin -0.006010015 0.44500853 -0.1453172  
## Oatmeal\_Raisin\_Crisp 0.679131670 0.30298453 -0.1453172  
## shelf weight cups  
## 100%\_Natural\_Bran 0.9515734 -0.1967771 0.7690100  
## Basic\_4 0.9515734 1.9962520 -0.3052601  
## Clusters 0.9515734 -0.1967771 -1.3795303  
## Cracklin'\_Oat\_Bran 0.9515734 -0.1967771 -1.3795303  
## Crispy\_Wheat\_&\_Raisins 0.9515734 -0.1967771 -0.3052601  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats 0.9515734 1.4646086 -0.6490266  
## Fruitful\_Bran 0.9515734 1.9962520 -0.6490266  
## Great\_Grains\_Pecan 0.9515734 -0.1967771 -2.1100340  
## Life -0.2495930 -0.1967771 -0.6490266  
## Muesli\_Raisins,\_Dates,\_&\_Almonds 0.9515734 -0.1967771 0.7690100  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans 0.9515734 -0.1967771 0.7690100  
## Mueslix\_Crispy\_Blend 0.9515734 3.1259942 -0.6490266  
## Nutri-Grain\_Almond-Raisin 0.9515734 1.9962520 -0.6490266  
## Oatmeal\_Raisin\_Crisp 0.9515734 1.4646086 -1.3795303  
## rating cut\_2  
## 100%\_Natural\_Bran -0.6180571 2  
## Basic\_4 -0.4005857 2  
## Clusters -0.1612765 2  
## Cracklin'\_Oat\_Bran -0.1578193 2  
## Crispy\_Wheat\_&\_Raisins -0.4619759 2  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats -0.1244837 2  
## Fruitful\_Bran -0.1174756 2  
## Great\_Grains\_Pecan 0.2239586 2  
## Life 0.1895290 2  
## Muesli\_Raisins,\_Dates,\_&\_Almonds -0.3935878 2  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans -0.6069456 2  
## Mueslix\_Crispy\_Blend -0.8793408 2  
## Nutri-Grain\_Almond-Raisin -0.1404816 2  
## Oatmeal\_Raisin\_Crisp -0.8695530 2

centroid\_2 <- colMeans(result[result$cut\_2==2,])  
result[result$cut\_2==3,]

## calories protein fat sodium  
## Apple\_Cinnamon\_Cheerios 0.1599704 -0.4982277 0.98066557 0.2424445  
## Apple\_Jacks 0.1599704 -0.4982277 -1.00647256 -0.4136273  
## Bran\_Chex -0.8665066 -0.4982277 -0.01290349 0.4810160  
## Cap'n'Crunch 0.6732089 -1.4116451 0.98066557 0.7195875  
## Cinnamon\_Toast\_Crunch 0.6732089 -1.4116451 1.97423464 0.6003018  
## Cocoa\_Puffs 0.1599704 -1.4116451 -0.01290349 0.2424445  
## Corn\_Pops 0.1599704 -1.4116451 -1.00647256 -0.8311275  
## Count\_Chocula 0.1599704 -1.4116451 -0.01290349 0.2424445  
## Froot\_Loops 0.1599704 -0.4982277 -0.01290349 -0.4136273  
## Frosted\_Flakes 0.1599704 -1.4116451 -1.00647256 0.4810160  
## Fruity\_Pebbles 0.1599704 -1.4116451 -0.01290349 -0.2943415  
## Golden\_Crisp -0.3532681 -0.4982277 -1.00647256 -1.3679135  
## Golden\_Grahams 0.1599704 -1.4116451 -0.01290349 1.4353022  
## Honey\_Graham\_Ohs 0.6732089 -1.4116451 0.98066557 0.7195875  
## Honey\_Nut\_Cheerios 0.1599704 0.4151897 -0.01290349 1.0774449  
## Honey-comb 0.1599704 -1.4116451 -1.00647256 0.2424445  
## Lucky\_Charms 0.1599704 -0.4982277 -0.01290349 0.2424445  
## Multi-Grain\_Cheerios -0.3532681 -0.4982277 -0.01290349 0.7195875  
## Nut&Honey\_Crunch 0.6732089 -0.4982277 -0.01290349 0.3617302  
## fiber carbo sugars potass  
## Apple\_Cinnamon\_Cheerios -0.27354112 -1.10117049 0.6791317 -0.4071355  
## Apple\_Jacks -0.48332864 -0.97320572 1.5926539 -0.9752315  
## Bran\_Chex 0.77539645 0.05051241 -0.2343906 0.3739965  
## Cap'n'Crunch -0.90290366 -0.71727619 1.1358928 -0.9042195  
## Cinnamon\_Toast\_Crunch -0.90290366 -0.46134666 0.4507511 -0.7621955  
## Cocoa\_Puffs -0.90290366 -0.71727619 1.3642734 -0.6201715  
## Corn\_Pops -0.48332864 -0.46134666 1.1358928 -1.1172554  
## Count\_Chocula -0.90290366 -0.71727619 1.3642734 -0.4781475  
## Froot\_Loops -0.48332864 -0.97320572 1.3642734 -0.9752315  
## Frosted\_Flakes -0.48332864 -0.20541712 0.9075122 -1.0462434  
## Fruity\_Pebbles -0.90290366 -0.46134666 1.1358928 -1.0462434  
## Golden\_Crisp -0.90290366 -0.97320572 1.8210345 -0.8332075  
## Golden\_Grahams -0.90290366 0.05051241 0.4507511 -0.7621955  
## Honey\_Graham\_Ohs -0.48332864 -0.71727619 0.9075122 -0.7621955  
## Honey\_Nut\_Cheerios -0.27354112 -0.84524095 0.6791317 -0.1230875  
## Honey-comb -0.90290366 -0.20541712 0.9075122 -0.9042195  
## Lucky\_Charms -0.90290366 -0.71727619 1.1358928 -0.6201715  
## Multi-Grain\_Cheerios -0.06375361 0.05051241 -0.2343906 -0.1230875  
## Nut&Honey\_Crunch -0.90290366 0.05051241 0.4507511 -0.8332075  
## vitamins shelf weight cups rating  
## Apple\_Cinnamon\_Cheerios -0.1453172 -1.450759 -0.1967771 -0.3052601 -0.9365625  
## Apple\_Jacks -0.1453172 -0.249593 -0.1967771 0.7690100 -0.6756899  
## Bran\_Chex -0.1453172 -1.450759 -0.1967771 -0.6490266 0.4594871  
## Cap'n'Crunch -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.7528545  
## Cinnamon\_Toast\_Crunch -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.6260883  
## Cocoa\_Puffs -0.1453172 -0.249593 -0.1967771 0.7690100 -1.4187264  
## Corn\_Pops -0.1453172 -0.249593 -0.1967771 0.7690100 -0.4899817  
## Count\_Chocula -0.1453172 -0.249593 -0.1967771 0.7690100 -1.4429256  
## Froot\_Loops -0.1453172 -0.249593 -0.1967771 0.7690100 -0.7444941  
## Frosted\_Flakes -0.1453172 -1.450759 -0.1967771 -0.3052601 -0.7994234  
## Fruity\_Pebbles -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.0421897  
## Golden\_Crisp -0.1453172 -1.450759 -0.1967771 0.2533603 -0.5277361  
## Golden\_Grahams -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.3427262  
## Honey\_Graham\_Ohs -0.1453172 -0.249593 -0.1967771 0.7690100 -1.4803151  
## Honey\_Nut\_Cheerios -0.1453172 -1.450759 -0.1967771 -0.3052601 -0.8253186  
## Honey-comb -0.1453172 -1.450759 -0.1967771 2.1870466 -0.9911728  
## Lucky\_Charms -0.1453172 -0.249593 -0.1967771 0.7690100 -1.1341114  
## Multi-Grain\_Cheerios -0.1453172 -1.450759 -0.1967771 0.7690100 -0.1822231  
## Nut&Honey\_Crunch -0.1453172 -0.249593 -0.1967771 -0.6490266 -0.9070377  
## cut\_2  
## Apple\_Cinnamon\_Cheerios 3  
## Apple\_Jacks 3  
## Bran\_Chex 3  
## Cap'n'Crunch 3  
## Cinnamon\_Toast\_Crunch 3  
## Cocoa\_Puffs 3  
## Corn\_Pops 3  
## Count\_Chocula 3  
## Froot\_Loops 3  
## Frosted\_Flakes 3  
## Fruity\_Pebbles 3  
## Golden\_Crisp 3  
## Golden\_Grahams 3  
## Honey\_Graham\_Ohs 3  
## Honey\_Nut\_Cheerios 3  
## Honey-comb 3  
## Lucky\_Charms 3  
## Multi-Grain\_Cheerios 3  
## Nut&Honey\_Crunch 3

centroid\_3 <- colMeans(result[result$cut\_2==3,])  
result[result$cut\_2==4,]

## calories protein fat sodium fiber  
## Bran\_Flakes -0.8665066 0.4151897 -1.00647256 0.6003018 1.19497147  
## Cheerios 0.1599704 3.1554419 0.98066557 1.5545879 -0.06375361  
## Corn\_Chex 0.1599704 -0.4982277 -1.00647256 1.4353022 -0.90290366  
## Corn\_Flakes -0.3532681 -0.4982277 -1.00647256 1.5545879 -0.48332864  
## Crispix 0.1599704 -0.4982277 -1.00647256 0.7195875 -0.48332864  
## Double\_Chex -0.3532681 -0.4982277 -1.00647256 0.3617302 -0.48332864  
## Frosted\_Mini-Wheats -0.3532681 0.4151897 -1.00647256 -1.9046994 0.35582142  
## Grape\_Nuts\_Flakes -0.3532681 0.4151897 -0.01290349 -0.2346986 0.35582142  
## Grape-Nuts 0.1599704 0.4151897 -1.00647256 0.1231587 0.35582142  
## Kix 0.1599704 -0.4982277 -0.01290349 1.1967306 -0.90290366  
## Maypo -0.3532681 1.3286071 -0.01290349 -1.9046994 -0.90290366  
## Nutri-grain\_Wheat -0.8665066 0.4151897 -1.00647256 0.1231587 0.35582142  
## carbo sugars potass vitamins shelf  
## Bran\_Flakes -0.46134666 -0.462771138 1.29715251 -0.1453172 0.9515734  
## Cheerios 0.56237147 -1.376293384 0.08994853 -0.1453172 -1.4507595  
## Corn\_Chex 1.84201913 -0.919532261 -1.04624345 -0.1453172 -1.4507595  
## Corn\_Flakes 1.58608960 -1.147912823 -0.90421945 -0.1453172 -1.4507595  
## Crispix 1.58608960 -0.919532261 -0.97523145 -0.1453172 0.9515734  
## Double\_Chex 0.81830100 -0.462771138 -0.26511146 -0.1453172 0.9515734  
## Frosted\_Mini-Wheats -0.20541712 -0.006010015 0.01893653 -0.1453172 -0.2495930  
## Grape\_Nuts\_Flakes 0.05051241 -0.462771138 -0.19409946 -0.1453172 0.9515734  
## Grape-Nuts 0.56237147 -0.919532261 -0.12308746 -0.1453172 0.9515734  
## Kix 1.58608960 -0.919532261 -0.83320745 -0.1453172 -0.2495930  
## Maypo 0.30644194 -0.919532261 -0.05207547 -0.1453172 -0.2495930  
## Nutri-grain\_Wheat 0.81830100 -1.147912823 -0.12308746 -0.1453172 0.9515734  
## weight cups rating cut\_2  
## Bran\_Flakes -0.1967771 -0.64902659 0.75801873 4  
## Cheerios -0.1967771 1.84328015 0.57657347 4  
## Corn\_Chex -0.1967771 0.76901001 -0.08689833 4  
## Corn\_Flakes -0.1967771 0.76901001 0.22763247 4  
## Crispix -0.1967771 0.76901001 0.30112138 4  
## Double\_Chex -0.1967771 -0.30526014 0.11853896 4  
## Frosted\_Mini-Wheats -0.1967771 -0.09040611 1.11618949 4  
## Grape\_Nuts\_Flakes -0.1967771 0.25336034 0.66996501 4  
## Grape-Nuts -0.1967771 -2.45380043 0.76209027 4  
## Kix -0.1967771 2.91755030 -0.24379018 4  
## Maypo -0.1967771 0.76901001 0.86744227 4  
## Nutri-grain\_Wheat -0.1967771 0.76901001 1.20857002 4

centroid\_4 <- colMeans(result[result$cut\_2==4,])  
result[result$cut\_2==5,]

## calories protein fat sodium  
## Just\_Right\_Crunchy\_\_Nuggets 0.1599704 -0.4982277 -0.01290349 0.1231587  
## Just\_Right\_Fruit\_&\_Nut 1.6996859 0.4151897 -0.01290349 0.1231587  
## fiber carbo sugars potass  
## Just\_Right\_Crunchy\_\_Nuggets -0.48332864 0.5623715 -0.2343906 -0.54915946  
## Just\_Right\_Fruit\_&\_Nut -0.06375361 1.3301601 0.4507511 -0.05207547  
## vitamins shelf weight cups rating  
## Just\_Right\_Crunchy\_\_Nuggets 3.211511 0.9515734 -0.1967771 0.7690100 -0.4372390  
## Just\_Right\_Fruit\_&\_Nut 3.211511 0.9515734 1.7968857 -0.3052601 -0.4409529  
## cut\_2  
## Just\_Right\_Crunchy\_\_Nuggets 5  
## Just\_Right\_Fruit\_&\_Nut 5

centroids <- rbind(centroid\_1, centroid\_2, centroid\_3, centroid\_4)  
centroid\_5 <- colMeans(result[result$cut\_2==5,])  
centroids <- rbind(centroid\_1, centroid\_2, centroid\_3, centroid\_4, centroid\_5)  
x2 <- as.data.frame(rbind(centroids[,-14], Partion\_2))

#Calculating the Distance

Distance\_1 <- get\_dist(x2)  
Matrix\_1 <- as.matrix(Distance\_1)  
dataframe1 <- data.frame(data=seq(1,nrow(Partion\_2),1), Clusters = rep(0,nrow(Partion\_2)))  
for(i in 1:nrow(Partion\_2))   
 {dataframe1[i,2] <- which.min(Matrix\_1[i+4, 1:4])}  
dataframe1

## data Clusters  
## 1 1 4  
## 2 2 2  
## 3 3 4  
## 4 4 4  
## 5 5 4  
## 6 6 2  
## 7 7 2  
## 8 8 2  
## 9 9 4  
## 10 10 4  
## 11 11 4  
## 12 12 4  
## 13 13 4  
## 14 14 4  
## 15 15 3  
## 16 16 4  
## 17 17 4  
## 18 18 4  
## 19 19 2  
## 20 20 4  
## 21 21 4  
## 22 22 3  
## 23 23 4  
## 24 24 4

cbind(dataframe2$Cluster1[51:74], dataframe1$Clusters)

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

table(dataframe2$Cluster1[51:74] == dataframe1$Clusters)

## < table of extent 0 >

#Hence we can say Model is partially stable. #Cluster 3 has highest stability in terms of cluster stability amongst all.

#Q4 Cluster with healthy Cereal and High nutrition value #The elementary public schools would like to choose a set of cereals to include in their daily cafeterias. Every day a different cereal is offered, but all cereals should support a healthy diet. For this goal, you are requested to find a cluster of “healthy cereals.”Should the data be normalized? If not, how should they be used in the cluster analysis?

mydata <- na.omit(Assign\_New)  
rating <- cbind(mydata,cluster1)  
rating[rating$clust==1,]

## calories protein fat sodium fiber  
## 100%\_Bran -1.892984 1.328607 -0.01290349 -0.3539844 3.292847  
## All-Bran -1.892984 1.328607 -0.01290349 1.1967306 2.873272  
## All-Bran\_with\_Extra\_Fiber -2.919461 1.328607 -1.00647256 -0.2346986 4.971147  
## carbo sugars potass vitamins shelf  
## 100%\_Bran -2.508783 -0.2343906 2.575368 -0.1453172 0.9515734  
## All-Bran -1.996924 -0.4627711 3.143464 -0.1453172 0.9515734  
## All-Bran\_with\_Extra\_Fiber -1.740994 -1.6046739 3.285488 -0.1453172 0.9515734  
## weight cups rating cluster1  
## 100%\_Bran -0.1967771 -2.110034 1.832188 1  
## All-Bran -0.1967771 -2.110034 1.193099 1  
## All-Bran\_with\_Extra\_Fiber -0.1967771 -1.379530 3.633385 1

rating[rating$clust==2,]

## calories protein fat  
## 100%\_Natural\_Bran 0.6732089 0.4151897 3.96137277  
## Basic\_4 1.1864474 0.4151897 0.98066557  
## Clusters 0.1599704 0.4151897 0.98066557  
## Cracklin'\_Oat\_Bran 0.1599704 0.4151897 1.97423464  
## Crispy\_Wheat\_&\_Raisins -0.3532681 -0.4982277 -0.01290349  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats 0.6732089 0.4151897 0.98066557  
## Fruitful\_Bran 0.6732089 0.4151897 -1.00647256  
## Great\_Grains\_Pecan 0.6732089 0.4151897 1.97423464  
## Just\_Right\_Fruit\_&\_Nut 1.6996859 0.4151897 -0.01290349  
## Life -0.3532681 1.3286071 0.98066557  
## Muesli\_Raisins,\_Dates,\_&\_Almonds 2.2129244 1.3286071 1.97423464  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans 2.2129244 1.3286071 1.97423464  
## Mueslix\_Crispy\_Blend 2.7261629 0.4151897 0.98066557  
## Nutri-Grain\_Almond-Raisin 1.6996859 0.4151897 0.98066557  
## Oatmeal\_Raisin\_Crisp 1.1864474 0.4151897 0.98066557  
## Post\_Nat.\_Raisin\_Bran 0.6732089 0.4151897 -0.01290349  
## Quaker\_Oat\_Squares -0.3532681 1.3286071 -0.01290349  
## Raisin\_Bran 0.6732089 0.4151897 -0.01290349  
## Raisin\_Nut\_Bran -0.3532681 0.4151897 0.98066557  
## Total\_Raisin\_Bran 1.6996859 0.4151897 -0.01290349  
## sodium fiber carbo  
## 100%\_Natural\_Bran -1.725770770 -0.06375361 -1.74099432  
## Basic\_4 0.600301771 -0.06375361 0.81830100  
## Clusters -0.234698628 -0.06375361 -0.46134666  
## Cracklin'\_Oat\_Bran -0.234698628 0.77539645 -1.22913525  
## Crispy\_Wheat\_&\_Raisins -0.234698628 -0.06375361 -0.97320572  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats 0.003872915 1.19497147 -0.71727619  
## Fruitful\_Bran 0.958159085 1.19497147 -0.20541712  
## Great\_Grains\_Pecan -1.010056142 0.35582142 -0.46134666  
## Just\_Right\_Fruit\_&\_Nut 0.123158686 -0.06375361 1.33016007  
## Life -0.115412857 -0.06375361 -0.71727619  
## Muesli\_Raisins,\_Dates,\_&\_Almonds -0.771484599 0.35582142 0.30644194  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans -0.115412857 0.35582142 0.30644194  
## Mueslix\_Crispy\_Blend -0.115412857 0.35582142 0.56237147  
## Nutri-Grain\_Almond-Raisin 0.719587543 0.35582142 1.58608960  
## Oatmeal\_Raisin\_Crisp 0.123158686 -0.27354112 -0.33338189  
## Post\_Nat.\_Raisin\_Bran 0.481016000 1.61454650 -0.97320572  
## Quaker\_Oat\_Squares -0.294341514 -0.06375361 -0.20541712  
## Raisin\_Bran 0.600301771 1.19497147 -0.20541712  
## Raisin\_Nut\_Bran -0.234698628 0.14603391 -1.10117049  
## Total\_Raisin\_Bran 0.361730229 0.77539645 0.05051241  
## sugars potass vitamins  
## 100%\_Natural\_Bran 0.222370547 0.51602052 -1.2642598  
## Basic\_4 0.222370547 0.01893653 -0.1453172  
## Clusters -0.006010015 0.08994853 -0.1453172  
## Cracklin'\_Oat\_Bran -0.006010015 0.87108052 -0.1453172  
## Crispy\_Wheat\_&\_Raisins 0.679131670 0.30298453 -0.1453172  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats 0.679131670 1.43917651 -0.1453172  
## Fruitful\_Bran 1.135892793 1.29715251 -0.1453172  
## Great\_Grains\_Pecan -0.691151699 0.01893653 -0.1453172  
## Just\_Right\_Fruit\_&\_Nut 0.450751108 -0.05207547 3.2115106  
## Life -0.234390576 -0.05207547 -0.1453172  
## Muesli\_Raisins,\_Dates,\_&\_Almonds 0.907512232 1.01310452 -0.1453172  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans 0.907512232 1.01310452 -0.1453172  
## Mueslix\_Crispy\_Blend 1.364273355 0.87108052 -0.1453172  
## Nutri-Grain\_Almond-Raisin -0.006010015 0.44500853 -0.1453172  
## Oatmeal\_Raisin\_Crisp 0.679131670 0.30298453 -0.1453172  
## Post\_Nat.\_Raisin\_Bran 1.592653916 2.29132050 -0.1453172  
## Quaker\_Oat\_Squares -0.234390576 0.16096053 -0.1453172  
## Raisin\_Bran 1.135892793 2.00727250 -0.1453172  
## Raisin\_Nut\_Bran 0.222370547 0.58703252 -0.1453172  
## Total\_Raisin\_Bran 1.592653916 1.86524850 3.2115106  
## shelf weight cups  
## 100%\_Natural\_Bran 0.9515734 -0.1967771 0.7690100  
## Basic\_4 0.9515734 1.9962520 -0.3052601  
## Clusters 0.9515734 -0.1967771 -1.3795303  
## Cracklin'\_Oat\_Bran 0.9515734 -0.1967771 -1.3795303  
## Crispy\_Wheat\_&\_Raisins 0.9515734 -0.1967771 -0.3052601  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats 0.9515734 1.4646086 -0.6490266  
## Fruitful\_Bran 0.9515734 1.9962520 -0.6490266  
## Great\_Grains\_Pecan 0.9515734 -0.1967771 -2.1100340  
## Just\_Right\_Fruit\_&\_Nut 0.9515734 1.7968857 -0.3052601  
## Life -0.2495930 -0.1967771 -0.6490266  
## Muesli\_Raisins,\_Dates,\_&\_Almonds 0.9515734 -0.1967771 0.7690100  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans 0.9515734 -0.1967771 0.7690100  
## Mueslix\_Crispy\_Blend 0.9515734 3.1259942 -0.6490266  
## Nutri-Grain\_Almond-Raisin 0.9515734 1.9962520 -0.6490266  
## Oatmeal\_Raisin\_Crisp 0.9515734 1.4646086 -1.3795303  
## Post\_Nat.\_Raisin\_Bran 0.9515734 1.9962520 -0.6490266  
## Quaker\_Oat\_Squares 0.9515734 -0.1967771 -1.3795303  
## Raisin\_Bran -0.2495930 1.9962520 -0.3052601  
## Raisin\_Nut\_Bran 0.9515734 -0.1967771 -1.3795303  
## Total\_Raisin\_Bran 0.9515734 3.1259942 0.7690100  
## rating cluster1  
## 100%\_Natural\_Bran -0.6180571 2  
## Basic\_4 -0.4005857 2  
## Clusters -0.1612765 2  
## Cracklin'\_Oat\_Bran -0.1578193 2  
## Crispy\_Wheat\_&\_Raisins -0.4619759 2  
## Fruit\_&\_Fibre\_Dates,\_Walnuts,\_and\_Oats -0.1244837 2  
## Fruitful\_Bran -0.1174756 2  
## Great\_Grains\_Pecan 0.2239586 2  
## Just\_Right\_Fruit\_&\_Nut -0.4409529 2  
## Life 0.1895290 2  
## Muesli\_Raisins,\_Dates,\_&\_Almonds -0.3935878 2  
## Muesli\_Raisins,\_Peaches,\_&\_Pecans -0.6069456 2  
## Mueslix\_Crispy\_Blend -0.8793408 2  
## Nutri-Grain\_Almond-Raisin -0.1404816 2  
## Oatmeal\_Raisin\_Crisp -0.8695530 2  
## Post\_Nat.\_Raisin\_Bran -0.3434906 2  
## Quaker\_Oat\_Squares 0.4873659 2  
## Raisin\_Bran -0.2425029 2  
## Raisin\_Nut\_Bran -0.2108809 2  
## Total\_Raisin\_Bran -1.0018246 2

rating[rating$clust==3,]

## calories protein fat sodium  
## Apple\_Cinnamon\_Cheerios 0.1599704 -0.4982277 0.98066557 0.2424445  
## Apple\_Jacks 0.1599704 -0.4982277 -1.00647256 -0.4136273  
## Cap'n'Crunch 0.6732089 -1.4116451 0.98066557 0.7195875  
## Cinnamon\_Toast\_Crunch 0.6732089 -1.4116451 1.97423464 0.6003018  
## Cocoa\_Puffs 0.1599704 -1.4116451 -0.01290349 0.2424445  
## Corn\_Pops 0.1599704 -1.4116451 -1.00647256 -0.8311275  
## Count\_Chocula 0.1599704 -1.4116451 -0.01290349 0.2424445  
## Froot\_Loops 0.1599704 -0.4982277 -0.01290349 -0.4136273  
## Frosted\_Flakes 0.1599704 -1.4116451 -1.00647256 0.4810160  
## Fruity\_Pebbles 0.1599704 -1.4116451 -0.01290349 -0.2943415  
## Golden\_Crisp -0.3532681 -0.4982277 -1.00647256 -1.3679135  
## Golden\_Grahams 0.1599704 -1.4116451 -0.01290349 1.4353022  
## Honey\_Graham\_Ohs 0.6732089 -1.4116451 0.98066557 0.7195875  
## Honey\_Nut\_Cheerios 0.1599704 0.4151897 -0.01290349 1.0774449  
## Honey-comb 0.1599704 -1.4116451 -1.00647256 0.2424445  
## Lucky\_Charms 0.1599704 -0.4982277 -0.01290349 0.2424445  
## Multi-Grain\_Cheerios -0.3532681 -0.4982277 -0.01290349 0.7195875  
## Nut&Honey\_Crunch 0.6732089 -0.4982277 -0.01290349 0.3617302  
## Smacks 0.1599704 -0.4982277 -0.01290349 -1.0696990  
## Trix 0.1599704 -1.4116451 -0.01290349 -0.2346986  
## Wheaties\_Honey\_Gold 0.1599704 -0.4982277 -0.01290349 0.4810160  
## fiber carbo sugars potass  
## Apple\_Cinnamon\_Cheerios -0.27354112 -1.10117049 0.6791317 -0.4071355  
## Apple\_Jacks -0.48332864 -0.97320572 1.5926539 -0.9752315  
## Cap'n'Crunch -0.90290366 -0.71727619 1.1358928 -0.9042195  
## Cinnamon\_Toast\_Crunch -0.90290366 -0.46134666 0.4507511 -0.7621955  
## Cocoa\_Puffs -0.90290366 -0.71727619 1.3642734 -0.6201715  
## Corn\_Pops -0.48332864 -0.46134666 1.1358928 -1.1172554  
## Count\_Chocula -0.90290366 -0.71727619 1.3642734 -0.4781475  
## Froot\_Loops -0.48332864 -0.97320572 1.3642734 -0.9752315  
## Frosted\_Flakes -0.48332864 -0.20541712 0.9075122 -1.0462434  
## Fruity\_Pebbles -0.90290366 -0.46134666 1.1358928 -1.0462434  
## Golden\_Crisp -0.90290366 -0.97320572 1.8210345 -0.8332075  
## Golden\_Grahams -0.90290366 0.05051241 0.4507511 -0.7621955  
## Honey\_Graham\_Ohs -0.48332864 -0.71727619 0.9075122 -0.7621955  
## Honey\_Nut\_Cheerios -0.27354112 -0.84524095 0.6791317 -0.1230875  
## Honey-comb -0.90290366 -0.20541712 0.9075122 -0.9042195  
## Lucky\_Charms -0.90290366 -0.71727619 1.1358928 -0.6201715  
## Multi-Grain\_Cheerios -0.06375361 0.05051241 -0.2343906 -0.1230875  
## Nut&Honey\_Crunch -0.90290366 0.05051241 0.4507511 -0.8332075  
## Smacks -0.48332864 -1.48506478 1.8210345 -0.8332075  
## Trix -0.90290366 -0.46134666 1.1358928 -1.0462434  
## Wheaties\_Honey\_Gold -0.48332864 0.30644194 0.2223705 -0.5491595  
## vitamins shelf weight cups rating  
## Apple\_Cinnamon\_Cheerios -0.1453172 -1.450759 -0.1967771 -0.3052601 -0.9365625  
## Apple\_Jacks -0.1453172 -0.249593 -0.1967771 0.7690100 -0.6756899  
## Cap'n'Crunch -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.7528545  
## Cinnamon\_Toast\_Crunch -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.6260883  
## Cocoa\_Puffs -0.1453172 -0.249593 -0.1967771 0.7690100 -1.4187264  
## Corn\_Pops -0.1453172 -0.249593 -0.1967771 0.7690100 -0.4899817  
## Count\_Chocula -0.1453172 -0.249593 -0.1967771 0.7690100 -1.4429256  
## Froot\_Loops -0.1453172 -0.249593 -0.1967771 0.7690100 -0.7444941  
## Frosted\_Flakes -0.1453172 -1.450759 -0.1967771 -0.3052601 -0.7994234  
## Fruity\_Pebbles -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.0421897  
## Golden\_Crisp -0.1453172 -1.450759 -0.1967771 0.2533603 -0.5277361  
## Golden\_Grahams -0.1453172 -0.249593 -0.1967771 -0.3052601 -1.3427262  
## Honey\_Graham\_Ohs -0.1453172 -0.249593 -0.1967771 0.7690100 -1.4803151  
## Honey\_Nut\_Cheerios -0.1453172 -1.450759 -0.1967771 -0.3052601 -0.8253186  
## Honey-comb -0.1453172 -1.450759 -0.1967771 2.1870466 -0.9911728  
## Lucky\_Charms -0.1453172 -0.249593 -0.1967771 0.7690100 -1.1341114  
## Multi-Grain\_Cheerios -0.1453172 -1.450759 -0.1967771 0.7690100 -0.1822231  
## Nut&Honey\_Crunch -0.1453172 -0.249593 -0.1967771 -0.6490266 -0.9070377  
## Smacks -0.1453172 -0.249593 -0.1967771 -0.3052601 -0.8140824  
## Trix -0.1453172 -0.249593 -0.1967771 0.7690100 -1.0615859  
## Wheaties\_Honey\_Gold -0.1453172 -1.450759 -0.1967771 -0.3052601 -0.4611670  
## cluster1  
## Apple\_Cinnamon\_Cheerios 3  
## Apple\_Jacks 3  
## Cap'n'Crunch 3  
## Cinnamon\_Toast\_Crunch 3  
## Cocoa\_Puffs 3  
## Corn\_Pops 3  
## Count\_Chocula 3  
## Froot\_Loops 3  
## Frosted\_Flakes 3  
## Fruity\_Pebbles 3  
## Golden\_Crisp 3  
## Golden\_Grahams 3  
## Honey\_Graham\_Ohs 3  
## Honey\_Nut\_Cheerios 3  
## Honey-comb 3  
## Lucky\_Charms 3  
## Multi-Grain\_Cheerios 3  
## Nut&Honey\_Crunch 3  
## Smacks 3  
## Trix 3  
## Wheaties\_Honey\_Gold 3

rating[rating$clust==4,]

## calories protein fat sodium  
## Bran\_Chex -0.8665066 -0.4982277 -0.01290349 0.4810160  
## Bran\_Flakes -0.8665066 0.4151897 -1.00647256 0.6003018  
## Cheerios 0.1599704 3.1554419 0.98066557 1.5545879  
## Corn\_Chex 0.1599704 -0.4982277 -1.00647256 1.4353022  
## Corn\_Flakes -0.3532681 -0.4982277 -1.00647256 1.5545879  
## Crispix 0.1599704 -0.4982277 -1.00647256 0.7195875  
## Double\_Chex -0.3532681 -0.4982277 -1.00647256 0.3617302  
## Grape\_Nuts\_Flakes -0.3532681 0.4151897 -0.01290349 -0.2346986  
## Grape-Nuts 0.1599704 0.4151897 -1.00647256 0.1231587  
## Just\_Right\_Crunchy\_\_Nuggets 0.1599704 -0.4982277 -0.01290349 0.1231587  
## Kix 0.1599704 -0.4982277 -0.01290349 1.1967306  
## Nutri-grain\_Wheat -0.8665066 0.4151897 -1.00647256 0.1231587  
## Product\_19 -0.3532681 0.4151897 -1.00647256 1.9124453  
## Rice\_Chex 0.1599704 -1.4116451 -1.00647256 0.9581591  
## Rice\_Krispies 0.1599704 -0.4982277 -1.00647256 1.5545879  
## Special\_K 0.1599704 3.1554419 -1.00647256 0.8388733  
## Total\_Corn\_Flakes 0.1599704 -0.4982277 -0.01290349 0.4810160  
## Total\_Whole\_Grain -0.3532681 0.4151897 -0.01290349 0.4810160  
## Triples 0.1599704 -0.4982277 -0.01290349 1.0774449  
## Wheat\_Chex -0.3532681 0.4151897 -0.01290349 0.8388733  
## Wheaties -0.3532681 0.4151897 -0.01290349 0.4810160  
## fiber carbo sugars potass  
## Bran\_Chex 0.77539645 0.05051241 -0.2343906 0.37399653  
## Bran\_Flakes 1.19497147 -0.46134666 -0.4627711 1.29715251  
## Cheerios -0.06375361 0.56237147 -1.3762934 0.08994853  
## Corn\_Chex -0.90290366 1.84201913 -0.9195323 -1.04624345  
## Corn\_Flakes -0.48332864 1.58608960 -1.1479128 -0.90421945  
## Crispix -0.48332864 1.58608960 -0.9195323 -0.97523145  
## Double\_Chex -0.48332864 0.81830100 -0.4627711 -0.26511146  
## Grape\_Nuts\_Flakes 0.35582142 0.05051241 -0.4627711 -0.19409946  
## Grape-Nuts 0.35582142 0.56237147 -0.9195323 -0.12308746  
## Just\_Right\_Crunchy\_\_Nuggets -0.48332864 0.56237147 -0.2343906 -0.54915946  
## Kix -0.90290366 1.58608960 -0.9195323 -0.83320745  
## Nutri-grain\_Wheat 0.35582142 0.81830100 -1.1479128 -0.12308746  
## Product\_19 -0.48332864 1.33016007 -0.9195323 -0.76219545  
## Rice\_Chex -0.90290366 2.09794866 -1.1479128 -0.97523145  
## Rice\_Krispies -0.90290366 1.84201913 -0.9195323 -0.90421945  
## Special\_K -0.48332864 0.30644194 -0.9195323 -0.62017146  
## Total\_Corn\_Flakes -0.90290366 1.58608960 -0.9195323 -0.90421945  
## Total\_Whole\_Grain 0.35582142 0.30644194 -0.9195323 0.16096053  
## Triples -0.90290366 1.58608960 -0.9195323 -0.54915946  
## Wheat\_Chex 0.35582142 0.56237147 -0.9195323 0.23197253  
## Wheaties 0.35582142 0.56237147 -0.9195323 0.16096053  
## vitamins shelf weight cups  
## Bran\_Chex -0.1453172 -1.4507595 -0.1967771 -0.6490266  
## Bran\_Flakes -0.1453172 0.9515734 -0.1967771 -0.6490266  
## Cheerios -0.1453172 -1.4507595 -0.1967771 1.8432802  
## Corn\_Chex -0.1453172 -1.4507595 -0.1967771 0.7690100  
## Corn\_Flakes -0.1453172 -1.4507595 -0.1967771 0.7690100  
## Crispix -0.1453172 0.9515734 -0.1967771 0.7690100  
## Double\_Chex -0.1453172 0.9515734 -0.1967771 -0.3052601  
## Grape\_Nuts\_Flakes -0.1453172 0.9515734 -0.1967771 0.2533603  
## Grape-Nuts -0.1453172 0.9515734 -0.1967771 -2.4538004  
## Just\_Right\_Crunchy\_\_Nuggets 3.2115106 0.9515734 -0.1967771 0.7690100  
## Kix -0.1453172 -0.2495930 -0.1967771 2.9175503  
## Nutri-grain\_Wheat -0.1453172 0.9515734 -0.1967771 0.7690100  
## Product\_19 3.2115106 0.9515734 -0.1967771 0.7690100  
## Rice\_Chex -0.1453172 -1.4507595 -0.1967771 1.3276305  
## Rice\_Krispies -0.1453172 -1.4507595 -0.1967771 0.7690100  
## Special\_K -0.1453172 -1.4507595 -0.1967771 0.7690100  
## Total\_Corn\_Flakes 3.2115106 0.9515734 -0.1967771 0.7690100  
## Total\_Whole\_Grain 3.2115106 0.9515734 -0.1967771 0.7690100  
## Triples -0.1453172 0.9515734 -0.1967771 -0.3052601  
## Wheat\_Chex -0.1453172 -1.4507595 -0.1967771 -0.6490266  
## Wheaties -0.1453172 -1.4507595 -0.1967771 0.7690100  
## rating cluster1  
## Bran\_Chex 0.45948710 4  
## Bran\_Flakes 0.75801873 4  
## Cheerios 0.57657347 4  
## Corn\_Chex -0.08689833 4  
## Corn\_Flakes 0.22763247 4  
## Crispix 0.30112138 4  
## Double\_Chex 0.11853896 4  
## Grape\_Nuts\_Flakes 0.66996501 4  
## Grape-Nuts 0.76209027 4  
## Just\_Right\_Crunchy\_\_Nuggets -0.43723896 4  
## Kix -0.24379018 4  
## Nutri-grain\_Wheat 1.20857002 4  
## Product\_19 -0.08273233 4  
## Rice\_Chex -0.04746624 4  
## Rice\_Krispies -0.14988985 4  
## Special\_K 0.74502768 4  
## Total\_Corn\_Flakes -0.27236281 4  
## Total\_Whole\_Grain 0.28426404 4  
## Triples -0.25339630 4  
## Wheat\_Chex 0.50698324 4  
## Wheaties 0.63545985 4

rating[rating$clust==5,]

## calories protein fat sodium  
## Frosted\_Mini-Wheats -0.3532681 0.4151897 -1.00647256 -1.904699  
## Maypo -0.3532681 1.3286071 -0.01290349 -1.904699  
## Puffed\_Rice -2.9194605 -1.4116451 -1.00647256 -1.904699  
## Puffed\_Wheat -2.9194605 -0.4982277 -1.00647256 -1.904699  
## Raisin\_Squares -0.8665066 -0.4982277 -1.00647256 -1.904699  
## Shredded\_Wheat -1.3797451 -0.4982277 -1.00647256 -1.904699  
## Shredded\_Wheat\_'n'Bran -0.8665066 0.4151897 -1.00647256 -1.904699  
## Shredded\_Wheat\_spoon\_size -0.8665066 0.4151897 -1.00647256 -1.904699  
## Strawberry\_Fruit\_Wheats -0.8665066 -0.4982277 -1.00647256 -1.725771  
## fiber carbo sugars potass  
## Frosted\_Mini-Wheats 0.35582142 -0.20541712 -0.006010015 0.01893653  
## Maypo -0.90290366 0.30644194 -0.919532261 -0.05207547  
## Puffed\_Rice -0.90290366 -0.46134666 -1.604673946 -1.18826745  
## Puffed\_Wheat -0.48332864 -1.22913525 -1.604673946 -0.69118346  
## Raisin\_Squares -0.06375361 0.05051241 -0.234390576 0.16096053  
## Shredded\_Wheat 0.35582142 0.30644194 -1.604673946 -0.05207547  
## Shredded\_Wheat\_'n'Bran 0.77539645 1.07423054 -1.604673946 0.58703252  
## Shredded\_Wheat\_spoon\_size 0.35582142 1.33016007 -1.604673946 0.30298453  
## Strawberry\_Fruit\_Wheats 0.35582142 0.05051241 -0.462771138 -0.12308746  
## vitamins shelf weight cups  
## Frosted\_Mini-Wheats -0.1453172 -0.2495930 -0.1967771 -0.09040611  
## Maypo -0.1453172 -0.2495930 -0.1967771 0.76901001  
## Puffed\_Rice -1.2642598 0.9515734 -3.5195485 0.76901001  
## Puffed\_Wheat -1.2642598 0.9515734 -3.5195485 0.76901001  
## Raisin\_Squares -0.1453172 0.9515734 -0.1967771 -1.37953029  
## Shredded\_Wheat -1.2642598 -1.4507595 -1.3265194 0.76901001  
## Shredded\_Wheat\_'n'Bran -1.2642598 -1.4507595 -0.1967771 -0.64902659  
## Shredded\_Wheat\_spoon\_size -1.2642598 -1.4507595 -0.1967771 -0.64902659  
## Strawberry\_Fruit\_Wheats -0.1453172 -0.2495930 -0.1967771 0.76901001  
## rating cluster1  
## Frosted\_Mini-Wheats 1.1161895 5  
## Maypo 0.8674423 5  
## Puffed\_Rice 1.2878220 5  
## Puffed\_Wheat 1.4479620 5  
## Raisin\_Squares 0.9017710 5  
## Shredded\_Wheat 1.8202929 5  
## Shredded\_Wheat\_'n'Bran 2.2642977 5  
## Shredded\_Wheat\_spoon\_size 2.1453309 5  
## Strawberry\_Fruit\_Wheats 1.1887196 5

#Mean ratings to determine the best cluster.

mean(rating[rating$cluster1==1,"rating"])

## [1] 2.219557

mean(rating[rating$cluster1==2,"rating"])

## [1] -0.313519

mean(rating[rating$cluster1==3,"rating"])

## [1] -0.9836387

mean(rating[rating$cluster1==4,"rating"])

## [1] 0.2704742

mean(rating[rating$cluster1==5,"rating"])

## [1] 1.44887

#As we can see that the mean ratings of the cluster1 is the highest, and also as we are taking in consideration the word heathy diet which should include a cluster with healthy cereals I will choose cluster1 because of the following reason:

#Cluster 1 has high protein and fibre content compared to others.Hence, it can be said that cluster 1 possess high nutritional value and has healthy cereals

#Cluster 1 consists of fruits, nuts, wheat which can be considered as a healthy cereal.

#Data normalization is really important as we are using distance as a measure of performance.