session21_assign_pca.R

Seshan

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Data Set
2. Perform the below given activities:
a. Apply PCA to the dataset and show proportion of variance
b. Perform PCA using SVD approach

c. Show the graphs of PCA components

```
setwd("C:/Users/Seshan/Desktop/sv R related/acadgild/assignments/session21")
library(readr)
epi_r <- read.csv("C:/Users/Seshan/Desktop/sv R related/acadgild/assignments/
session21/epi_r.csv")
View(epi_r)
data<-epi_r
View(data)
head(data, n=10)

# data sets in package

data(package="arules")

# Split data

dt <- split(data$rating, data$arizona)

dt

# Loading arules package

require(arules)

require(arulesViz)


# Convert data to transaction level

dt2 = as(dt,"transactions")

dt2
```

```
summary(dt2)

inspect(dt2)

# Most Frequent Items

itemFrequency(dt2, type = "relative")

itemFrequencyPlot(dt2,topN = 5)

# with support parameters

itemFrequency(dt2, type = "relative")

itemFrequencyPlot(dt2,support= 0.10)

# aggregated data

rules = apriori(dt2, parameter=list(support=0.005, confidence=0.8))

rules = apriori(dt2, parameter=list(support=0.005, confidence=0.8, minlen = 3
))

rules = apriori(dt2, parameter=list(support=0.005, confidence=0.8, maxlen = 4
))

rules

summary(rules)


inspect(rules[1:10]) # to view first 10 rules


#Convert rules into data frame

rules3 = as(rules, "data.frame")

write(rules, "C:/Users/Seshan/Desktop/PCA//rules2.csv", sep=",")


# Show only particular product rules

inspect( subset( rules, subset = rhs %pin% "0" )[1:10])


# Show the top 10 rules

options(digits=2)

inspect(rules[1:10])
```

```
# Get Summary Information

summary(rules)
plot(rules)
plot(rules, method = "graph", interactive = T)

# Sort by Lift
rules<-sort(rules, by="lift", decreasing=TRUE)

# Sort by Lift
rules<-sort(rules, by="lift", decreasing=TRUE)

# Remove Unnecessary Rules
subset.matrix <- is.subset(rules, rules)
subset.matrix[lower.tri(subset.matrix, diag=T)] <- NA
redundant <- colSums(subset.matrix, na.rm=T) >= 1
which(redundant)
rules.pruned <- rules[!redundant]
rules<-rules.pruned
rules
#Clean Rules
rules3$rules=gsub("\\{", "", rules3$rules)
rules3$rules=gsub("\\}", "", rules3$rules)
rules3$rules=gsub("\"", "", rules3$rules)

#Split the rule
library(splitstackshape)
```

```
Rules4=cSplit(rules3, "rules","=>")

names(Rules4)[names(Rules4) == 'rules_1'] <- 'LHS'

Rules5=cSplit(Rules4, "LHS",",")

Rules6=subset(Rules5, select= -c(rules_2))

names(Rules6)[names(Rules6) == 'rules_3'] <- 'RHS'


# What are customers likely to buy before they purchase "Product A"

rules<-apriori(data=dt, parameter=list(supp=0.001,conf = 0.8),

               appearance = list(default="lhs",rhs="0"),

               control = list(verbose=F))

rules<-sort(rules, decreasing=TRUE,by="confidence")

inspect(rules[1:5])


# What are customers likely to buy if they purchased "Product A"

rules<-apriori(data=dt, parameter=list(supp=0.001,conf = 0.8),appearance = li
st(default="rhs",lhs="0"),control = list(verbose=F))

rules<-sort(rules, decreasing=TRUE,by="confidence")

inspect(rules[1:5])

rules

support<-seq(0.01,0.1,0.01)

support

rules_count<-c(472,128,46,26,14, 10, 10,8,8,8)

rules_count

plot(support,rules_count,type = "l",main="Number of rules at different suppor
t %",col="darkred",lwd=3)


conf<-seq(0.10,1.0,0.10)

conf
```

```
rules_count<-c(472,231,125,62,15,0,0,0,0,0)

rules_count


plot(conf,rules_count,type = "l",main="Number of rules at different confidenc
e %",col="darkred",lwd=3)

#rules_ec <- eclat(epi_r, parameter = list(supp = 0.05))

#summary(rules_ec)

#sorting out the most relevant rules

rules<-sort(rules, by="confidence", decreasing=TRUE)

inspect(rules[1:5])


rules<-sort(rules, by="lift", decreasing=TRUE)

inspect(rules[1:5])


########################################

library(factoextra)


library("factoextra")

data1<-na.exclude(data)

na.omit(data1)

data1.active <- data1[2:100, 2:6]

na.exclude(data1.active)

View(data1.active)

head(data1.active[, 2:5])


#Compute PCA in R using prcomp()

library(factoextra)

res.pca <- prcomp(data1.active, scale = TRUE)

res.pca
```

```
summary(res.pca)

fviz_eig(res.pca)

fviz_pca_ind(res.pca, col.ind = "cos2", # Color by the quality of representat
ion gradient.cols = c("#00AFBB", "#E7B800", "#FC4E07"), repel = TRUE     # Av
oid text overlapping)

fviz_pca_var(res.pca, col.var = "contrib", # Color by contributions to the PC
gradient.cols = c("#00AFBB", "#E7B800", "#FC4E07"), repel = TRUE     # Avoid
text overlapping)

fviz_pca_biplot(res.pca, repel = TRUE,col.var = "#2E9FDF", # Variables color
col.ind = "#696969"  # Individuals color)

library(factoextra)

# Eigenvalues

eig.val <- get_eigenvalue(res.pca)

eig.val

# Results for Variables

res.var <- get_pca_var(res.pca)

res.var$coord          # Coordinates

res.var$contrib        # Contributions to the PCs

res.var$cos2           # Quality of representation
```

```
##                                                    title rating
## 1                            Lentil, Apple, and Turkey Wrap   2.500
## 2                Boudin Blanc Terrine with Red Onion Confit   4.375
## 3                              Potato and Fennel Soup Hodge   3.750
## 4                           Mahi-Mahi in Tomato Olive Sauce   5.000
## 5                                 Spinach Noodle Casserole   3.125
## 6                                             The Best Blts   4.375
## 7   Ham and Spring Vegetable Salad with Shallot Vinaigrette   4.375
## 8                                       Spicy-Sweet Kumquats   3.750
## 9                                     Korean Marinated Beef   4.375
## 10 Ham Persillade with Mustard Potato Salad and Mashed Peas   3.750
##    calories protein fat sodium X.cakeweek X.wasteless X22.minute.meals
## 1       426      30   7    559          0           0                0
## 2       403      18  23   1439          0           0                0
## 3       165       6   7    165          0           0                0
```

```
## 4        NA      NA  NA     NA          0           0                0
## 5       547      20  32    452          0           0                0
## 6       948      19  79   1042          0           0                0
## 7        NA      NA  NA     NA          0           0                0
## 8        NA      NA  NA     NA          0           0                0
## 9       170       7  10   1272          0           0                0
## 10      602      23  41   1696          0           0                0
##    X3.ingredient.recipes X30.days.of.groceries advance.prep.required
## 1                      0                     0                    0
## 2                      0                     0                    0
## 3                      0                     0                    0
## 4                      0                     0                    0
## 5                      0                     0                    0
## 6                      0                     0                    0
## 7                      0                     0                    0
## 8                      0                     0                    0
## 9                      0                     0                    0
## 10                     0                     0                    0
##    alabama alaska alcoholic almond amaretto anchovy anise anniversary
## 1        0      0         0      0        0       0     0           0
## 2        0      0         0      0        0       0     0           0
## 3        0      0         0      0        0       0     0           0
## 4        0      0         0      0        0       0     0           0
## 5        0      0         0      0        0       0     0           0
## 6        0      0         0      0        0       0     0           0
## 7        0      0         0      0        0       0     0           0
## 8        0      0         0      0        0       0     0           0
## 9        0      0         0      0        0       0     0           0
## 10       0      0         0      0        0       0     0           0
##    anthony.bourdain aperitif appetizer apple apple.juice apricot arizona
## 1                 0        0         0     1           0       0       0
## 2                 0        0         0     0           0       0       0
## 3                 0        0         0     0           0       0       0
## 4                 0        0         0     0           0       0       0
## 5                 0        0         0     0           0       0       0
## 6                 0        0         0     0           0       0       0
## 7                 0        0         0     0           0       0       0
## 8                 0        0         0     0           0       0       0
## 9                 0        0         0     0           0       0       0
## 10                0        0         0     0           0       0       0
##    artichoke arugula asian.pear asparagus aspen atlanta australia avocado
## 1          0       0          0         0     0       0         0       0
## 2          0       0          0         0     0       0         0       0
## 3          0       0          0         0     0       0         0       0
## 4          0       0          0         0     0       0         0       0
## 5          0       0          0         0     0       0         0       0
## 6          0       0          0         0     0       0         0       0
## 7          0       0          0         1     0       0         0       0
## 8          0       0          0         0     0       0         0       0
## 9          0       0          0         0     0       0         0       0
```

```
## 9         0         0         0     0          0      0
## 10        0         0         0     0          0      0
```

```
# check  data
data
```

```
##
title
## 1
Lentil, Apple, and Turkey Wrap
## 2
Boudin Blanc Terrine with Red Onion Confit
## 3
Potato and Fennel Soup Hodge
## 4
Mahi-Mahi in Tomato Olive Sauce
## 5
Spinach Noodle Casserole
## 6
The Best Blts
## 7                                                                  Ham and Spr
ing Vegetable Salad with Shallot Vinaigrette
## 8
Spicy-Sweet Kumquats
## 9
Korean Marinated Beef
## 10                                                                Ham Persilla
de with Mustard Potato Salad and Mashed Peas
## 11
Yams Braised with Cream, Rosemary and Nutmeg
## 12
Spicy Noodle Soup
## 13                                                                  Banana-Cho
colate Chip Cake With Peanut Butter Frosting
## 14
Beef Tenderloin with Garlic and Brandy
## 15
Peach Mustard
## 16
Raw Cream of Spinach Soup
## 17
Sweet Buttermilk Spoon Breads
## 18
Crisp Braised Pork Shoulder
## 19                                                                      Mozzar
ella-Topped Peppers with Tomatoes and Garlic
## 20                                          Tuna, Asparagus, and New Potato S
alad with Chive Vinaigrette and Fried Capers
## 21                                                                   Asian Pe
```

```
ar and Watercress Salad with Sesame Dressing
## 22
"Fried" Chicken
## 23                                                                  Fish Fi
llets in Parchment with Asparagus and Orange
## 24
Pancetta and Taleggio Lasagna with Treviso
## 25
Sea Salt-Roasted Pecans
## 26
Garlic Baguette Crumbs
## 27
Cucumber-Basil Egg Salad
## 28
Dried Pear Crisps
## 29                                          Green Bean, Red Onion, and
Roast Potato Salad with Rosemary Vinaigrette
## 30
Apricot-Cherry Shortcakes
## 31
Asian Steak Topped with Bell Pepper Stir-Fry
## 32
Moroccan-Style Preserved Lemons
## 33                                                                Roaste
d Sweet-Potato Spears with Bacon Vinaigrette
## 34
Deviled Ham
## 35
Fontina Mac with Squash and Sage
## 36
Aztec Chicken
## 37
Pastry Twists with Spiced Sugar-Honey Glaze
## 38
Sauteed Broccoli Rabe
## 39
Grouper with Tomato and Basil
## 40
Better-Than-Pita Grill Bread
## 41
Coconut-Key Lime Sheet Cake
## 42                                                              Baked Hal
ibut with Orzo, Spinach, and Cherry Tomatoes
## 43
Honey Rye
## 44
Purple-Potato and Crab Gratin
## 45
Grilled Beef, JÃ-cama, and Apple Salad
## 46
```

```
Pickled Red Onions
## 47
Spicy Black Beans and Rice
## 48
Herbed Goat Cheese Spread with Mint
## 49
Mexican Lime Soup
## 50
Citrus Salad with Mint Sugar
## 51
Mexican Chile and Mushroom Soup
## 52
Peanut Butter-Banana Muffins
## 53
Braised Chicken With Artichokes and Olives
## 54
Pancetta Roast Chicken with Walnut Stuffing
## 55
1977 Coconut Angel Food Cake
## 56                                                    Collard-and-Prosc
iutto Chicken Roulades Over Watercress Salad
## 57
Veal Burgers Stuffed with Mozzarella Cheese
## 58
Pumpkin Muffins
## 59
Orange Balsamic Glaze
## 60                                                        Roasted Egg
plant and Olive Spread with Pita Bread Chips
## 61
Pecan Blue Cheese Crackers
## 62                                    Romaine, Grilled Avocado, and Sm
oky Corn Salad with Chipotle-Caesar Dressing
## 63                                                   Southwest Cor
n Bread Stuffing with Corn and Green Chilies
## 64                                                            Coli
n Perryâ\200\231s Sorghum and Apple Sticky Pudding
## 65
Mixed Berry Pavlovas
## 66
Orange-Almond Cake with Chocolate Icing
## 67
Scarborough Fair Tofu Burger
## 68
Italian Vinaigrette
## 69                                                        White Choc
olate Tartlets with Strawberries and Bananas
## 70
Tomato-Infused Bulgur Pilaf with Fresh Basil
## 71                                                        Roasted Bu
```

```
tternut Squash, Rosemary, and Garlic Lasagne
## 72
Grilled Roast Beef and Stilton Sandwich
## 73                                                                  Pear-Ha
zelnut Cheesecakes with Pear-Raspberry Sauce
## 74
Nut Butter
## 75
Cheese Ravioli with Fresh Tomato Sauce
## 76
Banana Layer Cake with Cream Cheese Frosting
## 77                                                                       S
outh American-Style JÃ-cama and Orange Salad
## 78
Roasted Acorn Squash and Chestnuts
## 79
Maple Pumpkin Pots de CrÃ¨me
## 80
Anadama Rolls with Mixed Seeds
## 81                                          Braised Chicken and Rice with
Orange, Saffron, Almond, and Pistachio Syrup
## 82
Horseradish Dill Potato Salad
## 83
Chicken in Green Pumpkin-Seed Sauce
## 84
Jeweled Rice
## 85
Braised Brisket with Bourbon-Peach Glaze
## 86                                                                    Gr
illed Pork Chops with Classic Barbecue Sauce
## 87
Bacon Crackers
## 88
Roast Chicken With Sorghum and Squash
## 89
Asparagus with Bacon and Onion
## 90
Ricotta Omelets
## 91                                                 Carrot, Snow Pea,
and Red Pepper Julienne in Honey Vinaigrette
## 92
Salmon with Chili-Mango Salsa
## 93
Turkey and Pinto Bean Chili
## 94
Cucumber-Yogurt Salad with Mint
## 95
Lamb Shanks Braised with Anise and Orange
## 96
```

```
Parsley Mayo
## 97
Acini di Pepe Pasta with Garlic and Olives
## 98                                                                  R
oast Beef Salad with Cabbage and Horseradish
## 99
Savoy Cabbage and Arugula Salad
## 100
Fennel, Beet and Orange Salad with Olives
## 101
Shrimp Gazpacho
## 102
Grilled Steak Salad with Beets and Scallions
## 103
Parsnip and Apple Soup
## 104
Short Rib Pot Pie
## 105
Stout Floats
## 106
Apricot-Pistachio Muffins Baked on the Grill
## 107
Garlic Bruschetta
## 108
Asian Noodles with Barbecued Duck Confit
## 109
Sausage Fennel Stuffing
## 110                                                               Banan
a Split with Curried Chocolate-Coconut Sauce
## 111
Escarole and Cheese Spoon Bread
## 112
Honey-Ginger Barbecue Sauce
## 113                                                            Baked Pea
rs with Rosemary, Gorgonzola Cheese and Port
## 114
Kids' Matzoh Pizza
## 115
Cranberry, Quince, and Pearl Onion Compote
## 116
Chocolate-Mint Shamrock Shake
## 117
Tropical Rum Punch
## 118                                                            Chickpea S
alad Sandwich With Creamy Carrot-Radish Slaw
## 119
Blackberry-Raspberry Sauce
## 120
Laddie's Sub-Bourbon
## 121
```

```
Red Cabbage and Onions
## 122
Roast Cod with Potatoes, Onions, and Olives
## 123
Spicy Tomato Sauce
## 124                                                                  Cod Ca
nnelloni with Swiss Chard and Roasted Pepper
## 125
Swiss Chard with Roasted Pepper
## 126
Chocolate Almond Butter
## 127
Pastry Dough
## 128                                                        Roasted Bell P
epper Halves Stuffed with Bulgur and Spinach
## 129                                                          Spicy Sesame
Noodles with Chopped Peanuts and Thai Basil
## 130
Potato Gratin with Goat Cheese and Garlic
## 131
Country Sausage and Sage Dressing
## 132
Cherry Lime Virgin Rickeys
## 133
Buttermilk-Spinach Spaetzle
## 134
Radishes with Burrata
## 135
Winter Squash SoufflÃ©
## 136
Blueberry Streusel Cake
## 137
Low-Fat Chicken Stock
## 138
Honey Mustard Sauce
## 139
Rosemary and Lemon Pinto Beans
## 140
Asian Dipping Sauce
## 141
Shrimp and Green Onion Pancakes
## 142
Gnocchi with Tomato, Basil, and Olives
## 143
Mustard-Ginger Shrimp Canapes
## 144
Rumbrosia
## 145
Roasted Root Vegetables
## 146
```

```
Thai Vegetables
## 147                                                          Sage-Roasted T
urkey with Caramelized Onions and Sage Gravy
##       rating calories protein     fat   sodium X.cakeweek X.wasteless
## 1      2.500      426      30       7      559          0           0
## 2      4.375      403      18      23     1439          0           0
## 3      3.750      165       6       7      165          0           0
## 4      5.000       NA      NA      NA       NA          0           0
## 5      3.125      547      20      32      452          0           0
## 6      4.375      948      19      79     1042          0           0
## 7      4.375       NA      NA      NA       NA          0           0
## 8      3.750       NA      NA      NA       NA          0           0
## 9      4.375      170       7      10     1272          0           0
## 10     3.750      602      23      41     1696          0           0
## 11     3.750      256       4       5       30          0           0
## 12     4.375       NA      NA      NA       NA          0           0
## 13     4.375      766      12      48      439          0           0
## 14     4.375      174      11      12      176          0           0
## 15     3.125      134       4       3     1394          0           0
## 16     4.375      382       5      31      977          0           0
## 17     1.875      146       4       5      160          0           0
## 18     4.375      890      59      68     1027          0           0
## 19     5.000      107       5       7      344          0           0
## 20     5.000      421      10      33      383          0           0
## 21     4.375      345      11      19      423          0           0
## 22     3.750       NA      NA      NA       NA          0           0
## 23     3.750       NA      NA      NA       NA          0           0
## 24     3.750       NA      NA      NA       NA          0           0
## 25     3.750      279       3      30      206          0           0
## 26     0.000       95       1       7      103          0           0
## 27     3.750      215       6      20      250          0           0
## 28     2.500       14       0       0        0          0           0
## 29     4.375      351       6      19       79          0           0
## 30     4.375      311       5       5      226          0           0
## 31     4.375       NA      NA      NA       NA          0           0
## 32     5.000       NA      NA      NA       NA          0           0
## 33     4.375      376       7      18      604          0           0
## 34     3.125      185      10      13      765          0           0
## 35     5.000       NA      NA      NA       NA          0           0
## 36     3.750      625      39      44     1248          0           0
## 37     0.000       NA      NA      NA       NA          0           0
## 38     4.375      107       4      10      329          0           0
## 39     4.375      336      44      16      413          0           0
## 40     2.500      145       3       6      208          0           0
## 41     4.375      483       5      35      100          0           0
## 42     4.375      634      44      31      181          0           0
## 43     0.000       NA      NA      NA       NA          0           0
## 44     3.750       NA      NA      NA       NA          0           0
## 45     4.375       NA      NA      NA       NA          0           0
## 46     4.375       90       2       0      881          0           0
```

```
## 47     3.750      202       19        8       815          0            0
##
## 101        0        0        0    0       0   0       0                  0
## 102        0        0        0    0       1   0       0                  0
## 103        0        0        0    0       0   0       0                  0
## 104        0        0        0    0       1   0       0                  0
## 105        0        1        0    0       0   0       0                  0
## 106        0        0        0    0       0   0       0                  0
## 107        0        0        0    0       0   0       0                  0
## 108        0        0        0    0       0   0       0                  0
## 109        0        0        0    0       0   0       0                  0
## 110        0        1        0    0       0   0       0                  0
## 111        0        0        0    0       0   0       0                  0
## 112        0        0        0    0       0   0       0                  0
## 113        0        1        0    0       0   0       0                  0
## 114        0        0        0    0       0   0       0                  0
## 115        0        0        0    0       0   0       0                  0
## 116        0        0        0    0       0   0       0                  0
## 117        0        0        0    0       0   0       0                  0
## 118        0        0        0    0       0   0       0                  0
## 119        0        1        0    0       0   0       0                  0
## 120        0        0        0    0       0   0       0                  0
## 121        0        0        0    0       0   0       0                  0
## 122        0        0        0    0       0   0       0                  0
## 123        0        0        0    0       0   0       0                  0
## 124        0        0        0    0       0   0       0                  0
## 125        0        0        0    0       0   0       0                  0
## 126        0        0        0    0       0   0       0                  0
## 127        0        0        0    0       0   0       0                  0
## 128        0        0        0    0       0   0       0                  0
## 129        0        0        0    0       1   0       0                  0
## 130        0        0        0    0       0   0       0                  0
## 131        0        0        0    0       0   0       0                  0
## 132        0        0        0    0       0   0       0                  0
## 133        0        0        0    0       0   0       0                  0
## 134        0        0        0    0       0   0       0                  0
## 135        0        0        0    0       0   0       0                  0
## 136        0        1        0    0       0   0       0                  0
## 137        0        0        0    0       0   0       0                  0
## 138        0        0        0    0       0   0       0                  0
## 139        0        0        0    0       0   0       0                  0
## 140        0        0        0    0       0   0       0                  0
## 141        0        0        0    0       1   0       0                  0
## 142        0        0        0    0       1   0       0                  0
## 143        0        0        0    0       0   0       0                  0
## 144        0        0        0    0       0   0       0                  0
## 145        0        0        0    0       0   0       0                  0
## 146        0        0        0    0       0   0       0                  0
## 147        0        0        0    0       1   0       0                  0
##       dorie.greenspan double.boiler dried.fruit drink drinks duck easter
```

```
## 1                   0              0              0     0       0     0       0
## 2                   0              0              1     0       0     0       0
## 3                   0              0              0     0       0     0       0
## 4                   0              0              0     0       0     0       0
## 5                   0              0              0     0       0     0       0
## 6                   0              0              0     0       0     0       0
## 7                   0              0              0     0       0     0       1
## 8                   0              0              0     0       0     0       0
## 9                   0              0              0     0       0     0       0
## 10                  0              0              0     0       0     0       0
## 11                  0              0              0     0       0     0       0
## 12                  0              0              0     0       0     0       0
## 13                  0              0              0     0       0     0       0
## 14                  0              0              0     0       0     0       0
## 15                  0              0              0     0       0     0       0
## 16                  0              0              0     0       0     0       0
## 17                  0              0              0     0       0     0       0
## 18                  0              0              0     0       0     0       0
## 19                  0              0              0     0       0     0       0
## 20                  0              0              0     0       0     0       0
## 21                  0              0              0     0       0     0       0
## 116             0      0
## 117             0      0
## 118             0      0
## 119             0      0
## 120             0      0
## 121             0      0
## 122             0      0
## 123             0      0
## 124             0      0
## 125             0      0
## 126             0      0
## 127             0      0
## 128             0      0
## 129             0      0
## 130             0      0
## 131             0      0
## 132             0      0
## 133             0      0
## 134             0      0
## 135             0      0
## 136             0      0
## 137             0      0
## 138             0      0
## 139             0      0
## 140             0      0
## 141             0      0
## 142             0      0
## 143             0      0
## 144             0      0
```

```
## 145            0      0
## 146            0      0
## 147            0      1
##  [ reached getOption("max.print") -- omitted 19905 rows ]
```

```
head(data, n=10)
```

```
##                                                    title rating
## 1                           Lentil, Apple, and Turkey Wrap   2.500
## 2               Boudin Blanc Terrine with Red Onion Confit   4.375
## 3                             Potato and Fennel Soup Hodge   3.750
## 4                         Mahi-Mahi in Tomato Olive Sauce   5.000
## 5                               Spinach Noodle Casserole   3.125
## 6                                           The Best Blts   4.375
## 7   Ham and Spring Vegetable Salad with Shallot Vinaigrette   4.375
## 8                                     Spicy-Sweet Kumquats   3.750
## 9                                   Korean Marinated Beef   4.375
## 10 Ham Persillade with Mustard Potato Salad and Mashed Peas   3.750
##    calories protein fat sodium X.cakeweek X.wasteless X22.minute.meals
## 1       426      30   7    559          0           0                0
## 2       403      18  23   1439          0           0                0
## 3       165       6   7    165          0           0                0
## 4        NA      NA  NA     NA          0           0                0
## 5       547      20  32    452          0           0                0
## 6       948      19  79   1042          0           0                0
## 7        NA      NA  NA     NA          0           0                0
## 8        NA      NA  NA     NA          0           0                0
## 9       170       7  10   1272          0           0                0
## 10      602      23  41   1696          0           0                0
##    X3.ingredient.recipes X30.days.of.groceries advance.prep.required
```

```
## [12541] 4.375 4.375 3.125 4.375 3.750 5.000 4.375 4.375 4.375 3.750 4.375
## [12552] 0.000 4.375 5.000 3.750 4.375 4.375 0.000 4.375 3.125 3.750 5.000
## [12563] 3.750 3.750 4.375 4.375 5.000 2.500 3.125 5.000 3.750 3.125 4.375
## [12574] 4.375 3.750 5.000 5.000 3.750 2.500 4.375 5.000 4.375 3.125 4.375
## [12585] 3.750 4.375 5.000 4.375 4.375 4.375 2.500 3.750 3.125 4.375 5.000
## [12596] 3.125 3.750 0.000 4.375 3.750 4.375 0.000 4.375 3.750 0.000 5.000
## [12607] 4.375 4.375 1.250 4.375 0.000 3.750 3.750 4.375 0.000 0.000 0.000
## [12618] 4.375 0.000 4.375 3.750 4.375 4.375 3.750 5.000 5.000 4.375 3.750
## [12629] 3.750 3.750 3.750 4.375 3.750 0.000 3.750 3.750 0.000 4.375 4.375
## [12640] 3.750 1.875 3.750 4.375 5.000 3.750 3.750 3.125 4.375 2.500 4.375
## [12651] 3.750 3.750 4.375 3.125 3.750 4.375 3.750 4.375 2.500 4.375 4.375
## [12662] 4.375 4.375 3.750 3.750 5.000 3.750 4.375 2.500 0.000 0.000 4.375
## [12673] 3.125 5.000 5.000 4.375 5.000 4.375 4.375 4.375 3.750 0.000 0.000
## [12684] 4.375 0.000 4.375 4.375 3.750 3.125 4.375 4.375 4.375 3.750 4.375
## [12695] 4.375 4.375 4.375 5.000 4.375 0.000 4.375 0.000 4.375 5.000 4.375
## [12706] 4.375 5.000 4.375 5.000 3.750 4.375 5.000 3.750 4.375 4.375 5.000
## [12717] 3.750 1.250 4.375 4.375 5.000 4.375 3.750 4.375 3.750 3.750 5.000
```

```
## [12728] 4.375 3.125 5.000 5.000 5.000 1.875 3.750 3.750 3.750 0.000 4.375
## [12739] 4.375 4.375 3.750 3.750 3.125 1.250 4.375 4.375 3.750 4.375 3.750
## [12750] 3.750 4.375 3.750 3.750 4.375 4.375 4.375 2.500 3.125 4.375 4.375
## [12761] 5.000 4.375 4.375 5.000 0.000 5.000 4.375 3.750 4.375 4.375 3.125
## [12772] 3.750 3.125 3.750 3.750 4.375 0.000 5.000 5.000 3.750 4.375 1.250
## [12783] 4.375 4.375 3.750 3.750 4.375 4.375 3.750 4.375 3.125 4.375 5.000
## [12794] 5.000 3.125 3.750 3.750 3.750 5.000 4.375 5.000 5.000 5.000 3.750
## [12805] 2.500 5.000 0.000 3.125 3.750 4.375 4.375 4.375 5.000 4.375 4.375
## [12816] 3.750 5.000 4.375 0.000 5.000 3.750 5.000 4.375 4.375 1.250 4.375
## [12827] 4.375 4.375 5.000 4.375 3.750 4.375 4.375 5.000 4.375 5.000 3.750
## [12838] 2.500 3.750 4.375 0.000 5.000 4.375 4.375 3.750 3.750 4.375 3.750
## [12849] 4.375 4.375 4.375 3.750 0.000 0.000 4.375 3.750 3.750 3.750 5.000
## [12860] 3.750 4.375 4.375 0.000 4.375 0.000 4.375 0.000 4.375 0.000 3.125
## [12871] 4.375 5.000 4.375 3.750 5.000 4.375 3.125 3.750 2.500 4.375 5.000
## [12882] 3.750 3.750 5.000 0.000 1.250 3.750 4.375 3.750 4.375 3.750 5.000
## [12893] 3.750 4.375 3.125 3.750 4.375 3.750 4.375 4.375 4.375 3.750 0.000
## [12904] 4.375 3.750 4.375 4.375 4.375 3.750 5.000 3.750 4.375 3.125 3.125
## [12915] 0.000 5.000 4.375 0.000 3.750 4.375 3.750 4.375 4.375 0.000 3.750
## [12926] 3.125 3.125 3.750 4.375 5.000 0.000 4.375 3.750 0.000 5.000 4.375
## [12937] 2.500 4.375 3.750 4.375 4.375 4.375 0.000 4.375 3.750 4.375 3.750
## [12948] 4.375 3.750 5.000 4.375 4.375 3.125 4.375 4.375 0.000 4.375 3.750
## [12959] 0.000 3.750 4.375 3.125 3.750 0.000 4.375 5.000 3.125 5.000 3.750
## [12970] 3.125 3.125 5.000 4.375 4.375 0.000 3.125 0.000 3.750 3.750 4.375
## [12981] 5.000 4.375 3.750 4.375 5.000 4.375 3.125 3.750 5.000 3.750 0.000
## [12992] 0.000 5.000 5.000 4.375 4.375 4.375 0.000 5.000 3.750 0.000 3.750
## [13003] 0.000 0.000 4.375 4.375 4.375 4.375 3.750 4.375 0.000 5.000 4.375
## [13014] 4.375 4.375 3.750 4.375 4.375 0.000 4.375 4.375 0.000 4.375 3.750
## [13025] 4.375 3.125 0.000 4.375 3.750 3.750 0.000 5.000 3.750 0.000 5.000
## [13036] 5.000 4.375 3.125 3.125 4.375 3.125 4.375 5.000 4.375 3.750 3.750
## [13047] 5.000 0.000 3.750 3.750 5.000 4.375 4.375 3.750 3.750 4.375 0.000
## [13058] 3.750 3.750 3.125 5.000 3.125 4.375 4.375 3.750 3.750 3.750 3.750
## [13069] 4.375 3.750 4.375 3.125 0.000 5.000 0.000 4.375 4.375 0.000 4.375
## [13080] 0.000 3.750 2.500 4.375 4.375 4.375 0.000 5.000 3.125 2.500 4.375
## [13091] 3.125 3.750 3.750 0.000 4.375 3.750 0.000 5.000 3.750 3.750 4.375
## [13102] 4.375 0.000 3.125 3.125 5.000 3.750 4.375 4.375 3.750 4.375 3.750
## [13113] 3.750 3.750 3.750 4.375 4.375 4.375 4.375 5.000 3.750 3.750 3.750
## [13124] 3.750 0.000 3.750 4.375 0.000 3.750 4.375 4.375 4.375 3.750 4.375
## [13135] 0.000 4.375 0.000 3.750 5.000 4.375 3.125 4.375 0.000 4.375 4.375
## [13146] 4.375 4.375 4.375 4.375 4.375 3.750 5.000 4.375 3.750 3.750 3.750
## [13157] 5.000 5.000 0.000 3.750 4.375 5.000 4.375 4.375 3.125 4.375 3.125
## [13168] 4.375 5.000 3.750 5.000 5.000 4.375 5.000 5.000 3.125 4.375 4.375
## [13179] 2.500 0.000 2.500 4.375 4.375 4.375 4.375 4.375 4.375 4.375 4.375
## [13190] 3.750 3.750 2.500 4.375 4.375 3.750 3.125 4.375 0.000 4.375 1.875
## [13201] 4.375 4.375 4.375 5.000 3.750 4.375 4.375 4.375 3.125 5.000 3.750
## [13212] 4.375 3.750 0.000 4.375 4.375 5.000 0.000 0.000 4.375 5.000 0.000
## [13223] 4.375 0.000 4.375 3.125 0.000 3.750 3.750 4.375 2.500 4.375 4.375
## [13234] 4.375 4.375 3.750 3.750 3.750 3.125 5.000 4.375 4.375 0.000 0.000
## [13245] 3.750 3.125 4.375 4.375 4.375 3.750 3.125 3.125 0.000 4.375 4.375
## [13256] 4.375 0.000 3.125 3.750 0.000 5.000 3.750 4.375 3.750 4.375 1.250
## [13267] 0.000 5.000 4.375 4.375 3.750 4.375 2.500 3.125 3.750 4.375 4.375
```

```
## [13278] 5.000 3.750 5.000 4.375 1.875 4.375 5.000 4.375 3.125 3.750 0.000
## [13289] 3.750 4.375 4.375 3.125 5.000 4.375 4.375 3.125 3.125 4.375 4.375
## [19900] 4.375 4.375 3.125 4.375 3.750 4.375 3.750 4.375 5.000 4.375 3.750
## [19911] 4.375 4.375 0.000 4.375 3.125 3.750 4.375 5.000 3.750 4.375 4.375
## [19922] 4.375 4.375 4.375 3.125 4.375 3.750 3.125 4.375 4.375 4.375 0.000
## [19933] 0.000 3.750 3.750 3.750 3.125 5.000 0.000 4.375 4.375 1.250 0.000
## [19944] 0.000 5.000 4.375 4.375 3.750 3.125 3.750 3.750 3.750 3.750 3.750
## [19955] 4.375 4.375 5.000 0.000 0.000 4.375 0.000 3.750 4.375 4.375 3.750
## [19966] 3.750 3.125 4.375 0.000 3.750 3.750 3.125 4.375 4.375 4.375 0.000
## [19977] 5.000 4.375 4.375 3.750 5.000 4.375 3.750 4.375 4.375 3.750 3.750
## [19988] 3.750 0.000 4.375 5.000 5.000 0.000 4.375 2.500 2.500 3.750 4.375
## [19999] 0.000 4.375 0.000 3.750 5.000 5.000 3.750 3.750 4.375 4.375 3.125
## [20010] 4.375 5.000 0.000 3.750 5.000 4.375 3.125 4.375 4.375 5.000 4.375
## [20021] 3.750 3.750 3.750 5.000 4.375 5.000 4.375 3.750 5.000 0.000 3.125
## [20032] 3.125 4.375 2.500 2.500 5.000 3.750 3.750 3.750 3.125 4.375 4.375
## [20043] 4.375 4.375
##
## $`1`
## [1] 3.750 3.750 4.375 4.375 3.750 4.375 4.375 5.000
```

```
# Loading arules package
require(arules)
```

```
## Loading required package: arules
```

```
## Loading required package: Matrix
```

```
##
## Attaching package: 'arules'
```

```
## The following objects are masked from 'package:base':
##
##     abbreviate, write
```

```
require(arulesViz)
```

```
## Loading required package: arulesViz
```

```
## Loading required package: grid
```

```
# Convert data to transaction level
dt2 = as(dt,"transactions")
```

```
## Warning in asMethod(object): removing duplicated items in transactions
```

```
dt2
```

```
## transactions in sparse format with
##  2 transactions (rows) and
##  8 items (columns)
```

```
summary(dt2)
```

```
## transactions as itemMatrix in sparse format with
##  2 rows (elements/itemsets/transactions) and
##  8 columns (items) and a density of 0.6875
##
## most frequent items:
##    3.75   4.375       5       0    1.25 (Other)
##       2       2       2       1       1       3
##
## element (itemset/transaction) length distribution:
## sizes
## 3 8
## 1 1
##
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    3.00    4.25    5.50    5.50    6.75    8.00
##
## includes extended item information - examples:
##   labels
## 1      0
## 2   1.25
## 3  1.875
##
## includes extended transaction information - examples:
##   transactionID
## 1             0
## 2             1
```

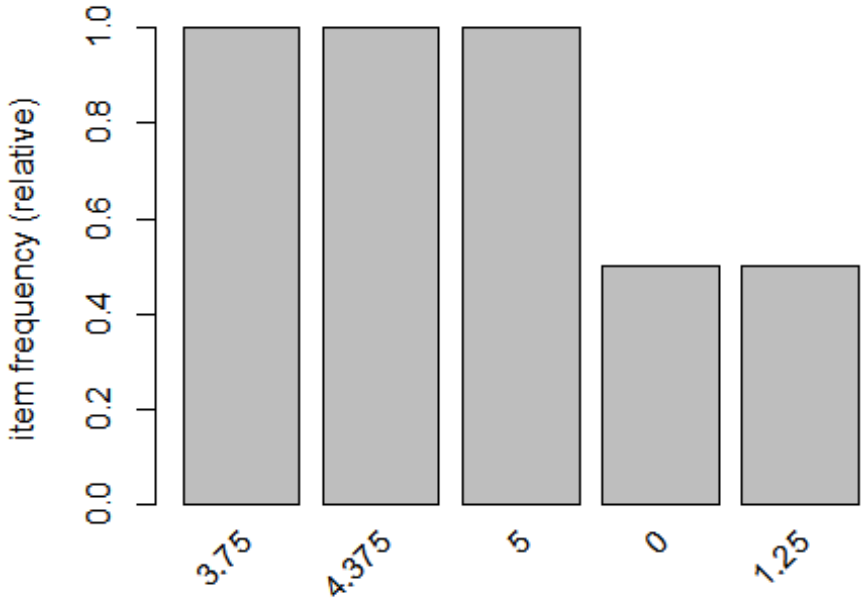
```
inspect(dt2)
```

```
##     items                                   transactionID
## [1] {0,1.25,1.875,2.5,3.125,3.75,4.375,5} 0
## [2] {3.75,4.375,5}                          1
```

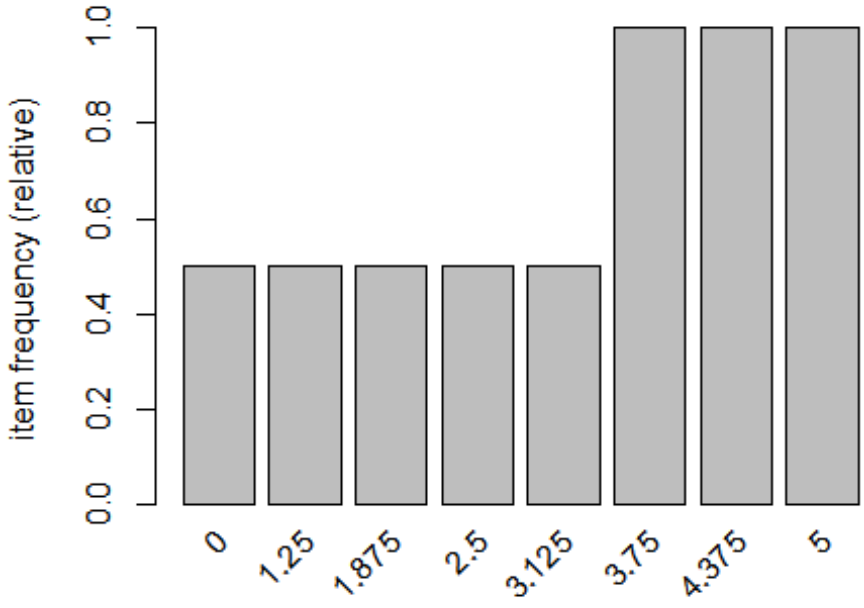
```
# Most Frequent Items
itemFrequency(dt2, type = "relative")
```

```
##     0  1.25 1.875   2.5 3.125  3.75 4.375     5
##   0.5   0.5   0.5   0.5   0.5   1.0   1.0   1.0
```

```
itemFrequencyPlot(dt2,topN = 5)
```




```
# with support parameters
itemFrequency(dt2, type = "relative")

##     0  1.25 1.875   2.5 3.125  3.75 4.375     5
##   0.5   0.5   0.5   0.5   0.5   1.0   1.0   1.0

itemFrequencyPlot(dt2,support= 0.10)
```




```
# aggregated data
rules = apriori(dt2, parameter=list(support=0.005, confidence=0.8))

## Apriori
##
## Parameter specification:
##  confidence minval smax arem  aval originalSupport maxtime support minlen
##         0.8    0.1    1 none FALSE            TRUE       5   0.005      1
##  maxlen target   ext
##      10  rules FALSE
##
## Algorithmic control:
##  filter tree heap memopt load sort verbose
##     0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 0
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[8 item(s), 2 transaction(s)] done [0.00s].
## sorting and recoding items ... [8 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4 5 6 7 8 done [0.00s].
## writing ... [984 rule(s)] done [0.00s].
## creating S4 object  ... done [0.00s].

rules = apriori(dt2, parameter=list(support=0.005, confidence=0.8, minlen = 3
))
```

```
## Apriori
##
## Parameter specification:
##  confidence minval smax arem  aval originalSupport maxtime support minlen
##         0.8    0.1    1 none FALSE            TRUE       5   0.005      3
##  maxlen target   ext
##      10  rules FALSE
##
## Algorithmic control:
##  filter tree heap memopt load sort verbose
##     0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 0
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[8 item(s), 2 transaction(s)] done [0.00s].
## sorting and recoding items ... [8 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4 5 6 7 8 done [0.00s].
## writing ... [940 rule(s)] done [0.00s].
## creating S4 object  ... done [0.00s].
```

```
rules = apriori(dt2, parameter=list(support=0.005, confidence=0.8, maxlen = 4
))
```

```
## Apriori
##
## Parameter specification:
##  confidence minval smax arem  aval originalSupport maxtime support minlen
##         0.8    0.1    1 none FALSE            TRUE       5   0.005      1
##  maxlen target   ext
##       4  rules FALSE
##
## Algorithmic control:
##  filter tree heap memopt load sort verbose
##     0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 0
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[8 item(s), 2 transaction(s)] done [0.00s].
## sorting and recoding items ... [8 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4

## Warning in apriori(dt2, parameter = list(support = 0.005, confidence =
## 0.8, : Mining stopped (maxlen reached). Only patterns up to a length of 4
## returned!
```

```
##  done [0.00s].
## writing ... [472 rule(s)] done [0.00s].
## creating S4 object  ... done [0.00s].

rules

## set of 472 rules

summary(rules)

## set of 472 rules
##
## rule length distribution (lhs + rhs):sizes
##   1   2   3   4
##   3  41 153 275
##
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   1.000   3.000   4.000   3.483   4.000   4.000
##
## summary of quality measures:
##     support         confidence      lift           count
##  Min.   :0.5000   Min.   :1    Min.   :1.000   Min.   :1.000
##  1st Qu.:0.5000   1st Qu.:1    1st Qu.:1.000   1st Qu.:1.000
##  Median :0.5000   Median :1    Median :2.000   Median :1.000
##  Mean   :0.5127   Mean   :1    Mean   :1.593   Mean   :1.025
##  3rd Qu.:0.5000   3rd Qu.:1    3rd Qu.:2.000   3rd Qu.:1.000
##  Max.   :1.0000   Max.   :1    Max.   :2.000   Max.   :2.000
##
## mining info:
##  data ntransactions support confidence
##   dt2             2   0.005        0.8

inspect(rules[1:10]) # to view first 10 rules

##      lhs         rhs     support confidence lift count
## [1]  {}      => {3.75}  1.0     1          1    2
## [2]  {}      => {4.375} 1.0     1          1    2
## [3]  {}      => {5}     1.0     1          1    2
## [4]  {0}     => {1.25}  0.5     1          2    1
## [5]  {1.25}  => {0}     0.5     1          2    1
## [6]  {0}     => {1.875} 0.5     1          2    1
## [7]  {1.875} => {0}     0.5     1          2    1
## [8]  {0}     => {2.5}   0.5     1          2    1
## [9]  {2.5}   => {0}     0.5     1          2    1
## [10] {0}     => {3.125} 0.5     1          2    1

#Convert rules into data frame
rules3 = as(rules, "data.frame")
write(rules, "C:/Users/Seshan/Desktop/PCA//rules2.csv", sep=",")
```

```r
# Show only particular product rules
inspect( subset( rules, subset = rhs %pin% "0" )[1:10])
```

```
##      lhs              rhs support confidence lift count
## [1]  {1.25}       => {0} 0.5     1          2    1
## [2]  {1.875}      => {0} 0.5     1          2    1
## [3]  {2.5}        => {0} 0.5     1          2    1
## [4]  {3.125}      => {0} 0.5     1          2    1
## [5]  {1.25,1.875} => {0} 0.5     1          2    1
## [6]  {1.25,2.5}   => {0} 0.5     1          2    1
## [7]  {1.25,3.125} => {0} 0.5     1          2    1
## [8]  {1.25,3.75}  => {0} 0.5     1          2    1
## [9]  {1.25,4.375} => {0} 0.5     1          2    1
## [10] {1.25,5}     => {0} 0.5     1          2    1
```

```r
# Show the top 10 rules
options(digits=2)
inspect(rules[1:10])
```

```
##      lhs        rhs     support confidence lift count
## [1]  {}      => {3.75}  1.0     1          1    2
## [2]  {}      => {4.375} 1.0     1          1    2
## [3]  {}      => {5}     1.0     1          1    2
## [4]  {0}     => {1.25}  0.5     1          2    1
## [5]  {1.25}  => {0}     0.5     1          2    1
## [6]  {0}     => {1.875} 0.5     1          2    1
## [7]  {1.875} => {0}     0.5     1          2    1
## [8]  {0}     => {2.5}   0.5     1          2    1
## [9]  {2.5}   => {0}     0.5     1          2    1
## [10] {0}     => {3.125} 0.5     1          2    1
```

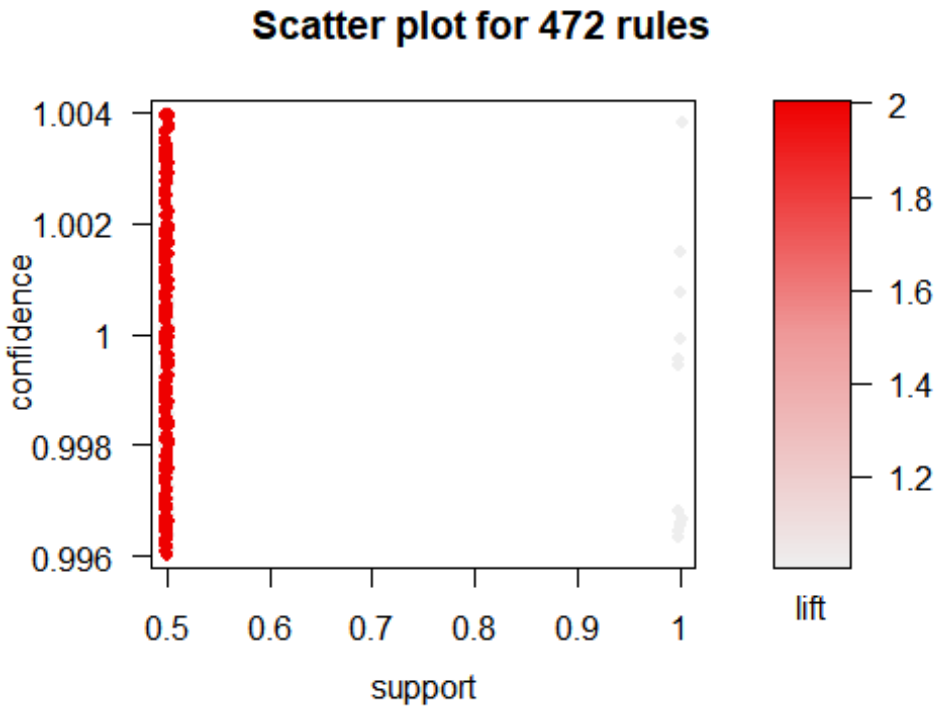
```r
# Get Summary Information

summary(rules)
```

```
## set of 472 rules
##
## rule length distribution (lhs + rhs):sizes
##   1   2   3   4
##   3  41 153 275
##
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     1.0     3.0     4.0     3.5     4.0     4.0
##
## summary of quality measures:
##     support       confidence      lift          count
##  Min.   :0.50   Min.   :1    Min.   :1.00   Min.   :1.00
##  1st Qu.:0.50   1st Qu.:1    1st Qu.:1.00   1st Qu.:1.00
##  Median :0.50   Median :1    Median :2.00   Median :1.00
##  Mean   :0.51   Mean   :1    Mean   :1.59   Mean   :1.03
##  3rd Qu.:0.50   3rd Qu.:1    3rd Qu.:2.00   3rd Qu.:1.00
```

```
##  Max.   :1.00   Max.   :1    Max.   :2.00   Max.   :2.00
##
## mining info:
##  data ntransactions support confidence
##   dt2             2   0.005        0.8
```

```
plot(rules)
```

```
## To reduce overplotting, jitter is added! Use jitter = 0 to prevent jitter.
```




```
plot(rules, method = "graph", interactive = T)
```

```
## Warning in plot.rules(rules, method = "graph", interactive = T): The
## parameter interactive is deprecated. Use engine='interactive' instead.
```

```
## Warning: plot: Too many rules supplied. Only plotting the best 100 rules
## using 'support' (change control parameter max if needed)
```

```
# Sort by Lift
rules<-sort(rules, by="lift", decreasing=TRUE)
```

```
# Sort by Lift
rules<-sort(rules, by="lift", decreasing=TRUE)
```

```
# Remove Unnecessary Rules
subset.matrix <- is.subset(rules, rules)
subset.matrix[lower.tri(subset.matrix, diag=T)] <- NA
```

```
## Warning in `[<-`(`*tmp*`, as.vector(i), value = NA): x[.] <- val: x is
## "ngTMatrix", val not in {TRUE, FALSE} is coerced; NA |--> TRUE.
```

```
redundant <- colSums(subset.matrix, na.rm=T) >= 1
which(redundant)
```

```
##                 {0,1.25}                 {0,1.25}                {0,1.875}
##                        1                        2                        3
##                {0,1.875}                  {0,2.5}                  {0,2.5}
##                        4                        5                        6
##                {0,3.125}                {0,3.125}             {1.25,1.875}
##                        7                        8                        9
##             {1.25,1.875}                {1.25,2.5}                {1.25,2.5}
##                       10                       11                       12
##             {1.25,3.125}             {1.25,3.125}              {1.875,2.5}
##                       13                       14                       15
##              {1.875,2.5}             {1.875,3.125}             {1.875,3.125}
##                       16                       17                       18
##              {2.5,3.125}               {2.5,3.125}           {0,1.25,1.875}
##                       19                       20                       21
##           {0,1.25,1.875}           {0,1.25,1.875}              {0,1.25,2.5}
##                       22                       23                       24
##             {0,1.25,2.5}               {0,1.25,2.5}           {0,1.25,3.125}
##                       25                       26                       27
##           {0,1.25,3.125}           {0,1.25,3.125}            {0,1.25,3.75}
##                       28                       29                       30
##            {0,1.25,3.75}            {0,1.25,4.375}           {0,1.25,4.375}
##                       31                       32                       33
##               {0,1.25,5}                 {0,1.25,5}             {0,1.875,2.5}
##                       34                       35                       36
##             {0,1.875,2.5}              {0,1.875,2.5}           {0,1.875,3.125}
##                       37                       38                       39
##          {0,1.875,3.125}          {0,1.875,3.125}            {0,1.875,3.75}
##                       40                       41                       42
##           {0,1.875,3.75}           {0,1.875,4.375}           {0,1.875,4.375}
##                       43                       44                       45
##              {0,1.875,5}                {0,1.875,5}              {0,2.5,3.125}
##                       46                       47                       48
##             {0,2.5,3.125}              {0,2.5,3.125}              {0,2.5,3.75}
##                       49                       50                       51
##             {0,2.5,3.75}              {0,2.5,4.375}              {0,2.5,4.375}
##                       52                       53                       54
##                {0,2.5,5}                  {0,2.5,5}            {0,3.125,3.75}
##                       55                       56                       57
##           {0,3.125,3.75}           {0,3.125,4.375}           {0,3.125,4.375}
##                       58                       59                       60
##              {0,3.125,5}                {0,3.125,5}           {1.25,1.875,2.5}
##                       61                       62                       63
##          {1.25,1.875,2.5}         {1.25,1.875,2.5}         {1.25,1.875,3.125}
##                       64                       65                       66
```

```
##       {1.25,1.875,3.125}       {1.25,1.875,3.125}        {1.25,1.875,3.75}
##                       67                       68                       69
##        {1.25,1.875,3.75}       {1.25,1.875,4.375}       {1.25,1.875,4.375}
##                       70                       71                       72
##           {1.25,1.875,5}           {1.25,1.875,5}         {1.25,2.5,3.125}
##                       73                       74                       75
##         {1.25,2.5,3.125}         {1.25,2.5,3.125}          {1.25,2.5,3.75}
##                       76                       77                       78
##          {1.25,2.5,3.75}         {1.25,2.5,4.375}         {1.25,2.5,4.375}
##                       79                       80                       81
##             {1.25,2.5,5}             {1.25,2.5,5}        {1.25,3.125,3.75}
##                       82                       83                       84
##        {1.25,3.125,3.75}       {1.25,3.125,4.375}       {1.25,3.125,4.375}
##                       85                       86                       87
##           {1.25,3.125,5}           {1.25,3.125,5}        {1.875,2.5,3.125}
##                       88                       89                       90
##        {1.875,2.5,3.125}        {1.875,2.5,3.125}         {1.875,2.5,3.75}
##                       91                       92                       93
##         {1.875,2.5,3.75}         {1.875,2.5,4.375}        {1.875,2.5,4.375}
##                       94                       95                       96
##           {1.875,2.5,5}            {1.875,2.5,5}       {1.875,3.125,3.75}
##                       97                       98                       99
##       {1.875,3.125,3.75}      {1.875,3.125,4.375}      {1.875,3.125,4.375}
##                      100                      101                      102
##          {1.875,3.125,5}          {1.875,3.125,5}          {2.5,3.125,3.75}
##                      103                      104                      105
##         {2.5,3.125,3.75}         {2.5,3.125,4.375}         {2.5,3.125,4.375}
##                      106                      107                      108
##            {2.5,3.125,5}            {2.5,3.125,5}       {0,1.25,1.875,2.5}
##                      109                      110                      111
##       {0,1.25,1.875,2.5}       {0,1.25,1.875,2.5}       {0,1.25,1.875,2.5}
##                      112                      113                      114
##     {0,1.25,1.875,3.125}     {0,1.25,1.875,3.125}     {0,1.25,1.875,3.125}
##                      115                      116                      117
##     {0,1.25,1.875,3.125}      {0,1.25,1.875,3.75}      {0,1.25,1.875,3.75}
##                      118                      119                      120
##      {0,1.25,1.875,3.75}     {0,1.25,1.875,4.375}     {0,1.25,1.875,4.375}
##                      121                      122                      123
##     {0,1.25,1.875,4.375}         {0,1.25,1.875,5}         {0,1.25,1.875,5}
##                      124                      125                      126
##         {0,1.25,1.875,5}       {0,1.25,2.5,3.125}       {0,1.25,2.5,3.125}
##                      127                      128                      129
##       {0,1.25,2.5,3.125}       {0,1.25,2.5,3.125}        {0,1.25,2.5,3.75}
##                      130                      131                      132
##        {0,1.25,2.5,3.75}        {0,1.25,2.5,3.75}       {0,1.25,2.5,4.375}
##                      133                      134                      135
##       {0,1.25,2.5,4.375}       {0,1.25,2.5,4.375}           {0,1.25,2.5,5}
##                      136                      137                      138
##           {0,1.25,2.5,5}           {0,1.25,2.5,5}      {0,1.25,3.125,3.75}
##                      139                      140                      141
```

```
##      {0,1.25,3.125,3.75}      {0,1.25,3.125,3.75}     {0,1.25,3.125,4.375}
##                      142                      143                      144
##     {0,1.25,3.125,4.375}     {0,1.25,3.125,4.375}        {0,1.25,3.125,5}
##                      145                      146                      147
##        {0,1.25,3.125,5}        {0,1.25,3.125,5}     {0,1.25,3.75,4.375}
##                      148                      149                      150
##      {0,1.25,3.75,4.375}         {0,1.25,3.75,5}         {0,1.25,3.75,5}
##                      151                      152                      153
##        {0,1.25,4.375,5}        {0,1.25,4.375,5}     {0,1.875,2.5,3.125}
##                      154                      155                      156
##      {0,1.875,2.5,3.125}     {0,1.875,2.5,3.125}     {0,1.875,2.5,3.125}
##                      157                      158                      159
##       {0,1.875,2.5,3.75}      {0,1.875,2.5,3.75}      {0,1.875,2.5,3.75}
##                      160                      161                      162
##      {0,1.875,2.5,4.375}     {0,1.875,2.5,4.375}     {0,1.875,2.5,4.375}
##                      163                      164                      165
##          {0,1.875,2.5,5}         {0,1.875,2.5,5}         {0,1.875,2.5,5}
##                      166                      167                      168
##     {0,1.875,3.125,3.75}    {0,1.875,3.125,3.75}    {0,1.875,3.125,3.75}
##                      169                      170                      171
##    {0,1.875,3.125,4.375}   {0,1.875,3.125,4.375}   {0,1.875,3.125,4.375}
##                      172                      173                      174
##        {0,1.875,3.125,5}       {0,1.875,3.125,5}       {0,1.875,3.125,5}
##                      175                      176                      177
##     {0,1.875,3.75,4.375}    {0,1.875,3.75,4.375}        {0,1.875,3.75,5}
##                      178                      179                      180
##        {0,1.875,3.75,5}        {0,1.875,4.375,5}       {0,1.875,4.375,5}
##                      181                      182                      183
##       {0,2.5,3.125,3.75}      {0,2.5,3.125,3.75}      {0,2.5,3.125,3.75}
##                      184                      185                      186
##      {0,2.5,3.125,4.375}     {0,2.5,3.125,4.375}     {0,2.5,3.125,4.375}
##                      187                      188                      189
##          {0,2.5,3.125,5}         {0,2.5,3.125,5}         {0,2.5,3.125,5}
##                      190                      191                      192
##       {0,2.5,3.75,4.375}      {0,2.5,3.75,4.375}          {0,2.5,3.75,5}
##                      193                      194                      195
##           {0,2.5,3.75,5}         {0,2.5,4.375,5}         {0,2.5,4.375,5}
##                      196                      197                      198
##     {0,3.125,3.75,4.375}    {0,3.125,3.75,4.375}        {0,3.125,3.75,5}
##                      199                      200                      201
##        {0,3.125,3.75,5}        {0,3.125,4.375,5}       {0,3.125,4.375,5}
##                      202                      203                      204
##   {1.25,1.875,2.5,3.125}  {1.25,1.875,2.5,3.125}  {1.25,1.875,2.5,3.125}
##                      205                      206                      207
##   {1.25,1.875,2.5,3.125}   {1.25,1.875,2.5,3.75}   {1.25,1.875,2.5,3.75}
##                      208                      209                      210
##    {1.25,1.875,2.5,3.75}  {1.25,1.875,2.5,4.375}  {1.25,1.875,2.5,4.375}
##                      211                      212                      213
##   {1.25,1.875,2.5,4.375}      {1.25,1.875,2.5,5}      {1.25,1.875,2.5,5}
##                      214                      215                      216
```

```
##       {1.25,1.875,2.5,5}  {1.25,1.875,3.125,3.75}  {1.25,1.875,3.125,3.75}
##                      217                     218                     219
##  {1.25,1.875,3.125,3.75} {1.25,1.875,3.125,4.375} {1.25,1.875,3.125,4.375}
##                      220                     221                     222
## {1.25,1.875,3.125,4.375}     {1.25,1.875,3.125,5}     {1.25,1.875,3.125,5}
##                      223                     224                     225
##     {1.25,1.875,3.125,5}  {1.25,1.875,3.75,4.375}  {1.25,1.875,3.75,4.375}
##                      226                     227                     228
##      {1.25,1.875,3.75,5}     {1.25,1.875,3.75,5}     {1.25,1.875,4.375,5}
##                      229                     230                     231
##     {1.25,1.875,4.375,5}    {1.25,2.5,3.125,3.75}    {1.25,2.5,3.125,3.75}
##                      232                     233                     234
##    {1.25,2.5,3.125,3.75}   {1.25,2.5,3.125,4.375}   {1.25,2.5,3.125,4.375}
##                      235                     236                     237
##   {1.25,2.5,3.125,4.375}       {1.25,2.5,3.125,5}       {1.25,2.5,3.125,5}
##                      238                     239                     240
##       {1.25,2.5,3.125,5}    {1.25,2.5,3.75,4.375}    {1.25,2.5,3.75,4.375}
##                      241                     242                     243
##        {1.25,2.5,3.75,5}        {1.25,2.5,3.75,5}       {1.25,2.5,4.375,5}
##                      244                     245                     246
##       {1.25,2.5,4.375,5}  {1.25,3.125,3.75,4.375}  {1.25,3.125,3.75,4.375}
##                      247                     248                     249
##      {1.25,3.125,3.75,5}     {1.25,3.125,3.75,5}     {1.25,3.125,4.375,5}
##                      250                     251                     252
##     {1.25,3.125,4.375,5}   {1.875,2.5,3.125,3.75}   {1.875,2.5,3.125,3.75}
##                      253                     254                     255
##    {1.875,2.5,3.125,3.75}  {1.875,2.5,3.125,4.375}  {1.875,2.5,3.125,4.375}
##                      256                     257                     258
##  {1.875,2.5,3.125,4.375}     {1.875,2.5,3.125,5}     {1.875,2.5,3.125,5}
##                      259                     260                     261
##      {1.875,2.5,3.125,5}   {1.875,2.5,3.75,4.375}   {1.875,2.5,3.75,4.375}
##                      262                     263                     264
##       {1.875,2.5,3.75,5}      {1.875,2.5,3.75,5}      {1.875,2.5,4.375,5}
##                      265                     266                     267
##      {1.875,2.5,4.375,5} {1.875,3.125,3.75,4.375} {1.875,3.125,3.75,4.375}
##                      268                     269                     270
##     {1.875,3.125,3.75,5}    {1.875,3.125,3.75,5}    {1.875,3.125,4.375,5}
##                      271                     272                     273
##    {1.875,3.125,4.375,5}   {2.5,3.125,3.75,4.375}   {2.5,3.125,3.75,4.375}
##                      274                     275                     276
##       {2.5,3.125,3.75,5}      {2.5,3.125,3.75,5}      {2.5,3.125,4.375,5}
##                      277                     278                     279
##      {2.5,3.125,4.375,5}                  {3.75}                  {4.375}
##                      280                     281                     282
##                      {5}                {0,3.75}                {0,4.375}
##                      283                     284                     285
##                    {0,5}             {1.25,3.75}             {1.25,4.375}
##                      286                     287                     288
##                 {1.25,5}            {1.875,3.75}            {1.875,4.375}
##                      289                     290                     291
```

```
##                {1.875,5}              {2.5,3.75}             {2.5,4.375}
##                      292                     293                     294
##                  {2.5,5}            {3.125,3.75}           {3.125,4.375}
##                      295                     296                     297
##                {3.125,5}            {3.75,4.375}            {3.75,4.375}
##                      298                     299                     300
##                 {3.75,5}                {3.75,5}                {4.375,5}
##                      301                     302                     303
##                {4.375,5}            {0,1.25,3.75}           {0,1.25,4.375}
##                      304                     305                     306
##               {0,1.25,5}           {0,1.875,3.75}          {0,1.875,4.375}
##                      307                     308                     309
##              {0,1.875,5}             {0,2.5,3.75}            {0,2.5,4.375}
##                      310                     311                     312
##               {0,2.5,5}           {0,3.125,3.75}          {0,3.125,4.375}
##                      313                     314                     315
##              {0,3.125,5}           {0,3.75,4.375}          {0,3.75,4.375}
##                      316                     317                     318
##               {0,3.75,5}              {0,3.75,5}              {0,4.375,5}
##                      319                     320                     321
##              {0,4.375,5}         {1.25,1.875,3.75}       {1.25,1.875,4.375}
##                      322                     323                     324
##           {1.25,1.875,5}           {1.25,2.5,3.75}         {1.25,2.5,4.375}
##                      325                     326                     327
##             {1.25,2.5,5}         {1.25,3.125,3.75}       {1.25,3.125,4.375}
##                      328                     329                     330
##           {1.25,3.125,5}         {1.25,3.75,4.375}       {1.25,3.75,4.375}
##                      331                     332                     333
##            {1.25,3.75,5}              {1.25,3.75,5}           {1.25,4.375,5}
##                      334                     335                     336
##           {1.25,4.375,5}          {1.875,2.5,3.75}        {1.875,2.5,4.375}
##                      337                     338                     339
##            {1.875,2.5,5}        {1.875,3.125,3.75}      {1.875,3.125,4.375}
##                      340                     341                     342
##          {1.875,3.125,5}        {1.875,3.75,4.375}      {1.875,3.75,4.375}
##                      343                     344                     345
##           {1.875,3.75,5}              {1.875,3.75,5}          {1.875,4.375,5}
##                      346                     347                     348
##          {1.875,4.375,5}          {2.5,3.125,3.75}        {2.5,3.125,4.375}
##                      349                     350                     351
##            {2.5,3.125,5}          {2.5,3.75,4.375}        {2.5,3.75,4.375}
##                      352                     353                     354
##             {2.5,3.75,5}              {2.5,3.75,5}            {2.5,4.375,5}
##                      355                     356                     357
##            {2.5,4.375,5}        {3.125,3.75,4.375}      {3.125,3.75,4.375}
##                      358                     359                     360
##           {3.125,3.75,5}              {3.125,3.75,5}          {3.125,4.375,5}
##                      361                     362                     363
##          {3.125,4.375,5}              {3.75,4.375,5}          {3.75,4.375,5}
##                      364                     365                     366
```

```
##          {3.75,4.375,5}     {0,1.25,1.875,3.75}     {0,1.25,1.875,4.375}
##                     367                     368                     369
##       {0,1.25,1.875,5}       {0,1.25,2.5,3.75}       {0,1.25,2.5,4.375}
##                     370                     371                     372
##         {0,1.25,2.5,5}     {0,1.25,3.125,3.75}     {0,1.25,3.125,4.375}
##                     373                     374                     375
##       {0,1.25,3.125,5}     {0,1.25,3.75,4.375}      {0,1.25,3.75,4.375}
##                     376                     377                     378
##        {0,1.25,3.75,5}         {0,1.25,3.75,5}         {0,1.25,4.375,5}
##                     379                     380                     381
##       {0,1.25,4.375,5}      {0,1.875,2.5,3.75}      {0,1.875,2.5,4.375}
##                     382                     383                     384
##        {0,1.875,2.5,5}     {0,1.875,3.125,3.75}    {0,1.875,3.125,4.375}
##                     385                     386                     387
##       {0,1.875,3.125,5}     {0,1.875,3.75,4.375}     {0,1.875,3.75,4.375}
##                     388                     389                     390
##       {0,1.875,3.75,5}        {0,1.875,3.75,5}        {0,1.875,4.375,5}
##                     391                     392                     393
##       {0,1.875,4.375,5}       {0,2.5,3.125,3.75}      {0,2.5,3.125,4.375}
##                     394                     395                     396
##         {0,2.5,3.125,5}       {0,2.5,3.75,4.375}       {0,2.5,3.75,4.375}
##                     397                     398                     399
##          {0,2.5,3.75,5}          {0,2.5,3.75,5}          {0,2.5,4.375,5}
##                     400                     401                     402
##         {0,2.5,4.375,5}     {0,3.125,3.75,4.375}     {0,3.125,3.75,4.375}
##                     403                     404                     405
##       {0,3.125,3.75,5}        {0,3.125,3.75,5}        {0,3.125,4.375,5}
##                     406                     407                     408
##       {0,3.125,4.375,5}        {0,3.75,4.375,5}         {0,3.75,4.375,5}
##                     409                     410                     411
##        {0,3.75,4.375,5}    {1.25,1.875,2.5,3.75}   {1.25,1.875,2.5,4.375}
##                     412                     413                     414
##      {1.25,1.875,2.5,5}  {1.25,1.875,3.125,3.75} {1.25,1.875,3.125,4.375}
##                     415                     416                     417
##    {1.25,1.875,3.125,5}  {1.25,1.875,3.75,4.375}  {1.25,1.875,3.75,4.375}
##                     418                     419                     420
##     {1.25,1.875,3.75,5}     {1.25,1.875,3.75,5}     {1.25,1.875,4.375,5}
##                     421                     422                     423
##    {1.25,1.875,4.375,5}    {1.25,2.5,3.125,3.75}   {1.25,2.5,3.125,4.375}
##                     424                     425                     426
##      {1.25,2.5,3.125,5}    {1.25,2.5,3.75,4.375}    {1.25,2.5,3.75,4.375}
##                     427                     428                     429
##       {1.25,2.5,3.75,5}       {1.25,2.5,3.75,5}       {1.25,2.5,4.375,5}
##                     430                     431                     432
##      {1.25,2.5,4.375,5}  {1.25,3.125,3.75,4.375}  {1.25,3.125,3.75,4.375}
##                     433                     434                     435
##     {1.25,3.125,3.75,5}     {1.25,3.125,3.75,5}     {1.25,3.125,4.375,5}
##                     436                     437                     438
##    {1.25,3.125,4.375,5}     {1.25,3.75,4.375,5}      {1.25,3.75,4.375,5}
##                     439                     440                     441
```

```
##      {1.25,3.75,4.375,5}   {1.875,2.5,3.125,3.75}  {1.875,2.5,3.125,4.375}
##                      442                      443                      444
##      {1.875,2.5,3.125,5}   {1.875,2.5,3.75,4.375}   {1.875,2.5,3.75,4.375}
##                      445                      446                      447
##       {1.875,2.5,3.75,5}       {1.875,2.5,3.75,5}      {1.875,2.5,4.375,5}
##                      448                      449                      450
##      {1.875,2.5,4.375,5} {1.875,3.125,3.75,4.375} {1.875,3.125,3.75,4.375}
##                      451                      452                      453
##     {1.875,3.125,3.75,5}     {1.875,3.125,3.75,5}    {1.875,3.125,4.375,5}
##                      454                      455                      456
##    {1.875,3.125,4.375,5}     {1.875,3.75,4.375,5}     {1.875,3.75,4.375,5}
##                      457                      458                      459
##     {1.875,3.75,4.375,5}   {2.5,3.125,3.75,4.375}   {2.5,3.125,3.75,4.375}
##                      460                      461                      462
##       {2.5,3.125,3.75,5}       {2.5,3.125,3.75,5}      {2.5,3.125,4.375,5}
##                      463                      464                      465
##      {2.5,3.125,4.375,5}       {2.5,3.75,4.375,5}       {2.5,3.75,4.375,5}
##                      466                      467                      468
##       {2.5,3.75,4.375,5}     {3.125,3.75,4.375,5}     {3.125,3.75,4.375,5}
##                      469                      470                      471
##     {3.125,3.75,4.375,5}
##                      472
```

```
rules.pruned <- rules[!redundant]
rules<-rules.pruned
rules
```

```
## set of 0 rules
```

```
#Clean Rules
rules3$rules=gsub("\\{", "", rules3$rules)
rules3$rules=gsub("\\}", "", rules3$rules)
rules3$rules=gsub("\"", "", rules3$rules)

#Split the rule
library(splitstackshape)
Rules4=cSplit(rules3, "rules","=>")
names(Rules4)[names(Rules4) == 'rules_1'] <- 'LHS'
Rules5=cSplit(Rules4, "LHS",",")
Rules6=subset(Rules5, select= -c(rules_2))
names(Rules6)[names(Rules6) == 'rules_3'] <- 'RHS'

# What are customers likely to buy before they purchase "Product A"
rules<-apriori(data=dt, parameter=list(supp=0.001,conf = 0.8),
               appearance = list(default="lhs",rhs="0"),
               control = list(verbose=F))
```

```
## Warning in asMethod(object): removing duplicated items in transactions
```

```
rules<-sort(rules, decreasing=TRUE,by="confidence")
inspect(rules[1:5])
```

```
##     lhs             rhs support confidence lift count
## [1] {1.25}       => {0} 0.5     1          2    1
## [2] {1.875}      => {0} 0.5     1          2    1
## [3] {2.5}        => {0} 0.5     1          2    1
## [4] {3.125}      => {0} 0.5     1          2    1
## [5] {1.25,1.875} => {0} 0.5     1          2    1
```

```
# What are customers likely to buy if they purchased "Product A"
rules<-apriori(data=dt, parameter=list(supp=0.001,conf = 0.8),
               appearance = list(default="rhs",lhs="0"),
               control = list(verbose=F))
```

```
## Warning in asMethod(object): removing duplicated items in transactions
```

```
rules<-sort(rules, decreasing=TRUE,by="confidence")
inspect(rules[1:5])
```

```
##     lhs    rhs     support confidence lift count
## [1] {}  => {3.75}  1.0     1          1    2
## [2] {}  => {4.375} 1.0     1          1    2
## [3] {}  => {5}     1.0     1          1    2
## [4] {0} => {1.25}  0.5     1          2    1
## [5] {0} => {1.875} 0.5     1          2    1
```

```
rules
```

```
## set of 10 rules
```

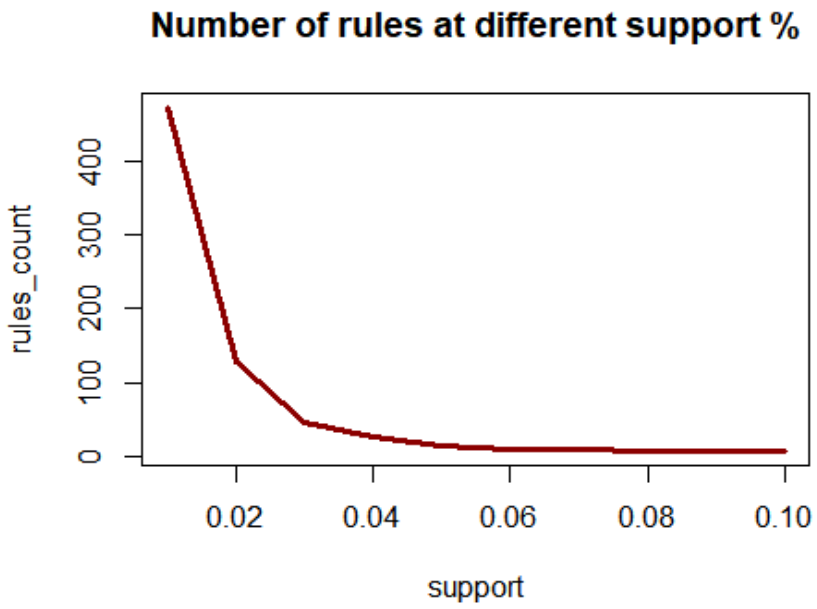
```
support<-seq(0.01,0.1,0.01)
support
```

```
##  [1] 0.01 0.02 0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10
```

```
rules_count<-c(472,128,46,26,14, 10, 10,8,8,8)
rules_count
```

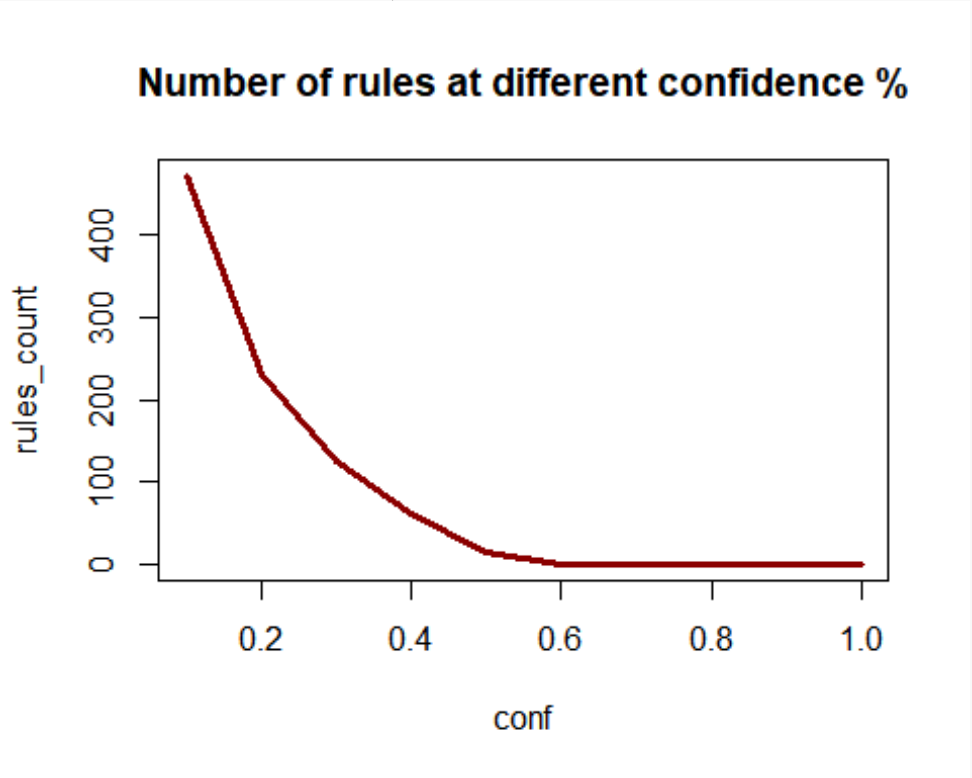
```
##  [1] 472 128  46  26  14  10  10   8   8   8
```

```
plot(support,rules_count,type = "l",main="Number of rules at different suppor
t %",
     col="darkred",lwd=3)
```




```
conf<-seq(0.10,1.0,0.10)
conf

##  [1] 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0

rules_count<-c(472,231,125,62,15,0,0,0,0,0)
rules_count

##  [1] 472 231 125  62  15   0   0   0   0   0

plot(conf,rules_count,type = "l",main="Number of rules at different confidenc
e %",
```

```
     col="darkred",lwd=3)
```




```
#rules_ec <- eclat(epi_r, parameter = list(supp = 0.05))

#summary(rules_ec)

#sorting out the most relevant rules
rules<-sort(rules, by="confidence", decreasing=TRUE)
inspect(rules[1:5])

##     lhs    rhs      support confidence lift count
## [1] {}  => {3.75}  1.0     1          1    2
## [2] {}  => {4.375} 1.0     1          1    2
## [3] {}  => {5}     1.0     1          1    2
## [4] {0} => {1.25}  0.5     1          2    1
## [5] {0} => {1.875} 0.5     1          2    1

rules<-sort(rules, by="lift", decreasing=TRUE)
inspect(rules[1:5])

##     lhs    rhs      support confidence lift count
## [1] {0} => {1.25}  0.5     1          2    1
## [2] {0} => {1.875} 0.5     1          2    1
## [3] {0} => {2.5}   0.5     1          2    1
## [4] {0} => {3.125} 0.5     1          2    1
## [5] {}  => {3.75}  1.0     1          1    2
```

```
########################################
library(factoextra)

## Loading required package: ggplot2

## Welcome! Related Books: `Practical Guide To Cluster Analysis in R` at http
s://goo.gl/13EFCZ

library("factoextra")
data1<-na.exclude(data)
na.omit(data1)

##
title
## 1
Lentil, Apple, and Turkey Wrap
## 2
Boudin Blanc Terrine with Red Onion Confit
## 3
Potato and Fennel Soup Hodge
## 5
Spinach Noodle Casserole
## 6
The Best Blts
## 9
Korean Marinated Beef
## 10                                                                  Ham Persilla
de with Mustard Potato Salad and Mashed Peas
## 11
Yams Braised with Cream, Rosemary and Nutmeg
## 13                                                                    Banana-Cho
colate Chip Cake With Peanut Butter Frosting
## 14
Beef Tenderloin with Garlic and Brandy
## 15
Peach Mustard
## 16
Raw Cream of Spinach Soup
## 17
Sweet Buttermilk Spoon Breads
## 18
Crisp Braised Pork Shoulder
## 19                                                                      Mozzar
ella-Topped Peppers with Tomatoes and Garlic
## 20                                          Tuna, Asparagus, and New Potato S
alad with Chive Vinaigrette and Fried Capers
## 21                                                                   Asian Pe
ar and Watercress Salad with Sesame Dressing
## 25
Sea Salt-Roasted Pecans
## 26
```

```
Garlic Baguette Crumbs
## 27
Cucumber-Basil Egg Salad
## 28
Dried Pear Crisps
## 29                                                  Green Bean, Red Onion, and
Roast Potato Salad with Rosemary Vinaigrette
## 30
Apricot-Cherry Shortcakes
## 33                                                                      Roaste
d Sweet-Potato Spears with Bacon Vinaigrette
## 34
Deviled Ham
## 36
Aztec Chicken
## 38
Sauteed Broccoli Rabe
## 39
Grouper with Tomato and Basil
## 40
Better-Than-Pita Grill Bread
## 41
Coconut-Key Lime Sheet Cake
## 42                                                                  Baked Hal
ibut with Orzo, Spinach, and Cherry Tomatoes
## 46
Pickled Red Onions
## 47
Spicy Black Beans and Rice
## 49
Mexican Lime Soup
## 50
Citrus Salad with Mint Sugar
## 51
Mexican Chile and Mushroom Soup
## 52
Peanut Butter-Banana Muffins
## 54
Pancetta Roast Chicken with Walnut Stuffing
## 55
1977 Coconut Angel Food Cake
## 57
Veal Burgers Stuffed with Mozzarella Cheese
## 58
Pumpkin Muffins
## 59
Orange Balsamic Glaze
## 60                                                                Roasted Egg
plant and Olive Spread with Pita Bread Chips
## 61
```

```
Pecan Blue Cheese Crackers
## 62                                          Romaine, Grilled Avocado, and Sm
oky Corn Salad with Chipotle-Caesar Dressing
## 63                                                          Southwest Cor
n Bread Stuffing with Corn and Green Chilies
## 64                                                                  Coli
n Perryâ\200\231s Sorghum and Apple Sticky Pudding
## 65
Mixed Berry Pavlovas
## 67
Scarborough Fair Tofu Burger
## 68
Italian Vinaigrette
## 69                                                             White Choc
olate Tartlets with Strawberries and Bananas
## 70
Tomato-Infused Bulgur Pilaf with Fresh Basil
## 71                                                             Roasted Bu
tternut Squash, Rosemary, and Garlic Lasagne
## 72
Grilled Roast Beef and Stilton Sandwich
## 73                                                                Pear-Ha
zelnut Cheesecakes with Pear-Raspberry Sauce
## 74
Nut Butter
## 75
Cheese Ravioli with Fresh Tomato Sauce
## 76
Banana Layer Cake with Cream Cheese Frosting
## 77                                                                      S
outh American-Style JÃ-cama and Orange Salad
## 78
Roasted Acorn Squash and Chestnuts
## 79
Maple Pumpkin Pots de CrÃ¨me
## 81                                       Braised Chicken and Rice with
Orange, Saffron, Almond, and Pistachio Syrup
## 82
Horseradish Dill Potato Salad
## 83
Chicken in Green Pumpkin-Seed Sauce
## 84
Jeweled Rice
## 85
Braised Brisket with Bourbon-Peach Glaze
## 86                                                                    Gr
illed Pork Chops with Classic Barbecue Sauce
## 88
Roast Chicken With Sorghum and Squash
## 89
```

```
Asparagus with Bacon and Onion
## 92
Salmon with Chili-Mango Salsa
## 93
Turkey and Pinto Bean Chili
## 94
Cucumber-Yogurt Salad with Mint
## 95
Lamb Shanks Braised with Anise and Orange
## 96
Parsley Mayo
## 97
Acini di Pepe Pasta with Garlic and Olives
## 98                                                                  R
oast Beef Salad with Cabbage and Horseradish
## 99
Savoy Cabbage and Arugula Salad
## 100
Fennel, Beet and Orange Salad with Olives
## 101
Shrimp Gazpacho
## 103
Parsnip and Apple Soup
## 105
Stout Floats
## 106
Apricot-Pistachio Muffins Baked on the Grill
## 107
Garlic Bruschetta
## 108
Asian Noodles with Barbecued Duck Confit
## 110                                                               Banan
a Split with Curried Chocolate-Coconut Sauce
## 111
Escarole and Cheese Spoon Bread
## 112
Honey-Ginger Barbecue Sauce
## 114
Kids' Matzoh Pizza
## 115
Cranberry, Quince, and Pearl Onion Compote
## 117
Tropical Rum Punch
## 118                                                          Chickpea S
alad Sandwich With Creamy Carrot-Radish Slaw
## 119
Blackberry-Raspberry Sauce
## 120
Laddie's Sub-Bourbon
## 121
```

Red Cabbage and Onions
122
Roast Cod with Potatoes, Onions, and Olives
123
Spicy Tomato Sauce
125
Swiss Chard with Roasted Pepper
126
Chocolate Almond Butter
127
Pastry Dough
129 Spicy Sesame
Noodles with Chopped Peanuts and Thai Basil
130
Potato Gratin with Goat Cheese and Garlic
131
Country Sausage and Sage Dressing
133
Buttermilk-Spinach Spaetzle
134
Radishes with Burrata
135
Winter Squash SoufflÃ©
136
Blueberry Streusel Cake
137
Low-Fat Chicken Stock
138
Honey Mustard Sauce
139
Rosemary and Lemon Pinto Beans
140
Asian Dipping Sauce
141
Shrimp and Green Onion Pancakes
143
Mustard-Ginger Shrimp Canapes
144
Rumbrosia
146
Thai Vegetables
147 Sage-Roasted T
urkey with Caramelized Onions and Sage Gravy
148
Shrimp Cakes with Andouille Sausage
149
Creamy Tofu Salad
150 Chocola
te-Cherry Ice Cream Pie with Hot Fudge Sauce
151

```
JalapeÃ±o-Cheddar Frittata
## 152
Roasted Beets and Citrus with Feta
## 153                                                                  Gree
n Beans with Crisp Shallots, Chile, and Mint
## 155
Cranberry Pear Tart with Gingerbread Crust
## 156                                                  Sauteed Veal w
ith Shrimp, Mushroom, and Brandy Cream Sauce
## 157
Lemon Vinaigrette
## 159
Cranberry, Shallot, and Dried-Cherry Compote
## 161
Peanut Butter Cream Tart
## 162
Cheddar Chicken Tenders with Wilted Spinach
## 163
Blueberry Cheesecake
## 165
Apple Pie with Whisky-Soaked Cherries
## 166
Parsleyed Yellow-Potato Salad
## 167
Sauteed Fennel and Carrots
## 168                                                                    Gr
illed Garlic-Marinated Skirt Steak with Lime
## 169
Miniature Crab Cakes with Tomato Ginger Jam
## 170
Egg Sandwich with Green Bean Slaw
## 171
Red Wine Brasato with Glazed Root Vegetables
## 173
Egg Salad with Lemon and Fennel
## 175
Shaved Brussels Sprout and Shallot SautÃ©
## 177
Roasted Carrot and Beet Salad with Feta
## 178
Cassata Cake
## 179
Baked Beans with Slab Bacon and Breadcrumbs
## 180
Grilled Corn with Lime-Cilantro Butter
## 181                                  Roasted Winter Squash and Parsnip
s with Maple Syrup Glaze and Marcona Almonds
## 185                                                              Roasted
Bell Peppers with Basil and Balsamic Vinegar
## 186
```

```
Homemade Tomato Ketchup
## 188                                                                Char-Grilled
Beef Tenderloin with Three-Herb Chimichurri
## 189                                                          Pork Roast Braised
with Milk and Fresh Herbs (Maiale al Latte )
## 191
Chocolate Pecan Banana Tarts
##       rating calories protein     fat  sodium X.cakeweek X.wasteless
## 1        2.5  4.3e+02      30       7 5.6e+02          0           0
## 2        4.4  4.0e+02      18      23 1.4e+03          0           0
## 3        3.8  1.6e+02       6       7 1.6e+02          0           0
## 5        3.1  5.5e+02      20      32 4.5e+02          0           0
## 6        4.4  9.5e+02      19      79 1.0e+03          0           0
## 9        4.4  1.7e+02       7      10 1.3e+03          0           0
## 10       3.8  6.0e+02      23      41 1.7e+03          0           0
## 11       3.8  2.6e+02       4       5 3.0e+01          0           0
## 13       4.4  7.7e+02      12      48 4.4e+02          0           0
## 14       4.4  1.7e+02      11      12 1.8e+02          0           0
## 15       3.1  1.3e+02       4       3 1.4e+03          0           0
## 16       4.4  3.8e+02       5      31 9.8e+02          0           0
## 17       1.9  1.5e+02       4       5 1.6e+02          0           0
## 18       4.4  8.9e+02      59      68 1.0e+03          0           0
## 19       5.0  1.1e+02       5       7 3.4e+02          0           0
## 20       5.0  4.2e+02      10      33 3.8e+02          0           0
## 21       4.4  3.4e+02      11      19 4.2e+02          0           0
## 25       3.8  2.8e+02       3      30 2.1e+02          0           0
## 26       0.0  9.5e+01       1       7 1.0e+02          0           0
## 27       3.8  2.2e+02       6      20 2.5e+02          0           0
## 28       2.5  1.4e+01       0       0 0.0e+00          0           0
## 29       4.4  3.5e+02       6      19 7.9e+01          0           0
## 30       4.4  3.1e+02       5       5 2.3e+02          0           0
## 33       4.4  3.8e+02       7      18 6.0e+02          0           0
## 34       3.1  1.8e+02      10      13 7.6e+02          0           0
## 36       3.8  6.2e+02      39      44 1.2e+03          0           0
## 38       4.4  1.1e+02       4      10 3.3e+02          0           0
## 39       4.4  3.4e+02      44      16 4.1e+02          0           0
## 40       2.5  1.4e+02       3       6 2.1e+02          0           0
## 41       4.4  4.8e+02       5      35 1.0e+02          0           0
## 42       4.4  6.3e+02      44      31 1.8e+02          0           0
## 46       4.4  9.0e+01       2       0 8.8e+02          0           0
## 47       3.8  2.0e+02      19       8 8.2e+02          0           0
## 49       4.4  3.4e+02      14      21 1.7e+02          0           0
## 50       4.4  1.9e+02       3       1 4.0e+00          0           0
## 51       3.1  1.7e+02       8      12 5.1e+02          0           0
## 52       3.8  2.8e+02       6      13 2.4e+02          0           0
## 54       5.0  1.2e+03      89      87 5.8e+02          0           0
## 55       3.8  2.7e+02       4       7 1.5e+02          0           0
## 57       4.4  9.0e+02      38      70 1.4e+03          0           0
## 58       4.4  2.2e+02       4      10 2.1e+02          0           0
## 59       3.8  1.9e+02       2       3 7.0e+02          0           0
```

```
## 60       3.8  1.8e+02       5       7 1.2e+02          0           0
## 61       3.8  7.0e+01       2       6 6.0e+01          0           0

## 127                    0       0      0         0      0         0
## 129                    0       0      0         0      0         0
## 130                    0       0      0         0      0         0
## 131                    0       0      0         0      0         0
## 133                    0       0      0         0      0         0
## 134                    0       0      0         0      0         0
1            0          0     0        0    0     0       0
## 62             0          0     0        0    0     0       0
## 63             0          0     0        0    0     0       0
## 64             0          0     0        0    0     0       0
## 65             0          0     0        0    0     0       0
## 67             0          0     0        0    0     0       0
## 68             0          0     0        0    0     0       0
## 69             0          0     0        0    0     0       0
## 70             0          0     0        0    0     0       0
## 71             0          0     0        0    0     0       0
## 72             0          0     0        0    0     0       0
## 73             0          0     0        0    0     0       0
## 74             0          0     0        0    0     0       0
## 75             0          0     0        0    0     0       0
## 76             0          0     0        0    0     0       0
## 77             0          0     0        0    0     0       0
## 78             0          0     0        0    0     0       0
## 79             0          0     0        0    0     0       0
## 81             1          0     0        0    0     0       0
## 82             0          0     0        0    0     0       0
## 83             0          0     0        0    0     0       0
## 84             1          0     0        0    0     0       0
## 85             0          0     0        0    0     0       0
## 86             0          0     0        0    0     0       0
## 88             0          0     0        0    0     0       0
## 89             0          0     0        0    0     0       0
## 92             0          0     0        0    0     0       0
## 93             0          0     0        0    0     0       0
## 94             0          0     0        0    0     0       0
## 95             0          0     0        0    0     0       0
## 96             0          0     0        0    0     0       0
## 97             0          0     0        0    0     0       0
## 98             0          0     0        0    0     0       0
## 99             0          0     0        0    0     0       0
## 100            0          0     0        0    0     0       0
## 101            0          0     0        0    0     0       0
## 103            0          0     0        0    0     0       0
## 105            0          0     0        0    0     0       0
## 106            1          0     0        0    0     0       0
## 107            0          0     0        0    0     0       0
## 108            0          0     0        0    0     0       0
```

```
## 110           0          0     0        0    0     0       0
## 111           0          0     0        0    0     0       0
## 112           0          0     0        0    0     0       0
## 114           0          0     0        0    0     0       0

## 191            0      0
##  [ reached getOption("max.print") -- omitted 15717 rows ]
```

```
data1.active <- data1[2:100, 2:6]
na.exclude(data1.active)
```

```
##     rating calories protein fat sodium
## 2      4.4      403      18  23   1439
## 3      3.8      165       6   7    165
## 5      3.1      547      20  32    452
## 6      4.4      948      19  79   1042
## 9      4.4      170       7  10   1272
## 10     3.8      602      23  41   1696
## 11     3.8      256       4   5     30
## 13     4.4      766      12  48    439
## 14     4.4      174      11  12    176
## 15     3.1      134       4   3   1394
## 16     4.4      382       5  31    977
## 17     1.9      146       4   5    160
## 18     4.4      890      59  68   1027
## 19     5.0      107       5   7    344
## 20     5.0      421      10  33    383
## 21     4.4      345      11  19    423
## 25     3.8      279       3  30    206
## 26     0.0       95       1   7    103
## 27     3.8      215       6  20    250
## 28     2.5       14       0   0      0
## 29     4.4      351       6  19     79
## 30     4.4      311       5   5    226
## 33     4.4      376       7  18    604
## 34     3.1      185      10  13    765
## 36     3.8      625      39  44   1248
## 38     4.4      107       4  10    329
## 39     4.4      336      44  16    413
## 40     2.5      145       3   6    208
## 41     4.4      483       5  35    100
## 42     4.4      634      44  31    181
## 46     4.4       90       2   0    881
## 47     3.8      202      19   8    815
## 49     4.4      338      14  21    174
## 50     4.4      191       3   1      4
## 51     3.1      166       8  12    508
## 52     3.8      275       6  13    242
## 54     5.0     1203      89  87    583
## 55     3.8      266       4   7    148
```

```
## 57     4.4      904      38  70   1413
## 58     4.4      223       4  10    211
## 59     3.8      194       2   3    697
## 60     3.8      177       5   7    116
## 61     3.8       70       2   6     60
## 62     4.4      368       6  32    112
## 63     5.0      293       7  15    565
## 64     0.0      523       8  19    694
## 65     3.8      252       4   7     89
## 67     3.1      224      21  12    340
## 68     3.8      185       0  20    155
## 69     4.4      830       9  59    148
## 70     0.0      195       7   5    469
## 71     4.4      684      21  42    637
## 72     4.4      641      39  37    907
## 73     3.8      538       8  36    231
## 74     3.8      264       7  24     84
## 75     3.8      365      19  14    599
## 76     4.4      926       9  56    569
## 77     3.1       26       1   0    364
## 78     3.8      230       2   7      9
## 79     4.4      157       3   8     51
## 81     4.4     1172      54  73    220
## 82     4.4      298       6  12    199
## 83     4.4      682      36  57    909
## 84     5.0      517       7  18     20
## 85     4.4      856      45  54   1797
## 86     4.4      599      48  28   1038
## 88     0.0     1143      63  77    311
## 89     4.4      129       4  11    146
## 92     4.4      571      36  37    106
## 93     4.4      508      45  17    826
## 94     3.8       62       2   3    603
## 95     3.1     1118      92  70   1226
## 96     0.0      306       0  34    302
## 97     4.4      209       5   8     77
## 98     3.1      645      22  52    324
## 99     3.1      126       3   9     46
## 100    4.4      133       2   8     91
## 101    4.4      285      19   7    635
## 103    4.4      310       3  25     89
## 105    3.1      248       3  10     73
## 106    5.0      247       5  10    185
## 107    3.8      201       4  11    210
## 108    5.0      519      14  25   1237
## 110    3.8     1076      11  73    150
## 111    4.4      338      15  18    515
## 112    4.4      298       1   0   1430
## 114    3.1      280      13  18    587
## 115    3.8      171       1   0      6
```

```
## 117    5.0      230       1   0     26
## 118    3.8      959      21  60   1541
## 119    4.4      129       1   0      2
## 120    2.5      107       0   0      0
## 121    3.8       86       3   1    339
## 122    3.8      679      55  36    333
## 123    0.0      112       2   7     12
## 125    3.8      123       5   7    605
## 126    0.0      273       2  28      5
## 127    5.0      234       3  16     99
## 129    4.4      724      21  28   1130
```

```
View(data1.active)
head(data1.active[, 2:5])
```

```
##    calories protein fat sodium
## 2       403      18  23   1439
## 3       165       6   7    165
## 5       547      20  32    452
## 6       948      19  79   1042
## 9       170       7  10   1272
## 10      602      23  41   1696
```

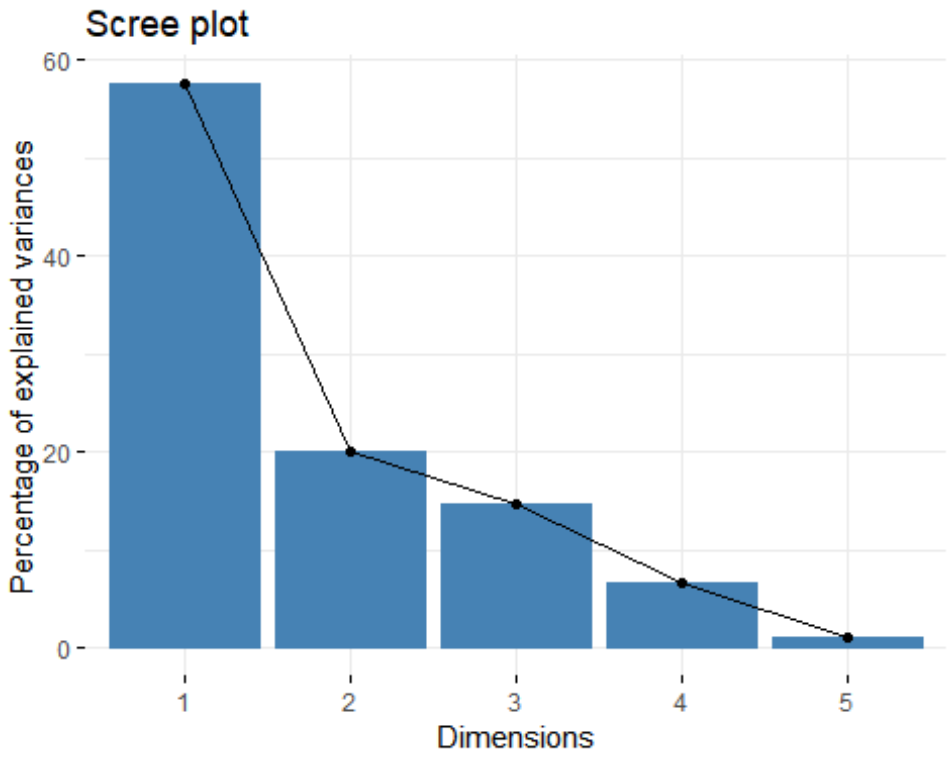
```
#Compute PCA in R using prcomp()
library(factoextra)
res.pca <- prcomp(data1.active, scale = TRUE)
res.pca
```

```
## Standard deviations (1, .., p=5):
## [1] 1.70 1.00 0.86 0.58 0.22
##
## Rotation (n x k) = (5 x 5):
##             PC1    PC2    PC3     PC4    PC5
## rating   -0.11  0.943  0.311  0.0031 -0.038
## calories -0.56 -0.105  0.208 -0.2732  0.746
## protein  -0.51 -0.085  0.052  0.8484 -0.099
## fat      -0.54 -0.169  0.241 -0.4344 -0.657
## sodium   -0.35  0.253 -0.894 -0.1299 -0.023
```

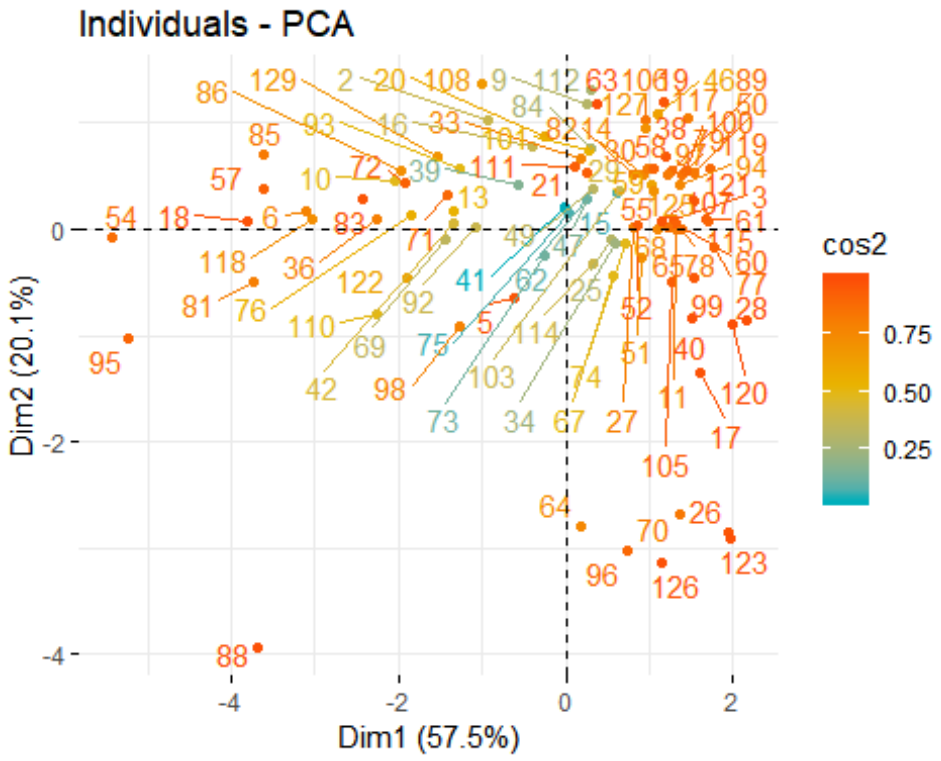
```
summary(res.pca)
```

```
## Importance of components:
##                           PC1   PC2   PC3   PC4    PC5
## Standard deviation     1.696 1.002 0.856 0.579 0.2243
## Proportion of Variance 0.575 0.201 0.147 0.067 0.0101
## Cumulative Proportion  0.575 0.776 0.923 0.990 1.0000
```

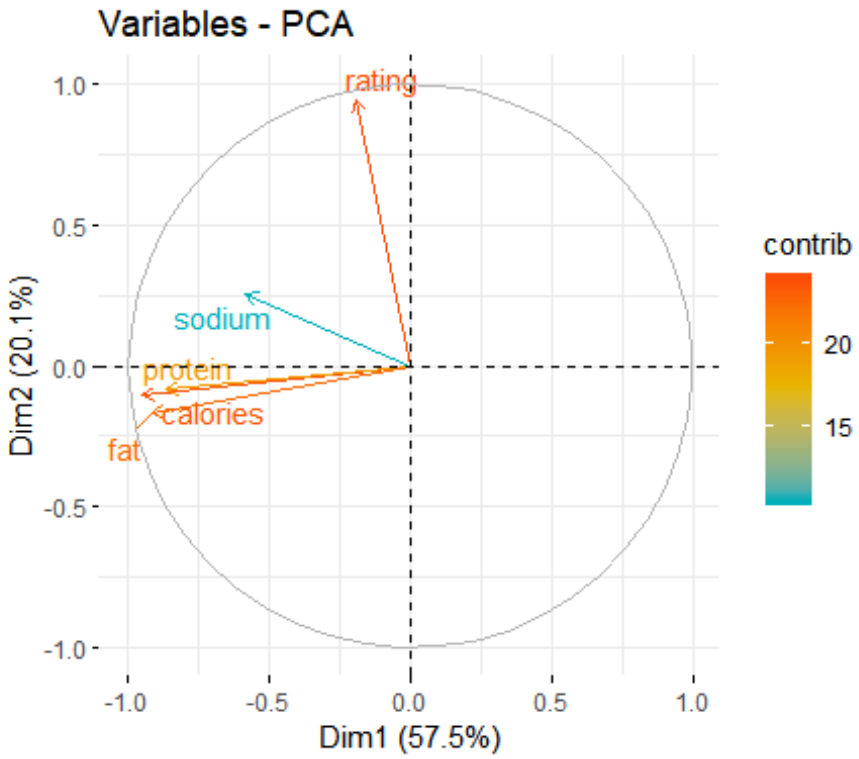
```
fviz_eig(res.pca)
```



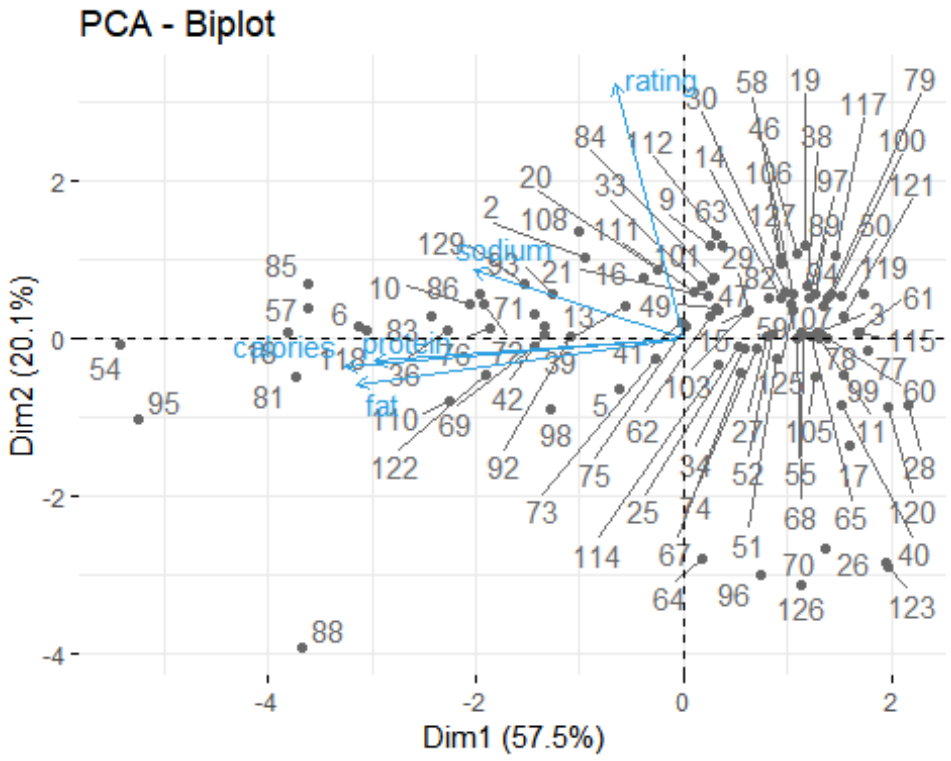

```
fviz_pca_ind(res.pca,
             col.ind = "cos2", # Color by the quality of representation
             gradient.cols = c("#00AFBB", "#E7B800", "#FC4E07"),
             repel = TRUE     # Avoid text overlapping
)
```




```
fviz_pca_var(res.pca,
             col.var = "contrib", # Color by contributions to the PC
             gradient.cols = c("#00AFBB", "#E7B800", "#FC4E07"),
             repel = TRUE     # Avoid text overlapping
)
```




```r
fviz_pca_biplot(res.pca, repel = TRUE,
                col.var = "#2E9FDF", # Variables color
                col.ind = "#696969"  # Individuals color
)
```




```
library(factoextra)
# Eigenvalues
eig.val <- get_eigenvalue(res.pca)
eig.val
```

```
##       eigenvalue variance.percent cumulative.variance.percent
## Dim.1       2.88             57.5                           58
## Dim.2       1.00             20.1                           78
## Dim.3       0.73             14.7                           92
## Dim.4       0.33              6.7                           99
## Dim.5       0.05              1.0                          100
```

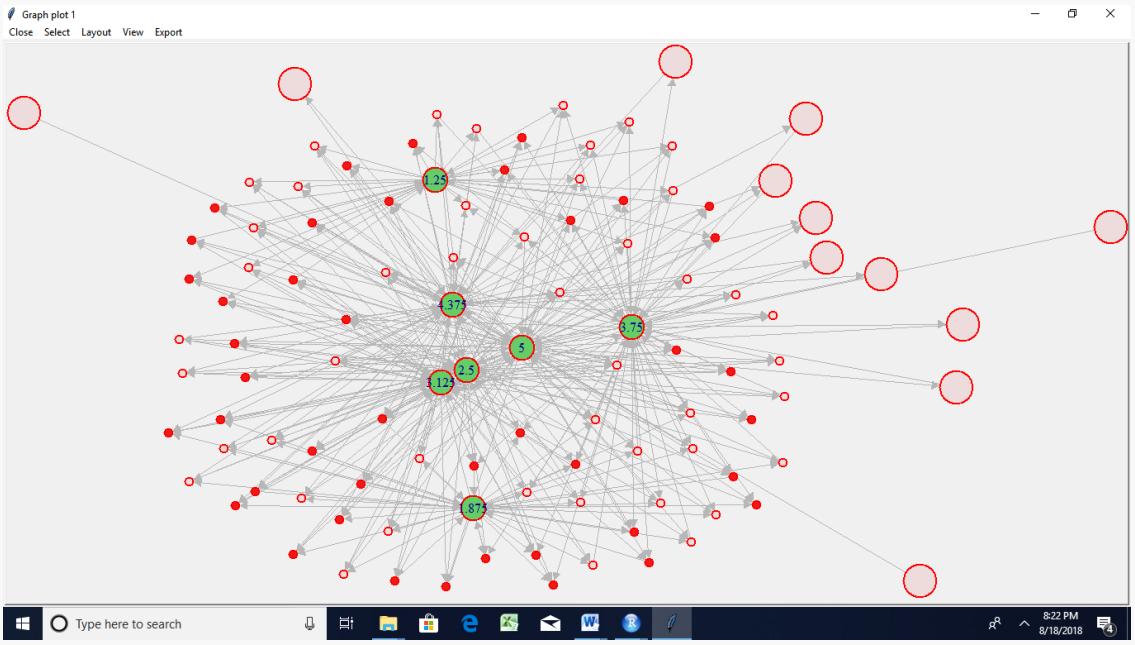
```
# Results for Variables
res.var <- get_pca_var(res.pca)
res.var$coord          # Coordinates
```

```
##          Dim.1  Dim.2  Dim.3   Dim.4   Dim.5
## rating   -0.19  0.945  0.267  0.0018 -0.0084
## calories -0.95 -0.105  0.178 -0.1581  0.1674
## protein  -0.87 -0.085  0.045  0.4911 -0.0223
## fat      -0.92 -0.169  0.207 -0.2514 -0.1473
## sodium   -0.59  0.254 -0.765 -0.0752 -0.0051
```

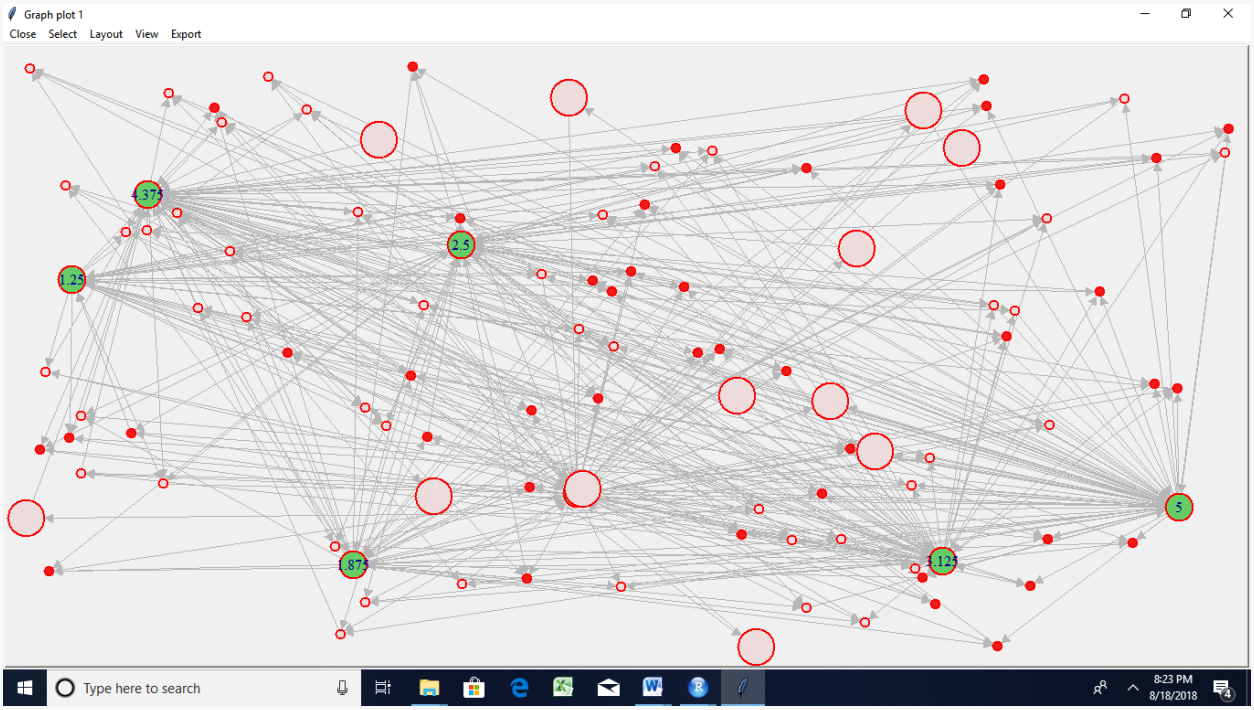
```
res.var$contrib        # Contributions to the PCs
```

```
##          Dim.1 Dim.2 Dim.3   Dim.4  Dim.5
## rating     1.3 88.89  9.70 9.9e-04  0.141
## calories  31.4  1.10  4.32 7.5e+00 55.692
```

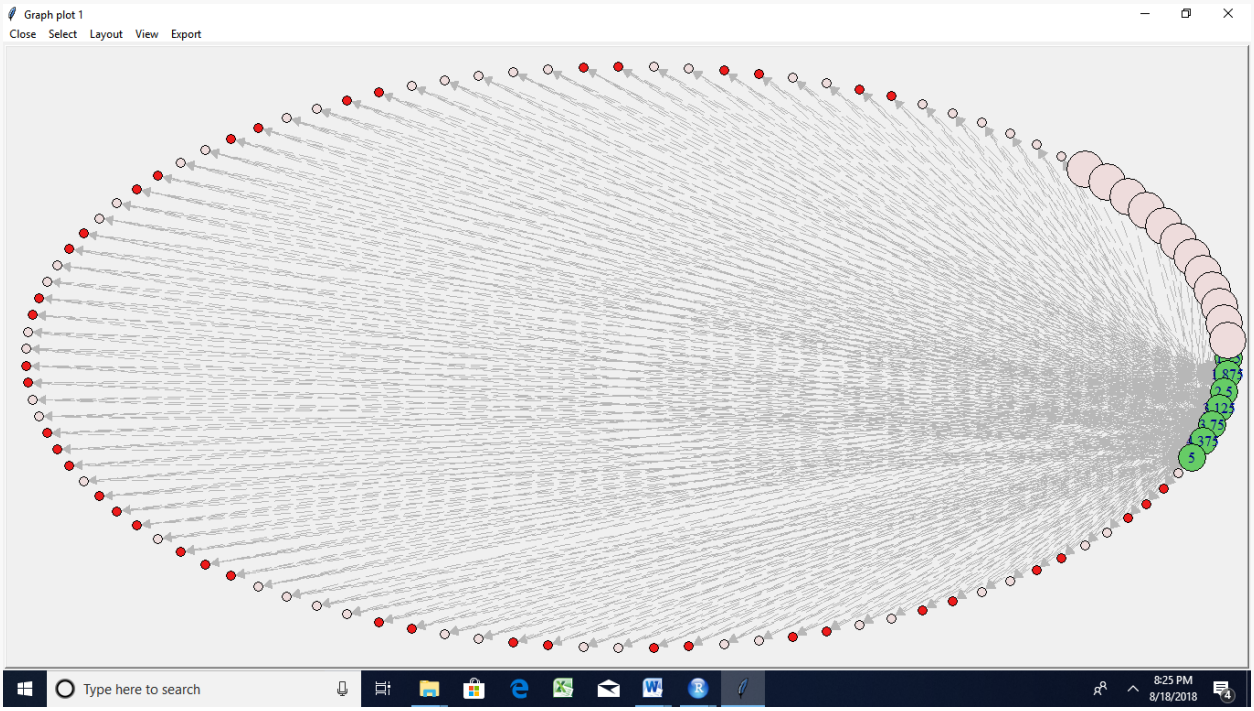
```
## protein   26.0  0.72  0.28 7.2e+01  0.986
## fat       29.3  2.86  5.82 1.9e+01 43.130
## sodium    12.0  6.42 79.89 1.7e+00  0.052

res.var$cos2           # Quality of representation

##          Dim.1  Dim.2 Dim.3   Dim.4   Dim.5
## rating   0.037 0.8922 0.071 3.3e-06 7.1e-05
## calories 0.904 0.0111 0.032 2.5e-02 2.8e-02
## protein  0.749 0.0073 0.002 2.4e-01 5.0e-04
## fat      0.844 0.0287 0.043 6.3e-02 2.2e-02
## sodium   0.344 0.0645 0.586 5.7e-03 2.6e-05
```

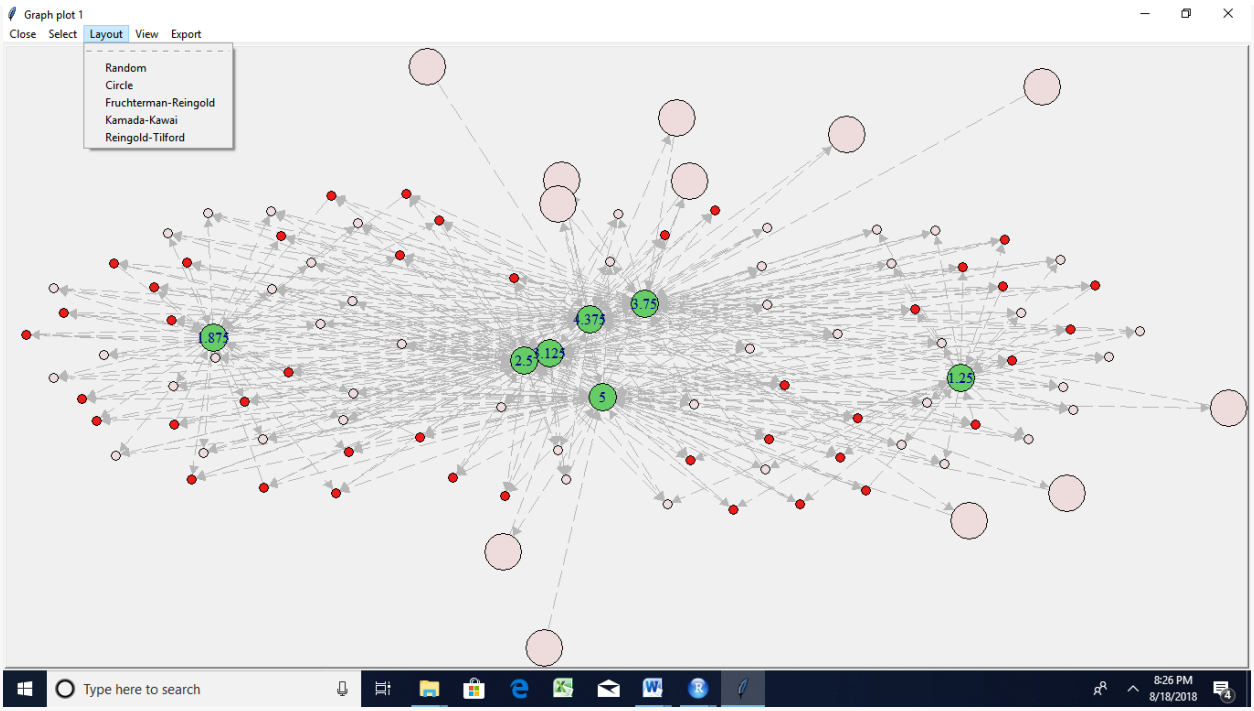


Random type

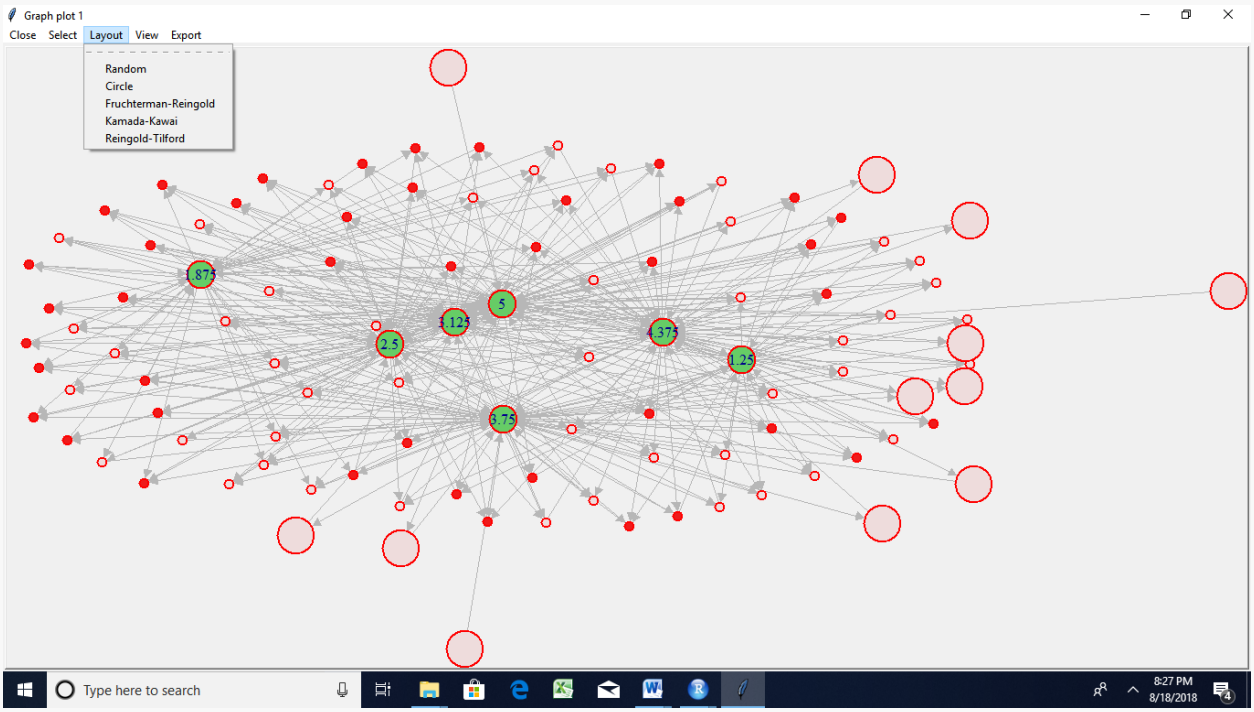


Circle

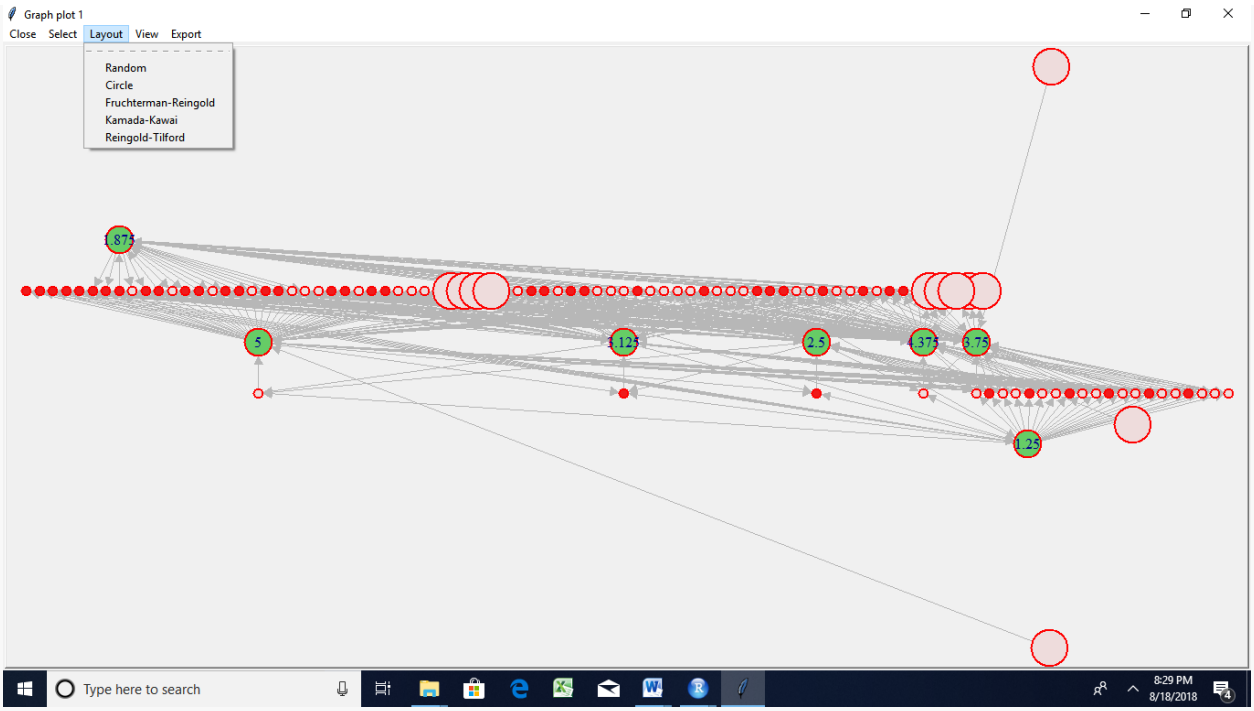




Kamada kawai



Reingold



Session 21 Assignment 2nd additional exercise

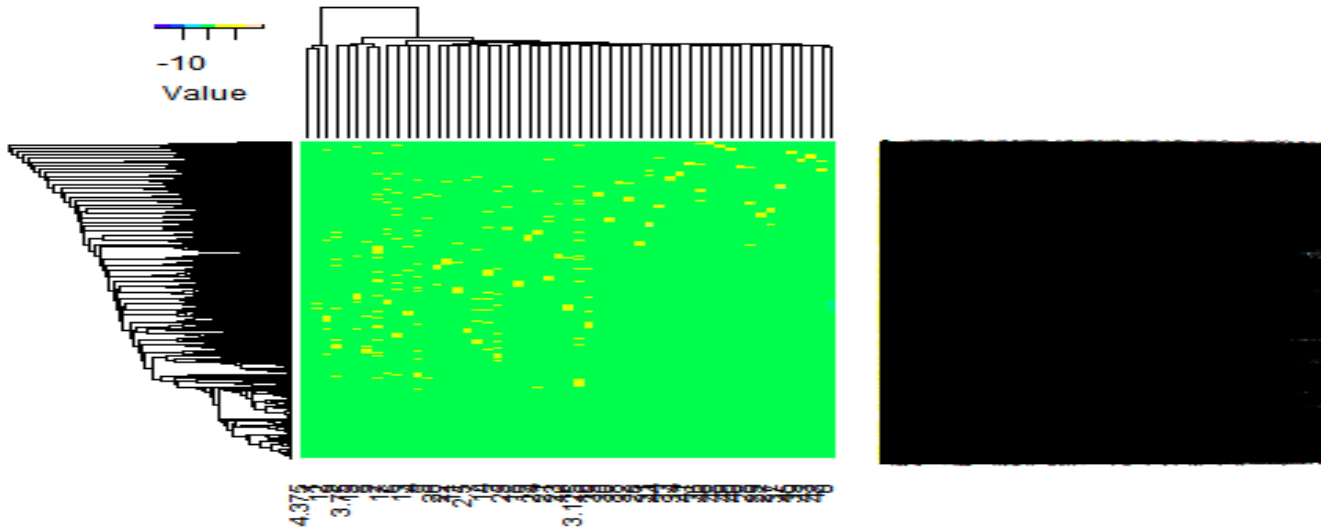
session21_pci.R

Seshan

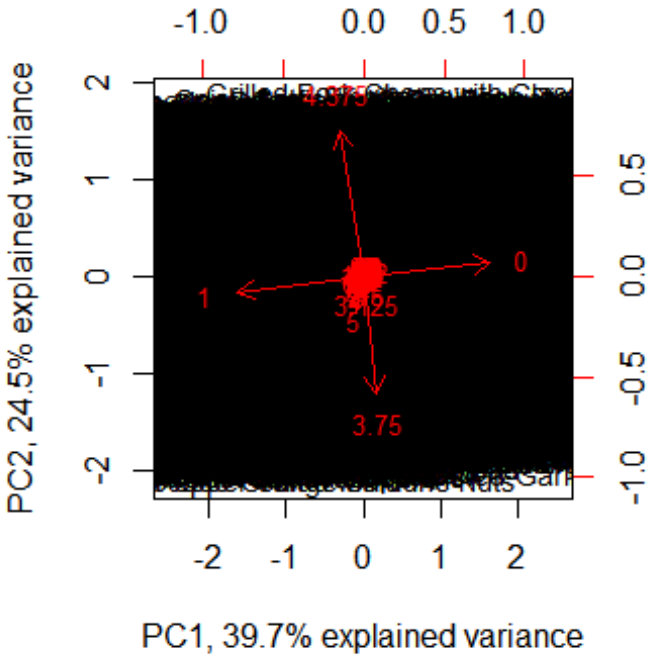
Thu Aug 16 15:46:09 2018

```
setwd("C:/Users/Seshan/Desktop/sv R related/acadgild/assignments/session21")
library(readr)
epi_r <- read.csv("C:/Users/Seshan/Desktop/sv R related/acadgild/assignments/
session21/epi_r.csv")
View(epi_r)
data<-epi_r
View(data)

a <- aggregate(data[,-1], by=list(data[,1]), paste, collapse=",")
a$combined <- apply(a[,2:ncol(a)], 1, paste, collapse=",")
a$combined <- gsub(",NA","",a$combined) ## this column contains the totality
of all ingredients for a cuisine

cuisines <- as.data.frame(table(data[,1])) ## Number of recipes for each cuis
ine
freq <- lapply(lapply(strsplit(a$combined,","), table), as.data.frame) ## Fre
quency of ingredients
```

```
names(freq) <- a[,1]
prop <- lapply(seq_along(freq), function(i) { colnames(freq[[i]])[2] <- names
(freq)[i] freq[[i]][,2] <- freq[[i]][,2]/cuisines[i,2] ## proportion (normali
zed frequency) freq[[i]]})
names(prop) <- a[,1] ## this is a list of 26 elements, one for each cuisine
final <- Reduce(function(...) merge(..., all=TRUE, by="Var1"), prop)
row.names(final) <- final[,1]
final <- final[,-1]
final[is.na(final)] <- 0 ## If ingredient missing in all recipes, proportion
set to zero
final <- t(final) ## proportion matrix
s <- sort(apply(final, 2, sd), decreasing=TRUE)
## Selecting ingredients with maximum variation in frequency among cuisines a
nd
## Using standardized proportions for final analysis
final_imp <- scale(subset(final, select=names(which(s > 0.1))))
## heatmap
library(gplots) ##
## Attaching package: 'gplots'

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

heatmap.2(final_imp, trace="none", margins = c(6,11), col=topo.colors(7),
          key=TRUE, key.title=NA, keysize=1.2, density.info="none")
```




```
## PCA and biplot
p <- princomp(final_imp)
biplot(p,pc.biplot=TRUE, col=c("black","red"), cex=c(0.9,0.8),xlim=c(-2.5,2.5
), xlab="PC1, 39.7% explained variance", ylab="PC2, 24.5% explained variance"
)
```


-1.0
0.0
0.5
1.0
2
1
0
-1
-2
0.5
0.0
-0.5
-1.0
4.375
1
0
3.125
5
3.75
-2
-1
0
1
2
PC2, 24.5% explained variance
PC1, 39.7% explained variance