Assignment 5

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```
library(factoextra)
```

```
## Loading required package: ggplot2
```

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

```
library(dendextend)
```

```
##
## ---------------------
## Welcome to dendextend version 1.16.0
## 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(cluster)
```

```
## Warning: package 'cluster' was built under R version 4.2.2
```

```
library(tidyverse)
```

```
## ── Attaching packages
## ──────────────────────────────────────────────────────
## tidyverse 1.3.2 ──
```

```
## ✓ tibble  3.1.8      ✓ dplyr   1.0.10
## ✓ tidyr   1.2.1      ✓ stringr 1.4.1
## ✓ readr   2.1.3      ✓ forcats 0.5.2
## ✓ purrr   0.3.4
## ── Conflicts ──────────────────────────────────────────────────────── tidyverse_conflicts() ──
## ✖ dplyr::filter() masks stats::filter()
## ✖ dplyr::lag()    masks stats::lag()
```

```
library(knitr)
```

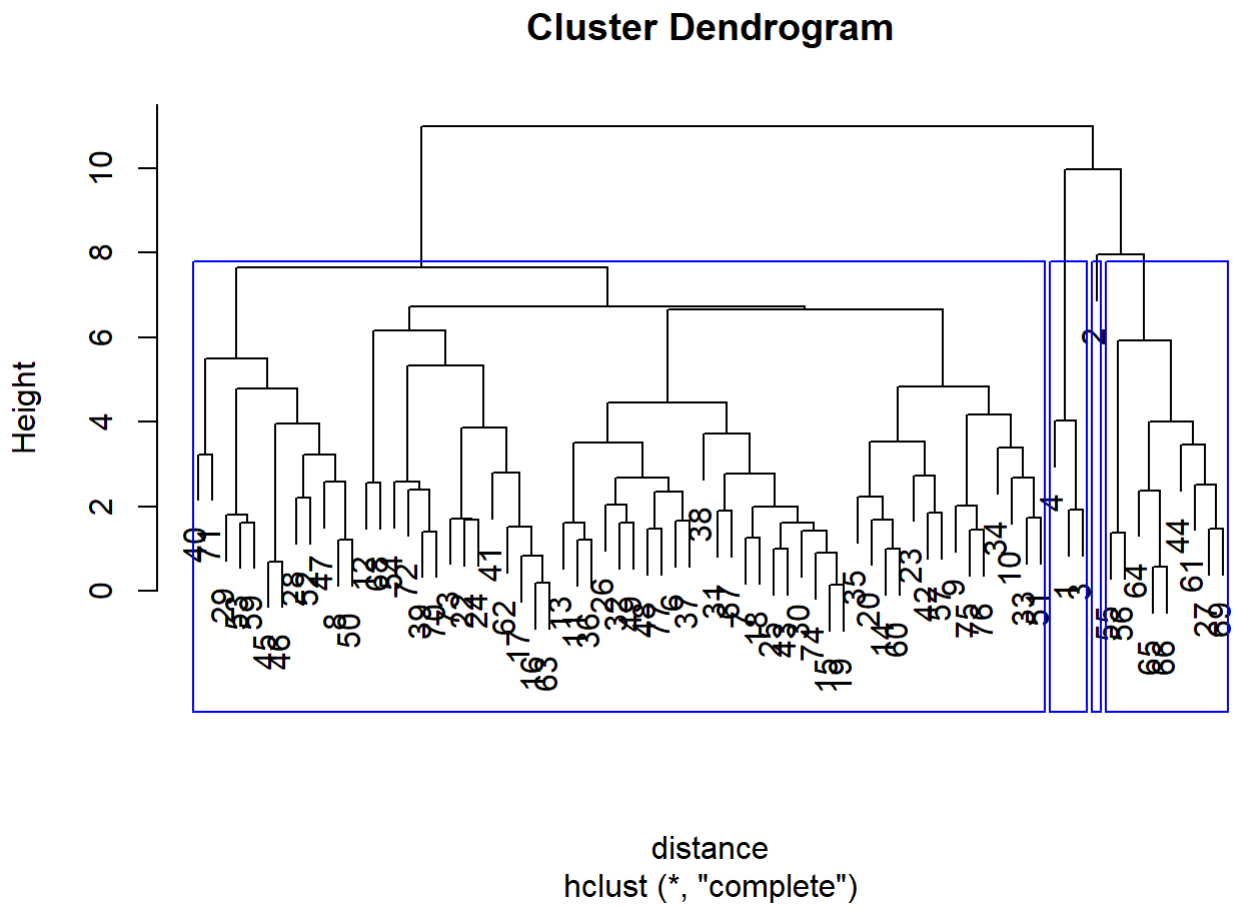
```
cereals<- read.csv('C:/Users/jenru/OneDrive/Documents/Cereals.csv')
numericaldata = data.frame(cereals[,4:16])



OmitMissing = na.omit(numericaldata)
Normalise = scale(OmitMissing)
distance = dist(Normalise, method = "euclidian")
clustering_heirarchial = hclust(distance,method = "complete")
plot(clustering_heirarchial)
round(clustering_heirarchial$height, 3)
```

```
##  [1]  0.143  0.196  0.575  0.698  0.828  0.904  1.003  1.004  1.201  1.203
## [11]  1.254  1.378  1.408  1.421  1.454  1.463  1.474  1.517  1.608  1.611
## [21]  1.616  1.625  1.650  1.687  1.692  1.720  1.730  1.795  1.839  1.897
## [31]  1.919  1.982  2.015  2.046  2.203  2.224  2.339  2.381  2.394  2.522
## [41]  2.563  2.574  2.579  2.668  2.682  2.734  2.776  2.787  3.229  3.236
## [51]  3.385  3.451  3.510  3.535  3.717  3.866  3.957  4.005  4.031  4.168
## [61]  4.456  4.779  4.839  5.342  5.488  5.920  6.169  6.669  6.731  7.650
## [71]  7.964  9.979 10.984
```

```
plot(clustering_heirarchial)
rect.hclust(clustering_heirarchial,k = 4, border = "blue")
```




```
singleClustering = agnes(Normalise, method = "single")
completeClustering = agnes(Normalise, method = "complete")
averageClustering = agnes(Normalise, method = "average")
wardClustering = agnes(Normalise, method = "ward")

print(singleClustering$ac)
```

```
## [1] 0.6067859
```

```
print(completeClustering$ac)
```

```
## [1] 0.8353712
```

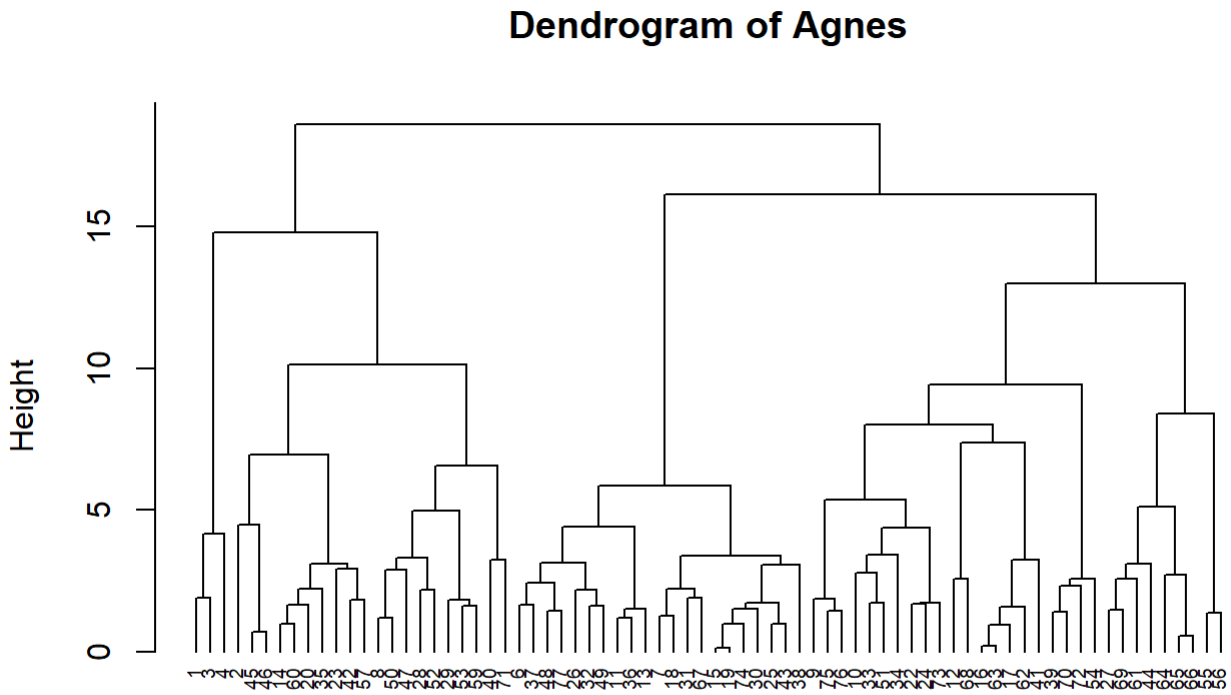
```
print(averageClustering$ac)
```

```
## [1] 0.7766075
```

```
print(wardClustering$ac)
```

```
## [1] 0.9046042
```

```
pltree(wardClustering, cex = 0.6, hang = -1, main = "Dendrogram of Agnes")
```



Normalise
agnes (*, "ward")

```
#Per the values above, Wards method is the best since the value is: 0.9046042
```

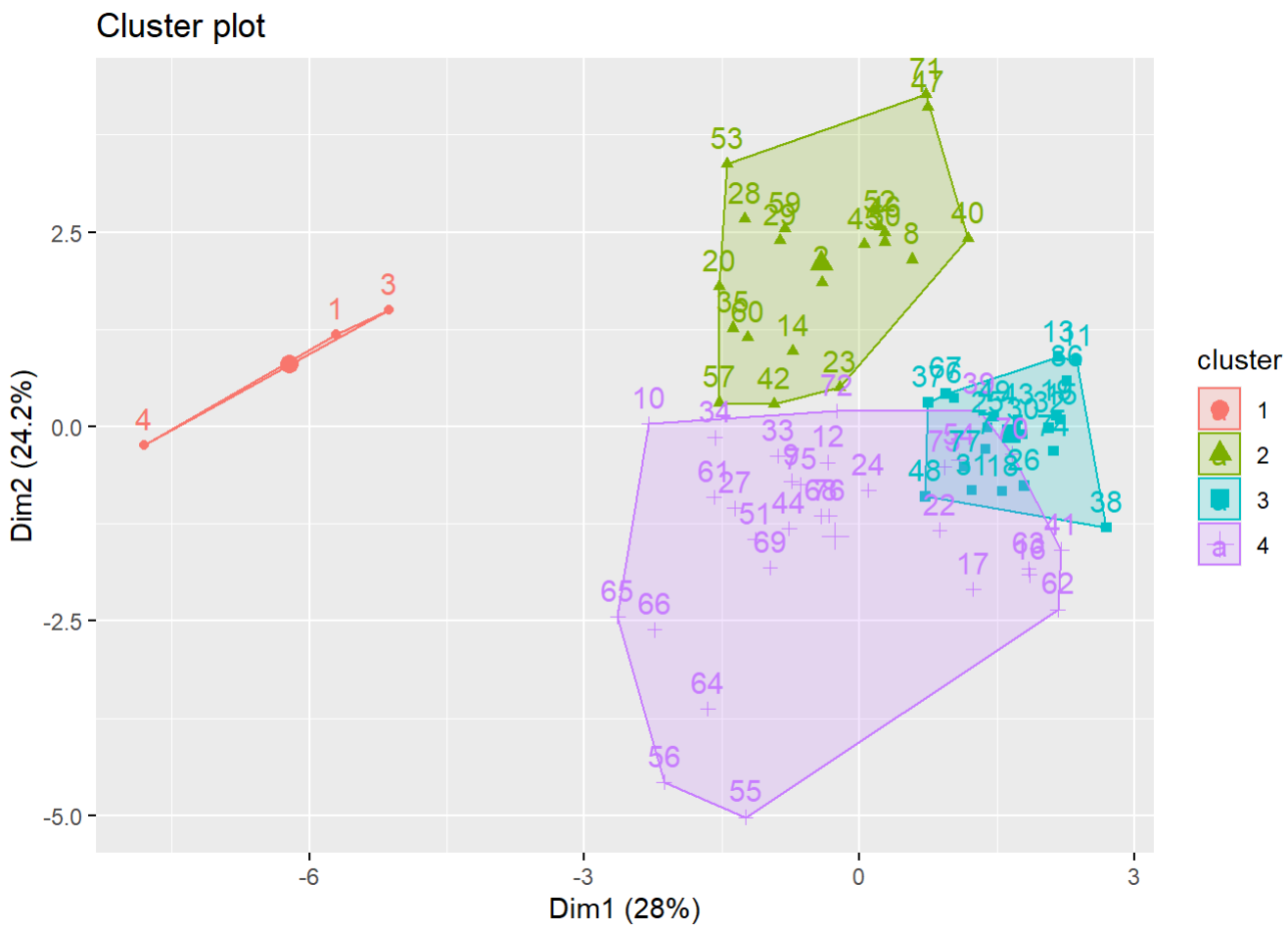
```
HierarchialClustering1 <- hclust(distance, method = "ward.D2" )
subgrp <- cutree(HierarchialClustering1, k = 4)
table(subgrp)
```

```
## subgrp
##  1  2  3  4
##  3 20 21 30
```

```
cereals <- as.data.frame(cbind(Normalise,subgrp))
```

```
#Visualizing the results on a scatterplot:

fviz_cluster(list(data = Normalise, cluster = subgrp))
```




```
Newcereals = numericaldata
Newcereals_omit = na.omit(Newcereals)
Clust = cbind(Newcereals_omit, subgrp)
Clust[Clust$subgrp==1,]
```

```
##   calories protein fat sodium fiber carbo sugars potass vitamins shelf weight
## 1       70       4   1    130    10     5      6     280       25     3      1
## 3       70       4   1    260     9     7      5     320       25     3      1
## 4       50       4   0    140    14     8      0     330       25     3      1
##    cups   rating subgrp
## 1 0.33 68.40297      1
## 3 0.33 59.42551      1
## 4 0.50 93.70491      1
```

```
Clust[Clust$subgrp==2,]
```

```
##    calories protein fat sodium fiber carbo sugars potass vitamins shelf weight
## 2       120       3   5     15   2.0   8.0      8    135        0     3   1.00
## 8       130       3   2    210   2.0  18.0      8    100       25     3   1.33
## 14      110       3   2    140   2.0  13.0      7    105       25     3   1.00
## 20      110       3   3    140   4.0  10.0      7    160       25     3   1.00
## 23      100       2   1    140   2.0  11.0     10    120       25     3   1.00
## 28      120       3   2    160   5.0  12.0     10    200       25     3   1.25
## 29      120       3   0    240   5.0  14.0     12    190       25     3   1.33
## 35      120       3   3     75   3.0  13.0      4    100       25     3   1.00
## 40      140       3   1    170   2.0  20.0      9     95      100     3   1.30
## 42      100       4   2    150   2.0  12.0      6     95       25     2   1.00
## 45      150       4   3     95   3.0  16.0     11    170       25     3   1.00
## 46      150       4   3    150   3.0  16.0     11    170       25     3   1.00
## 47      160       3   2    150   3.0  17.0     13    160       25     3   1.50
## 50      140       3   2    220   3.0  21.0      7    130       25     3   1.33
## 52      130       3   2    170   1.5  13.5     10    120       25     3   1.25
## 53      120       3   1    200   6.0  11.0     14    260       25     3   1.33
## 57      100       4   1    135   2.0  14.0      6    110       25     3   1.00
## 59      120       3   1    210   5.0  14.0     12    240       25     2   1.33
## 60      100       3   2    140   2.5  10.5      8    140       25     3   1.00
## 71      140       3   1    190   4.0  15.0     14    230      100     3   1.50
##    cups   rating subgrp
## 2  1.00 33.98368      2
## 8  0.75 37.03856      2
## 14 0.50 40.40021      2
## 20 0.50 40.44877      2
## 23 0.75 36.17620      2
## 28 0.67 40.91705      2
## 29 0.67 41.01549      2
## 35 0.33 45.81172      2
## 40 0.75 36.47151      2
## 42 0.67 45.32807      2
## 45 1.00 37.13686      2
## 46 1.00 34.13976      2
## 47 0.67 30.31335      2
## 50 0.67 40.69232      2
## 52 0.50 30.45084      2
## 53 0.67 37.84059      2
## 57 0.50 49.51187      2
## 59 0.75 39.25920      2
## 60 0.50 39.70340      2
## 71 1.00 28.59278      2
```

```
Clust[Clust$subgrp==3,]
```

```
##    calories protein fat sodium fiber carbo sugars potass vitamins shelf weight
## 6       110       2   2    180   1.5  10.5     10     70       25     1      1
## 7       110       2   0    125   1.0  11.0     14     30       25     2      1
## 11      120       1   2    220   0.0  12.0     12     35       25     2      1
## 13      120       1   3    210   0.0  13.0      9     45       25     2      1
## 15      110       1   1    180   0.0  12.0     13     55       25     2      1
## 18      110       1   0     90   1.0  13.0     12     20       25     2      1
## 19      110       1   1    180   0.0  12.0     13     65       25     2      1
## 25      110       2   1    125   1.0  11.0     13     30       25     2      1
## 26      110       1   0    200   1.0  14.0     11     25       25     1      1
## 30      110       1   1    135   0.0  13.0     12     25       25     2      1
## 31      100       2   0     45   0.0  11.0     15     40       25     1      1
## 32      110       1   1    280   0.0  15.0      9     45       25     2      1
## 36      120       1   2    220   1.0  12.0     11     45       25     2      1
## 37      110       3   1    250   1.5  11.5     10     90       25     1      1
## 38      110       1   0    180   0.0  14.0     11     35       25     1      1
## 43      110       2   1    180   0.0  12.0     12     55       25     2      1
## 48      100       2   1    220   2.0  15.0      6     90       25     1      1
## 49      120       2   1    190   0.0  15.0      9     40       25     2      1
## 67      110       2   1     70   1.0   9.0     15     40       25     2      1
## 74      110       1   1    140   0.0  13.0     12     25       25     2      1
## 77      110       2   1    200   1.0  16.0      8     60       25     1      1
##    cups    rating subgrp
## 6  0.75 29.50954      3
## 7  1.00 33.17409      3
## 11 0.75 18.04285      3
## 13 0.75 19.82357      3
## 15 1.00 22.73645      3
## 18 1.00 35.78279      3
## 19 1.00 22.39651      3
## 25 1.00 32.20758      3
## 26 0.75 31.43597      3
## 30 0.75 28.02576      3
## 31 0.88 35.25244      3
## 32 0.75 23.80404      3
## 36 1.00 21.87129      3
## 37 0.75 31.07222      3
## 38 1.33 28.74241      3
## 43 1.00 26.73451      3
## 48 1.00 40.10596      3
## 49 0.67 29.92429      3
## 67 0.75 31.23005      3
## 74 1.00 27.75330      3
## 77 0.75 36.18756      3
```

```
Clust[Clust$subgrp==4,]
```

```
##    calories protein fat sodium fiber carbo sugars potass vitamins shelf weight
## 9        90       2   1    200     4    15      6    125       25     1   1.00
## 10       90       3   0    210     5    13      5    190       25     3   1.00
## 12      110       6   2    290     2    17      1    105       25     1   1.00
## 16      110       2   0    280     0    22      3     25       25     1   1.00
## 17      100       2   0    290     1    21      2     35       25     1   1.00
## 22      110       2   0    220     1    21      3     30       25     3   1.00
## 24      100       2   0    190     1    18      5     80       25     3   1.00
## 27      100       3   0      0     3    14      7    100       25     2   1.00
## 33      100       3   1    140     3    15      5     85       25     3   1.00
## 34      110       3   0    170     3    17      3     90       25     3   1.00
## 39      110       2   1    170     1    17      6     60      100     3   1.00
## 41      110       2   1    260     0    21      3     40       25     2   1.00
## 44      100       4   1      0     0    16      3     95       25     2   1.00
## 51       90       3   0    170     3    18      2     90       25     3   1.00
## 54      100       3   0    320     1    20      3     45      100     3   1.00
## 55       50       1   0      0     0    13      0     15        0     3   0.50
## 56       50       2   0      0     1    10      0     50        0     3   0.50
## 61       90       2   0      0     2    15      6    110       25     3   1.00
## 62      110       1   0    240     0    23      2     30       25     1   1.00
## 63      110       2   0    290     0    22      3     35       25     1   1.00
## 64       80       2   0      0     3    16      0     95        0     1   0.83
## 65       90       3   0      0     4    19      0    140        0     1   1.00
## 66       90       3   0      0     3    20      0    120        0     1   1.00
## 68      110       6   0    230     1    16      3     55       25     1   1.00
## 69       90       2   0     15     3    15      5     90       25     2   1.00
## 70      110       2   1    200     0    21      3     35      100     3   1.00
## 72      100       3   1    200     3    16      3    110      100     3   1.00
## 73      110       2   1    250     0    21      3     60       25     3   1.00
## 75      100       3   1    230     3    17      3    115       25     1   1.00
## 76      100       3   1    200     3    17      3    110       25     1   1.00
##    cups    rating subgrp
## 9  0.67 49.12025      4
## 10 0.67 53.31381      4
## 12 1.25 50.76500      4
## 16 1.00 41.44502      4
## 17 1.00 45.86332      4
## 22 1.00 46.89564      4
## 24 0.75 44.33086      4
## 27 0.80 58.34514      4
## 33 0.88 52.07690      4
## 34 0.25 53.37101      4
## 39 1.00 36.52368      4
## 41 1.50 39.24111      4
## 44 1.00 54.85092      4
## 51 1.00 59.64284      4
## 54 1.00 41.50354      4
## 55 1.00 60.75611      4
## 56 1.00 63.00565      4
## 61 0.50 55.33314      4
## 62 1.13 41.99893      4
## 63 1.00 40.56016      4
```

```
## 64 1.00 68.23588     4
## 65 0.67 74.47295     4
## 66 0.67 72.80179     4
## 68 1.00 53.13132     4
## 69 1.00 59.36399     4
## 70 1.00 38.83975     4
## 72 1.00 46.65884     4
## 73 0.75 39.10617     4
## 75 0.67 49.78744     4
## 76 1.00 51.59219     4
```

```
#Calculating mean rating in order for cluster of healthy cereals

mean(Clust[Clust$subgrp==1,"rating"])
```

```
## [1] 73.84446
```

```
mean(Clust[Clust$subgrp==2,"rating"])
```

```
## [1] 38.26161
```

```
mean(Clust[Clust$subgrp==3,"rating"])
```

```
## [1] 28.84825
```

```
mean(Clust[Clust$subgrp==4,"rating"])
```

```
## [1] 51.43111
```

```
#As we see through calculating the mean rating, subgroup 1 has the highest. It is recommended to choose subgroup1 as a healthy  cluster
```