session21_assign_pca.R

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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

```r
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
```

```r
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])
```

```r
# 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)
```

```r
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
```

```r
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
```

```
## 10          0          0            0          0     0        0          0        0
##    back.to.school backyard.bbq bacon bake banana barley basil bass
## 1               0            0     0    0      0      0     0    0
## 2               0            0     0    1      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    1      0      0     0    0
## 6               0            0     1    0      0      0     1    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
##    bastille.day bean beef beef.rib beef.shank beef.tenderloin beer beet
## 1             0    1    0        0          0               0    0    0
## 2             1    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    1        0          0               0    0    0
## 10            0    0    0        0          0               0    0    0
##    bell.pepper berry beverly.hills birthday biscuit bitters blackberry
## 1            0     0             0        0       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
##    blender blue.cheese blueberry boil bok.choy bon.appÃ.tit
## 1        0           0         0    0        0            0
## 2        0           0         0    0        0            1
## 3        0           0         0    0        0            0
## 4        0           0         0    0        0            1
## 5        0           0         0    0        0            1
## 6        0           0         0    0        0            1
## 7        0           0         0    1        0            1
## 8        0           0         0    0        0            0
## 9        0           0         0    0        0            0
## 10       0           0         0    0        0            0
##    bon.appï..ï..tit boston bourbon braise bran brandy bread breadcrumbs
## 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
##     breakfast brie brine brisket broccoli broccoli.rabe broil brooklyn
## 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
##     brown.rice brownie brunch brussel.sprout buffalo buffet bulgaria bulgur
## 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
##     burrito butter buttermilk butternut.squash butterscotch.caramel cabbage
## 1         0      0          0                0                    0       0
## 2         0      0          0                0                    0       0
## 3         0      0          0                0                    0       0
## 4         0      0          0                0                    0       0
## 5         0      0          0                0                    0       0
## 6         0      0          0                0                    0       0
## 7         0      0          0                0                    0       0
## 8         0      0          0                0                    0       0
## 9         0      0          0                0                    0       0
## 10        0      0          0                0                    0       0
##     cake california calvados cambridge campari camping canada candy
## 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          1        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
```

```
##    candy.thermometer cantaloupe capers caraway cardamom carrot cashew
## 1                  0          0      0       0        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      1      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
##    casserole.gratin cauliflower caviar celery chambord champagne chard
## 1                 0           0      0      0        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
##    chartreuse cheddar cheese cherry chestnut chicago chicken chickpea
## 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      1      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
##    chile chile.pepper chili chill chive chocolate christmas christmas.eve
## 1      0            0     0     0     0         0         0             0
## 2      0            0     0     1     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
##    cilantro cinco.de.mayo cinnamon citrus clam clove cobbler.crumble
## 1         0             0        0      0    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
##     cocktail cocktail.party coconut cod coffee coffee.grinder
## 1          0              0       0   0      0              0
## 2          0              0       0   0      0              0
## 3          0              0       0   0      0              0
## 4          0              0       0   0      0              0
## 5          0              0       0   0      0              0
## 6          0              0       0   0      0              0
## 7          0              0       0   0      0              0
## 8          0              1       0   0      0              0
## 9          0              0       0   0      0              0
## 10         0              0       0   0      0              0
##     cognac.armagnac collard.greens colorado columbus condiment
## 1                 0              0        0        0         0
## 2                 0              0        0        0         0
## 3                 0              0        0        0         0
## 4                 0              0        0        0         0
## 5                 0              0        0        0         0
## 6                 0              0        0        0         0
## 7                 0              0        0        0         0
## 8                 0              0        0        0         0
## 9                 0              0        0        0         0
## 10                0              0        0        0         0
##     condiment.spread connecticut cook.like.a.diner cookbook.critic cookie
## 1                  0           0                 0               0      1
## 2                  0           0                 0               0      0
## 3                  0           0                 0               0      0
## 4                  0           0                 0               0      0
## 5                  0           0                 0               0      0
## 6                  0           0                 0               0      0
## 7                  0           0                 0               0      0
## 8                  0           0                 0               0      0
## 9                  0           0                 0               0      0
## 10                 0           0                 0               0      0
##     cookies coriander corn cornmeal costa.mesa cottage.cheese couscous crab
## 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
##     cranberry cranberry.sauce cream.cheese crÃ.me.de.cacao crÃªpe
```

```
## 1          0              0            0              0       0
## 2          0              0            0              0       0
## 3          0              0            0              0       0
## 4          0              0            0              0       0
## 5          0              0            0              0       0
## 6          0              0            0              0       0
## 7          0              0            0              0       0
## 8          0              0            0              0       0
## 9          0              0            0              0       0
## 10         0              0            0              0       0
##    crï..ï...me.de.cacao cuba cucumber cumin cupcake currant curry custard
## 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
##    dairy dairy.free dallas date deep.fry denver dessert digestif dill
## 1      0          0      0    0        0      0       0        0    0
## 2      0          0      0    0        0      0       0        0    0
## 3      1          0      0    0        0      0       0        0    0
## 4      0          1      0    0        0      0       0        0    0
## 5      1          0      0    0        0      0       0        0    0
## 6      0          0      0    0        0      0       0        0    0
## 7      0          1      0    0        0      0       0        0    0
## 8      0          0      0    0        0      0       0        0    0
## 9      0          0      0    0        0      0       0        0    0
## 10     0          1      0    0        0      0       0        0    0
##    dinner dip diwali dominican.republic dorie.greenspan double.boiler
## 1       0   0      0                  0               0             0
## 2       0   0      0                  0               0             0
## 3       0   0      0                  0               0             0
## 4       1   0      0                  0               0             0
## 5       0   0      0                  0               0             0
## 6       0   0      0                  0               0             0
## 7       0   0      0                  0               0             0
## 8       0   0      0                  0               0             0
## 9       0   0      0                  0               0             0
## 10      0   0      0                  0               0             0
##    dried.fruit drink drinks duck easter eau.de.vie edible.gift egg egg.nog
## 1            0     0      0    0      0          0           0   0       0
## 2            1     0      0    0      0          0           0   0       0
## 3            0     0      0    0      0          0           0   0       0
## 4            0     0      0    0      0          0           0   0       0
## 5            0     0      0    0      0          0           0   0       0
## 6            0     0      0    0      0          0           0   0       0
```

```
## 7                0        0        0       0          1             0                   0   0           0
## 8                0        0        0       0          0             0                   0   1           0
## 9                0        0        0       0          0             0                   0   0           0
## 10               0        0        0       0          0             0                   0   0           0
##      eggplant egypt emeril.lagasse endive engagement.party england
## 1           0     0              0      0                0        0
## 2           0     0              0      0                0        0
## 3           0     0              0      0                0        0
## 4           0     0              0      0                0        0
## 5           0     0              0      0                0        0
## 6           0     0              0      0                0        0
## 7           0     0              0      0                0        0
## 8           0     0              0      0                0        0
## 9           0     0              0      0                0        0
## 10          0     0              0      0                0        0
##      entertaining epi...ushg epi.loves.the.microwave escarole fall
## 1               0          0                        0        0    0
## 2               0          0                        0        0    0
## 3               0          0                        0        0    0
## 4               0          0                        0        0    0
## 5               0          0                        0        0    1
## 6               0          0                        0        0    0
## 7               0          0                        0        0    0
## 8               0          0                        0        0    0
## 9               0          0                        0        0    0
## 10              0          0                        0        0    0
##      family.reunion fat.free father.s.day fennel feta fig fish
## 1                 0        0            0      0    0   0    0
## 2                 0        0            0      0    0   0    0
## 3                 0        0            0      1    0   0    0
## 4                 0        0            0      0    0   0    1
## 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
##      flaming.hot.summer flat.bread florida fontina food.processor
## 1                     0          0       0       0              0
## 2                     0          0       0       0              1
## 3                     0          0       0       0              0
## 4                     0          0       0       0              0
## 5                     0          0       0       0              0
## 6                     0          0       0       0              1
## 7                     0          0       0       0              0
## 8                     0          0       0       0              0
## 9                     0          0       0       0              0
## 10                    0          0       0       0              0
##      fortified.wine fourth.of.july france frangelico frankenrecipe
## 1                 0              0      0          0              0
```

```
## 2                     0              0         0         0              0
## 3                     0              0         0         0              0
## 4                     0              0         0         0              0
## 5                     0              0         0         0              0
## 6                     0              0         0         0              0
## 7                     0              0         0         0              0
## 8                     0              0         0         0              0
## 9                     0              0         0         0              0
## 10                    0              0         0         0              0
##     freeze.chill freezer.food friendsgiving frittata fritter frozen.dessert
## 1              0            0             0        0       0              0
## 2              0            0             0        0       0              0
## 3              0            0             0        0       0              0
## 4              0            0             0        0       0              0
## 5              0            0             0        0       0              0
## 6              0            0             0        0       0              0
## 7              0            0             0        0       0              0
## 8              0            0             0        0       0              0
## 9              0            0             0        0       0              0
## 10             0            0             0        0       0              0
##     fruit fruit.juice fry game garlic georgia germany gin ginger
## 1       1           0   0    0      0       0       0   0      0
## 2       0           0   0    0      0       0       0   0      0
## 3       0           0   0    0      0       0       0   0      0
## 4       0           0   0    0      0       0       0   0      0
## 5       0           0   0    0      0       0       0   0      0
## 6       0           0   0    0      0       0       0   0      0
## 7       0           0   0    0      0       0       0   0      0
## 8       1           0   0    0      0       0       0   0      0
## 9       0           0   0    0      0       0       0   0      1
## 10      0           0   0    0      0       0       0   0      0
##     goat.cheese goose gouda gourmet graduation grains grand.marnier granola
## 1             0     0     0       0          0      0             0       0
## 2             0     0     0       0          0      0             0       0
## 3             0     0     0       1          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       1          0      0             0       0
## 9             0     0     0       1          0      0             0       0
## 10            0     0     0       1          0      0             0       0
##     grape grapefruit grappa green.bean green.onion.scallion grill
## 1       0          0      0          0                    0     0
## 2       0          0      0          0                    0     0
## 3       0          0      0          0                    0     0
## 4       0          0      0          0                    0     0
## 5       0          0      0          0                    0     0
## 6       0          0      0          0                    0     0
## 7       0          0      0          0                    0     0
```

```
## 8       0           0        0          0                    0       0
## 9       0           0        0          0                    0       0
## 10      0           0        0          0                    0       0
##     grill.barbecue ground.beef ground.lamb guam guava haiti halibut
## 1                0           0           0    0     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
##     halloween ham hamburger hanukkah harpercollins hawaii hazelnut
## 1           0   0         0        0             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   1         0        0             0      0        0
## 8           0   0         0        0             0      0        0
## 9           0   0         0        0             0      0        0
## 10          0   1         0        0             0      0        0
##     healdsburg healthy herb high.fiber hollywood hominy.cornmeal.masa honey
## 1            0       0    0          0         0                    0     0
## 2            0       0    0          0         0                    0     0
## 3            0       0    0          0         0                    0     0
## 4            0       1    0          1         0                    0     0
## 5            0       0    0          0         0                    0     0
## 6            0       0    0          0         0                    0     0
## 7            0       1    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
##     honeydew hors.d.oeuvre horseradish hot.drink hot.pepper house...garden
## 1          0             0           0         0          0               0
## 2          0             0           0         0          0               0
## 3          0             0           0         0          0               0
## 4          0             0           0         0          0               0
## 5          0             0           0         0          0               0
## 6          0             0           0         0          0               0
## 7          0             0           0         0          0               0
## 8          0             0           0         0          0               0
## 9          0             0           0         0          0               0
## 10         0             0           0         0          0               0
##     house.cocktail houston hummus ice.cream ice.cream.machine iced.coffee
## 1                0       0      0         0                 0           0
## 2                0       0      0         0                 0           0
```

```
## 3                0        0        0            0                  0              0
## 4                0        0        0            0                  0              0
## 5                0        0        0            0                  0              0
## 6                0        0        0            0                  0              0
## 7                0        0        0            0                  0              0
## 8                0        0        0            0                  0              0
## 9                0        0        0            0                  0              0
## 10               0        0        0            0                  0              0
##     iced.tea idaho illinois indiana iowa ireland israel italy jalapeÃ.o
## 1          0     0        0       0    0       0      0     0         0
## 2          0     0        0       0    0       0      0     0         0
## 3          0     0        0       0    0       0      0     0         0
## 4          0     0        0       0    0       0      0     0         0
## 5          0     0        0       0    0       0      0     0         0
## 6          0     0        0       0    0       0      0     0         0
## 7          0     0        0       0    0       0      0     0         0
## 8          0     0        0       0    0       0      0     0         0
## 9          0     0        0       0    0       0      0     0         0
## 10         0     0        0       0    0       0      0     0         0
##     jam.or.jelly jamaica japan jerusalem.artichoke juicer jÃ.cama kahlÃºa
## 1              0       0     0                   0      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
##     kale kansas kansas.city kentucky kentucky.derby kid.friendly
## 1      0      0           0        0              0            1
## 2      0      0           0        0              0            0
## 3      0      0           0        0              0            0
## 4      0      0           0        0              0            0
## 5      0      0           0        0              0            0
## 6      0      0           0        0              0            1
## 7      0      0           0        0              0            0
## 8      0      0           0        0              0            0
## 9      0      0           0        0              0            0
## 10     0      0           0        0              0            0
##     kidney.friendly kirsch kitchen.olympics kiwi kosher kosher.for.passover
## 1                 0      0                0    0      0                   0
## 2                 0      0                0    0      0                   0
## 3                 0      0                0    0      0                   0
## 4                 0      0                0    0      1                   0
## 5                 0      0                0    0      0                   0
## 6                 0      0                0    0      0                   0
## 7                 0      0                0    0      0                   0
## 8                 0      0                0    0      0                   0
```

```
## 9                      0         0                  0      0      0                        0
## 10                     0         0                  0      0      0                        0
##     kumquat kwanzaa labor.day lamb lamb.chop lamb.shank lancaster las.vegas
## 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         1       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
##     lasagna leafy.green leek legume lemon lemon.juice lemongrass lentil
## 1         0           0    0      0     0           0          0      1
## 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
##     lettuce lima.bean lime lime.juice lingonberry liqueur lobster london
## 1         1         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         1         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
##     long.beach los.angeles louisiana louisville low.cal low.carb
## 1            0           0         0          0       0        0
## 2            0           0         0          0       0        0
## 3            0           0         0          0       0        0
## 4            0           0         0          0       1        0
## 5            0           0         0          0       0        0
## 6            0           0         0          0       0        0
## 7            0           0         0          0       0        0
## 8            0           0         0          0       0        0
## 9            0           0         0          0       0        0
## 10           0           0         0          0       0        0
##     low.cholesterol low.fat low.sodium low.sugar low.no.sugar
## 1                 0       0          0         0            0
## 2                 0       0          0         0            0
## 3                 0       0          0         0            0
```

```
## 4                  0       1         0             0              0
## 5                  0       0         0             0              0
## 6                  0       0         0             0              0
## 7                  0       1         0             0              0
## 8                  0       0         0             0              0
## 9                  0       0         0             0              0
## 10                 0       0         0             0              0
##    lunar.new.year lunch lychee macadamia.nut macaroni.and.cheese maine
## 1               0     0      0             0                   0     0
## 2               0     0      0             0                   0     0
## 3               0     0      0             0                   0     0
## 4               0     0      0             0                   0     0
## 5               0     0      0             0                   0     0
## 6               0     0      0             0                   0     0
## 7               0     0      0             0                   0     0
## 8               0     0      0             0                   0     0
## 9               0     0      0             0                   0     0
## 10              0     1      0             0                   0     0
##    mandoline mango maple.syrup mardi.gras margarita marinade marinate
## 1          0     0           0          0         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
##    marsala marscarpone marshmallow martini maryland massachusetts
## 1        0           0           0       0        0             0
## 2        0           0           0       0        0             0
## 3        0           0           0       0        0             0
## 4        0           0           0       0        0             0
## 5        0           0           0       0        0             0
## 6        0           0           0       0        0             0
## 7        0           0           0       0        0             0
## 8        0           0           0       0        0             0
## 9        0           0           0       0        0             0
## 10       0           0           0       0        0             0
##    mayonnaise meat meatball meatloaf melon mexico mezcal miami michigan
## 1           0    0        0        0     0      0      0     0        0
## 2           0    0        0        0     0      0      0     0        0
## 3           0    0        0        0     0      0      0     0        0
## 4           0    0        0        0     0      0      0     0        0
## 5           0    0        0        0     0      0      0     0        0
## 6           0    0        0        0     0      0      0     0        0
## 7           0    0        0        0     0      0      0     0        0
## 8           0    0        0        0     0      0      0     0        0
## 9           0    0        0        0     0      0      0     0        0
```

```
## 10              1       0          0          0          0          0          0          0          0
##     microwave midori milk.cream minneapolis minnesota mint mississippi
## 1          0      0          0          0          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
##     missouri mixer molasses monterey.jack mortar.and.pestle mother.s.day
## 1        0     0        0             0                 0            0
## 2        0     0        0             0                 0            0
## 3        0     0        0             0                 0            0
## 4        0     0        0             0                 0            0
## 5        0     0        0             0                 0            0
## 6        0     0        0             0                 0            0
## 7        0     0        0             0                 0            0
## 8        0     0        0             0                 0            0
## 9        0     0        0             0                 0            0
## 10       0     0        0             0                 0            0
##     mozzarella muffin mushroom mussel mustard mustard.greens
## 1          0      0        0      0       0              0
## 2          0      0        0      0       0              0
## 3          0      0        0      0       0              0
## 4          0      0        0      0       0              0
## 5          0      0        0      0       0              0
## 6          0      0        0      0       0              0
## 7          0      0        0      0       0              0
## 8          0      0        0      0       0              0
## 9          0      0        0      0       0              0
## 10         0      0        0      0       1              0
##     nancy.silverton nebraska nectarine new.hampshire new.jersey new.mexico
## 1                0        0         0             0          0          0
## 2                0        0         0             0          0          0
## 3                0        0         0             0          0          0
## 4                0        0         0             0          0          0
## 5                0        0         0             0          0          0
## 6                0        0         0             0          0          0
## 7                0        0         0             0          0          0
## 8                0        0         0             0          0          0
## 9                0        0         0             0          0          0
## 10               0        0         0             0          0          0
##     new.orleans new.year.s.day new.year.s.eve new.york no.meat..no.problem
## 1            0              0              0        0                   0
## 2            0              0              1        0                   0
## 3            0              0              0        1                   0
## 4            0              0              0        0                   0
```

```
## 5               0               0               0            0                       0
## 6               0               0               0            0                       0
## 7               0               0               0            0                       0
## 8               0               0               0            0                       0
## 9               0               0               0            0                       0
## 10              0               0               0            0                       0
##    no.sugar.added no.cook non.alcoholic noodle north.carolina nut nutmeg
## 1               0       0             0      0              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               1       0             0      0              0   0      0
## 8               0       1             0      0              0   0      0
## 9               0       0             0      0              0   0      0
## 10              0       0             0      0              0   0      0
##    oat oatmeal octopus ohio oklahoma okra oktoberfest olive omelet
## 1    0       0       0    0        0    0           0     0      0
## 2    0       0       0    0        0    0           0     0      0
## 3    0       0       0    0        0    0           0     0      0
## 4    0       0       0    0        0    0           0     1      0
## 5    0       0       0    0        0    0           0     0      0
## 6    0       0       0    0        0    0           0     0      0
## 7    0       0       0    0        0    0           0     0      0
## 8    0       0       0    0        0    0           0     0      0
## 9    0       0       0    0        0    0           0     0      0
## 10   0       0       0    0        0    0           0     0      0
##    one.pot.meal onion orange orange.juice oregano oregon organic orzo
## 1             0     0      0            0       0      0       0    0
## 2             0     1      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
##    oscars oyster pacific.palisades paleo pan.fry pancake papaya paprika
## 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
```

```
##    parade paris parmesan parsley parsnip party pasadena passion.fruit
## 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
##    passover pasta pasta.maker pastry pea peach peanut peanut.butter
## 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     1           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   1     0      0             0
##    peanut.free pear pecan pennsylvania pepper pernod persian.new.year
## 1            0    0     0            0      0      0                0
## 2            0    0     0            0      0      0                0
## 3            0    0     0            0      0      0                0
## 4            1    0     0            0      0      0                0
## 5            0    0     0            0      0      0                0
## 6            0    0     0            0      0      0                0
## 7            1    0     0            0      0      0                0
## 8            0    0     0            0      0      0                0
## 9            0    0     0            0      0      0                0
## 10           1    0     0            0      0      0                0
##    persimmon peru pescatarian philippines phyllo.puff.pastry.dough pickles
## 1          0    0           0           0                        0       0
## 2          0    0           0           0                        0       0
## 3          0    0           0           0                        0       0
## 4          0    0           1           0                        0       0
## 5          0    0           0           0                        0       0
## 6          0    0           0           0                        0       0
## 7          0    0           0           0                        0       0
## 8          0    0           0           0                        0       0
## 9          0    0           0           0                        0       0
## 10         0    0           0           0                        0       0
##    picnic pie pine.nut pineapple pistachio pittsburgh pizza plantain plum
## 1       0   0        0         0         0          0     0        0    0
## 2       0   0        0         0         0          0     0        0    0
## 3       0   0        0         0         0          0     0        0    0
## 4       0   0        0         0         0          0     0        0    0
## 5       0   0        0         0         0          0     0        0    0
```

```
## 6          0   0        0            0             0                   0      0          0      0
## 7          0   0        0            0             0                   0      0          0      0
## 8          0   0        0            0             0                   0      0          0      0
## 9          0   0        0            0             0                   0      0          0      0
## 10         1   0        0            0             0                   0      0          0      0
##    poach poblano poker.game.night pomegranate pomegranate.juice poppy pork
## 1      0       0                0           0                 0     0    0
## 2      0       0                0           0                 0     0    1
## 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
##    pork.chop pork.rib pork.tenderloin port portland pot.pie potato
## 1          0        0               0    0        0       0      0
## 2          0        0               0    0        1       0      0
## 3          0        0               0    0        0       0      1
## 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      1
##    potato.salad potluck poultry poultry.sausage pressure.cooker prosciutto
## 1             0       0       0               0               0          0
## 2             0       0       0               0               0          0
## 3             0       0       0               0               0          0
## 4             0       0       0               0               0          0
## 5             0       0       0               0               0          0
## 6             0       0       0               0               0          0
## 7             0       0       0               0               0          0
## 8             0       0       0               0               0          0
## 9             0       0       0               0               0          0
## 10            0       0       0               0               0          0
##    providence prune pumpkin punch purim quail quiche quick...easy
## 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            1
## 6           0     0       0     0     0     0      0            1
## 7           0     0       0     0     0     0      0            1
## 8           0     0       0     0     0     0      0            0
## 9           0     0       0     0     0     0      0            1
## 10          0     0       0     0     0     0      0            0
##    quick.and.healthy quince quinoa rabbit rack.of.lamb radicchio radish
```

```
## 1                      0       0       0       0             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
##     raisin ramadan ramekin raspberry raw red.wine rhode.island rhubarb rice
## 1        0       0       0         0   0        0            0       0    0
## 2        0       0       0         0   0        0            0       0    0
## 3        0       0       0         0   0        0            0       0    0
## 4        0       0       0         0   0        0            0       0    0
## 5        0       0       0         0   0        0            0       0    0
## 6        0       0       0         0   0        0            0       0    0
## 7        0       0       0         0   0        0            0       0    0
## 8        0       0       0         0   0        0            0       0    0
## 9        0       0       0         0   0        0            0       0    0
## 10       0       0       0         0   0        0            0       0    0
##     ricotta roast root.vegetable rosemary rosh.hashanah.yom.kippur rosÃ.
## 1         0     0              0        0                        0     0
## 2         0     0              0        0                        0     0
## 3         0     0              0        0                        0     0
## 4         0     0              0        0                        0     0
## 5         0     0              0        0                        0     0
## 6         0     0              0        0                        0     0
## 7         0     0              0        0                        0     0
## 8         0     0              0        0                        0     0
## 9         0     0              0        0                        0     0
## 10        0     0              0        0                        0     0
##     rub rum rutabaga rye saffron sage sake salad salad.dressing salmon
## 1     0   0        0   0       0    0    0     0              0      0
## 2     0   0        0   0       0    0    0     0              0      0
## 3     0   0        0   0       0    0    0     0              0      0
## 4     0   0        0   0       0    0    0     0              0      0
## 5     0   0        0   0       0    0    0     0              0      0
## 6     0   0        0   0       0    0    0     0              0      0
## 7     0   0        0   0       0    0    0     1              0      0
## 8     0   0        0   0       0    0    0     0              0      0
## 9     0   0        0   0       0    0    0     0              0      0
## 10    0   0        0   0       0    0    0     1              0      0
##     salsa san.francisco sandwich sandwich.theory sangria santa.monica
## 1       0             0        1               0       0            0
## 2       0             0        0               0       0            0
## 3       0             0        0               0       0            0
## 4       0             0        0               0       0            0
## 5       0             0        0               0       0            0
## 6       0             0        1               0       0            0
```

```
## 7        0             0         0               0          0            0
## 8        0             0         0               0          0            0
## 9        0             0         0               0          0            0
## 10       0             0         0               0          0            0
##    sardine sauce sausage sautÃ. scallop scotch seafood seattle seed self
## 1        0     0       0      0       0      0       0       0    0    0
## 2        0     0       0      0       0      0       0       0    0    0
## 3        0     0       0      0       0      0       0       0    0    0
## 4        0     0       0      1       0      0       0       0    0    0
## 5        0     0       0      0       0      0       0       0    0    0
## 6        0     0       0      0       0      0       0       0    0    0
## 7        0     0       0      0       0      0       0       0    0    0
## 8        0     0       0      0       0      0       0       0    0    0
## 9        0     0       0      1       0      0       0       0    0    0
## 10       0     0       0      0       0      0       0       0    0    0
##    semolina sesame sesame.oil shallot shavuot shellfish sherry shower
## 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
##    shrimp side simmer skewer slow.cooker smoker smoothie snapper sorbet
## 1       0    0      0      0           0      0        0       0      0
## 2       0    0      0      0           0      0        0       0      0
## 3       0    0      0      0           0      0        0       0      0
## 4       0    0      1      0           0      0        0       0      0
## 5       0    1      0      0           0      0        0       0      0
## 6       0    0      0      0           0      0        0       0      0
## 7       0    1      0      0           0      0        0       0      0
## 8       0    0      0      0           0      0        0       0      0
## 9       0    0      0      0           0      0        0       0      0
## 10      0    0      0      0           0      0        0       0      0
##    soufflÃ..meringue soup.stew sour.cream sourdough south.carolina soy
## 1                  0         0          0         0              0   0
## 2                  0         0          0         0              0   0
## 3                  0         1          0         0              0   0
## 4                  0         0          0         0              0   0
## 5                  0         0          0         0              0   0
## 6                  0         0          0         0              0   0
## 7                  0         0          0         0              0   0
## 8                  0         0          0         0              0   0
## 9                  0         0          0         0              0   0
## 10                 0         0          0         0              0   0
##    soy.free soy.sauce spain sparkling.wine spice spinach spirit spring
## 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          1          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          1          0      0              0         0         1      0      1
## 8          0          0      0              0         0         0      0      0
## 9          0          1      0              0         0         0      0      1
## 10         1          0      0              0         0         0      0      0
##     spritzer squash squid st..louis st..patrick.s.day steak steam stew
## 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
##     stir.fry stock strawberry stuffing.dressing sugar.conscious
## 1          0     0          0                 0               0
## 2          0     0          0                 0               0
## 3          0     0          0                 0               0
## 4          0     0          0                 0               0
## 5          0     0          0                 0               0
## 6          0     0          0                 0               0
## 7          0     0          0                 0               0
## 8          0     0          0                 0               0
## 9          1     0          0                 0               0
## 10         0     0          0                 0               1
##     sugar.snap.pea sukkot summer super.bowl suzanne.goin sweet.potato.yam
## 1                0      0      0          0            0                0
## 2                0      0      0          0            0                0
## 3                0      0      0          0            0                0
## 4                0      0      0          0            0                0
## 5                0      0      0          0            0                0
## 6                0      0      1          0            0                0
## 7                1      0      0          0            0                0
## 8                0      0      0          0            0                0
## 9                0      0      0          0            0                0
## 10               0      0      1          0            0                0
##     swiss.cheese switzerland swordfish taco tailgating tamarind tangerine
## 1              0           0         0    0          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
##    tapioca tarragon tart tea tennessee tequila tested...improved texas
## 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
##    thanksgiving thyme tilapia tofu tomatillo tomato tortillas tree.nut
## 1             0     0       0    0         0      1         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      1         0        0
## 5             0     0       0    0         0      0         0        0
## 6             0     0       0    0         0      1         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
##    tree.nut.free triple.sec tropical.fruit trout tuna turnip utah
## 1              0          0              0     0    0      0    0
## 2              0          0              0     0    0      0    0
## 3              0          0              0     0    0      0    0
## 4              1          0              0     0    0      0    0
## 5              0          0              0     0    0      0    0
## 6              0          0              0     0    0      0    0
## 7              1          0              0     0    0      0    0
## 8              0          0              0     0    0      0    0
## 9              0          0              0     0    0      0    0
## 10             1          0              0     0    0      0    0
##    valentine.s.day vanilla veal vegan vegetable vegetarian venison vermont
## 1                0       0    0     0         1          0       0       0
## 2                0       0    0     0         0          0       0       0
## 3                0       0    0     0         1          0       0       0
## 4                0       0    0     0         0          0       0       0
## 5                0       0    0     0         1          1       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          1       0       0
## 9                0       0    0     0         0          0       0       0
## 10               0       0    0     0         0          0       0       0
##    vermouth vinegar virginia vodka waffle walnut wasabi washington
## 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
##     washington..d.c. watercress watermelon wedding weelicious west.virginia
## 1                  0          0          0       0          0             0
## 2                  0          0          0       0          0             0
## 3                  0          0          0       0          0             0
## 4                  0          0          0       0          0             0
## 5                  0          0          0       0          0             0
## 6                  0          0          0       0          0             0
## 7                  0          0          0       0          0             0
## 8                  0          0          0       0          0             0
## 9                  0          0          0       0          0             0
## 10                 0          0          0       0          0             0
##     westwood wheat.gluten.free whiskey white.wine whole.wheat wild.rice
## 1          0                 0       0          0           0         0
## 2          0                 0       0          0           0         0
## 3          0                 0       0          0           0         0
## 4          0                 0       0          0           0         0
## 5          0                 0       0          0           0         0
## 6          0                 0       0          0           0         0
## 7          0                 1       0          0           0         0
## 8          0                 0       0          0           0         0
## 9          0                 0       0          0           0         0
## 10         0                 1       0          0           0         0
##     windsor wine winter wisconsin wok yellow.squash yogurt yonkers yuca
## 1         0    0      0         0   0             0      0       0    0
## 2         0    0      1         0   0             0      0       0    0
## 3         0    0      0         0   0             0      0       0    0
## 4         0    0      0         0   0             0      0       0    0
## 5         0    0      0         0   0             0      0       0    0
## 6         0    0      0         0   0             0      0       0    0
## 7         0    0      0         0   0             0      0       0    0
## 8         0    0      1         0   0             0      0       0    0
## 9         0    0      0         0   0             0      0       0    0
## 10        0    0      0         0   0             0      0       0    0
##     zucchini cookbooks leftovers snack snack.week turkey
## 1          0         0         0     0          0      1
## 2          0         0         0     0          0      0
## 3          0         0         0     0          0      0
## 4          0         0         0     0          0      0
## 5          0         0         0     0          0      0
## 6          0         0         0     0          0      0
## 7          0         0         0     0          0      0
## 8          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, JÃcama, 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
Roast 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
Banana Split with Curried Chocolate-Coconut Sauce
111
Escarole and Cheese Spoon Bread
112
Honey-Ginger Barbecue Sauce
113
Baked Pears 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 Salad 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 Soufflé
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
```

```
## 48    4.375     NA     NA     NA      NA    0    0
## 49    4.375    338     14     21     174    0    0
## 50    4.375    191      3      1       4    0    0
## 51    3.125    166      8     12     508    0    0
## 52    3.750    275      6     13     242    0    0
## 53    4.375     NA     NA     NA      NA    0    0
## 54    5.000   1203     89     87     583    0    0
## 55    3.750    266      4      7     148    0    0
## 56    5.000     NA     NA     NA      NA    0    0
## 57    4.375    904     38     70    1413    0    0
## 58    4.375    223      4     10     211    0    0
## 59    3.750    194      2      3     697    0    0
## 60    3.750    177      5      7     116    0    0
## 61    3.750     70      2      6      60    0    0
## 62    4.375    368      6     32     112    0    0
## 63    5.000    293      7     15     565    0    0
## 64    0.000    523      8     19     694    0    0
## 65    3.750    252      4      7      89    0    0
## 66    4.375     NA     NA     NA      NA    0    0
## 67    3.125    224     21     12     340    0    0
## 68    3.750    185      0     20     155    0    0
## 69    4.375    830      9     59     148    0    0
## 70    0.000    195      7      5     469    0    0
## 71    4.375    684     21     42     637    0    0
## 72    4.375    641     39     37     907    0    0
## 73    3.750    538      8     36     231    0    0
## 74    3.750    264      7     24      84    0    0
## 75    3.750    365     19     14     599    0    0
## 76    4.375    926      9     56     569    0    0
## 77    3.125     26      1      0     364    0    0
## 78    3.750    230      2      7       9    0    0
## 79    4.375    157      3      8      51    0    0
## 80    3.750     NA     NA     NA      NA    0    0
## 81    4.375   1172     54     73     220    0    0
## 82    4.375    298      6     12     199    0    0
## 83    4.375    682     36     57     909    0    0
## 84    5.000    517      7     18      20    0    0
## 85    4.375    856     45     54    1797    0    0
## 86    4.375    599     48     28    1038    0    0
## 87    0.000     NA     NA     NA      NA    0    0
## 88    0.000   1143     63     77     311    0    0
## 89    4.375    129      4     11     146    0    0
## 90    3.750     NA     NA     NA      NA    0    0
## 91    3.750     NA     NA     NA      NA    0    0
## 92    4.375    571     36     37     106    0    0
## 93    4.375    508     45     17     826    0    0
## 94    3.750     62      2      3     603    0    0
## 95    3.125   1118     92     70    1226    0    0
## 96    0.000    306      0     34     302    0    0
## 97    4.375    209      5      8      77    0    0
```

```
## 98    3.125    645    22    52    324         0         0
## 99    3.125    126     3     9     46         0         0
## 100   4.375    133     2     8     91         0         0
## 101   4.375    285    19     7    635         0         0
## 102   3.125     NA    NA    NA     NA         0         0
## 103   4.375    310     3    25     89         0         0
## 104   5.000     NA    NA    NA     NA         0         0
## 105   3.125    248     3    10     73         0         0
## 106   5.000    247     5    10    185         0         0
## 107   3.750    201     4    11    210         0         0
## 108   5.000    519    14    25   1237         0         0
## 109   4.375     NA    NA    NA     NA         0         0
## 110   3.750   1076    11    73    150         0         0
## 111   4.375    338    15    18    515         0         0
## 112   4.375    298     1     0   1430         0         0
## 113   3.750     NA    NA    NA     NA         0         0
## 114   3.125    280    13    18    587         0         0
## 115   3.750    171     1     0      6         0         0

## 16              0     0            0     0     0     0
## 17              0     0            0     0     0     0
## 18              0     0            0     0     0     0
## 19              0     0            0     0     0     0
## 20              0     0            0     0     0     0
## 21              0     0            0     0     0     0
## 22              0     0            0     0     0     0
## 23              0     0            0     0     0     0
## 24              0     0            0     0     0     0
## 25              0     0            0     0     0     0
## 26              0     0            0     0     0     0
## 27              0     0            0     0     1     0
## 28              0     0            0     0     0     0
## 29              0     0            0     0     0     0
## 30              0     0            0     0     0     0
## 31              0     0            0     0     0     0
## 32              0     0            0     0     0     0
## 33              0     0            0     0     0     0
## 34              0     0            0     0     0     0
## 35              0     0            0     0     0     0
## 36              0     0            0     0     0     0
## 37              0     0            0     0     0     0
## 38              0     0            0     0     0     0
## 39              0     0            0     0     0     0
## 40              0     0            0     0     0     0
## 41              0     0            0     0     0     0
## 42              0     0            0     0     0     0
## 43              0     0            0     0     0     0
## 44              0     0            0     0     0     0
## 45              0     0            0     0     0     0
## 46              0     0            0     0     0     0
```

```
## 47                     0    0              0    0    0    0
## 48                     0    0              0    0    0    0
## 49                     0    0              0    0    0    0
## 50                     0    0              0    0    0    0
## 51                     0    0              0    0    0    0
## 52                     0    0              0    0    0    0
## 53                     0    0              0    0    0    0
## 54                     0    0              0    0    0    0
## 55                     0    0              0    0    0    0
## 56                     0    0              0    0    0    0
## 57                     0    0              0    0    0    0
## 58                     0    0              0    0    0    0
## 59                     0    0              0    0    0    0
## 60                     0    0              0    0    0    0
## 61                     0    0              0    0    0    0
## 62                     0    0              0    0    0    0
## 63                     0    0              0    0    0    0
## 64                     0    0              0    0    0    0
## 65                     0    0              0    0    0    0
## 66                     0    0              0    0    0    0
## 67                     0    0              0    0    0    0
## 68                     0    0              0    0    0    0
## 69                     0    0              0    0    0    0
## 70                     0    0              0    0    0    0
## 71                     0    0              0    0    0    0
## 72                     0    0              0    0    0    0
## 73                     0    0              0    0    0    0
## 74                     0    0              0    0    0    0
## 75                     0    0              0    0    0    0
## 76                     0    0              0    0    0    0
## 77                     0    0              0    0    0    0
## 78                     0    0              0    0    0    0
## 79                     0    0              0    0    0    0
## 80                     0    0              0    0    0    0
## 81                     0    0              0    0    0    0
## 82                     0    0              0    0    0    0
## 83                     0    0              0    0    0    0
## 84                     0    0              0    0    0    0
## 85                     0    0              0    0    0    0
## 86                     0    0              0    0    0    0
## 87                     0    0              0    0    0    0
## 88                     0    0              0    0    0    0
## 89                     0    0              0    0    0    0
## 90                     0    0              0    0    0    0
## 91                     0    0              0    0    0    0
## 92                     0    0              0    0    0    0
## 93                     0    0              0    0    0    0
## 94                     0    0              0    0    1    0
## 95                     0    0              0    0    0    0
## 96                     0    0              0    0    0    0
```

```
## 97            0    0            0    0    0    0
## 98            0    0            0    0    0    0
## 99            0    0            0    0    0    0
## 100           0    0            0    0    0    0
## 101           0    0            0    0    1    0
## 102           0    0            0    0    0    0
## 103           0    0            0    0    0    0
## 104           0    0            0    0    0    0
## 105           0    0            0    0    0    0
## 106           0    0            0    0    0    0
## 107           0    0            0    0    0    0
## 108           0    0            0    0    0    0
## 109           0    0            0    0    0    0
## 110           0    0            0    0    0    0
## 111           0    0            0    0    0    0
## 112           0    0            0    0    0    0
## 113           0    0            0    0    0    0
## 114           0    0            0    0    0    0
## 115           0    0            0    0    0    0
## 116           0    0            0    0    0    0
## 117           0    0            0    0    0    0
## 118           0    0            0    0    0    0
## 119           0    0            0    0    0    0
## 120           0    0            0    0    0    0
## 121           0    0            0    0    0    0
## 122           0    0            0    0    0    0
## 123           0    0            0    0    0    0
## 124           0    0            0    0    0    0
## 125           0    0            0    0    0    0
## 126           0    0            0    0    0    0
## 127           0    0            0    0    0    0
## 128           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
## 132           0    0            0    0    0    0
## 133           0    0            0    0    0    0
## 134           0    0            0    0    0    0
## 135           0    0            0    0    0    0
## 136           0    0            0    0    0    0
## 137           0    0            0    0    0    0
## 138           0    0            0    0    0    0
## 139           0    0            0    0    0    0
## 140           0    0            0    0    0    0
## 141           0    0            0    0    0    0
## 142           0    0            0    0    0    0
## 143           0    0            0    0    0    0
## 144           0    0            0    0    0    0
## 145           0    0            0    0    0    0
## 146           0    0            0    0    0    0
```

```
## 147                    0         0                   0      0          0      0
##         cupcake currant curry custard dairy dairy.free dallas date deep.fry
## 1            0       0     0       0     0          0      0    0        0
## 2            0       0     0       0     0          0      0    0        0
## 3            0       0     0       0     1          0      0    0        0
## 4            0       0     0       0     0          1      0    0        0
## 5            0       0     0       0     1          0      0    0        0
## 6            0       0     0       0     0          0      0    0        0
## 7            0       0     0       0     0          1      0    0        0
## 8            0       0     0       0     0          0      0    0        0
## 9            0       0     0       0     0          0      0    0        0
## 10           0       0     0       0     0          1      0    0        0
## 11           0       0     0       0     1          0      0    0        0
## 12           0       0     0       0     0          1      0    0        0
## 13           0       0     0       0     0          0      0    0        0
## 14           0       0     0       0     0          0      0    0        0
## 15           0       0     0       0     0          0      0    0        0
## 16           0       0     0       0     0          0      0    0        0
## 17           0       0     0       0     0          0      0    0        0
## 18           0       0     0       0     0          0      0    0        0
## 19           0       0     0       0     0          0      0    0        0
## 20           0       0     0       0     0          1      0    0        0
## 21           0       0     0       0     0          0      0    0        0
## 22           0       0     0       0     0          0      0    0        0
## 23           0       0     0       0     0          0      0    0        0
## 24           0       0     0       0     0          0      0    0        0
## 25           0       0     0       0     0          0      0    0        0
## 26           0       0     0       0     0          0      0    0        0
## 27           0       0     0       0     0          1      0    0        0
## 28           0       0     0       0     0          0      0    0        0
## 29           0       0     0       0     0          1      0    0        0
## 30           0       0     0       0     0          0      0    0        0
## 31           0       0     0       0     0          1      0    0        0
## 32           0       0     0       0     0          0      0    0        0
## 33           0       0     0       0     0          1      0    0        0
## 34           0       0     0       0     0          0      0    0        0
## 35           0       0     0       0     0          0      0    0        0
## 36           0       0     0       0     0          0      0    0        0
## 37           0       0     0       0     0          1      0    0        1
## 38           0       0     0       0     0          1      0    0        0
## 39           0       0     0       0     0          0      0    0        0
## 40           0       0     0       0     0          1      0    0        0
## 41           0       0     0       0     0          0      0    0        0
## 42           0       0     0       0     0          0      0    0        0
## 43           0       0     0       0     0          0      0    0        0
## 44           0       0     0       0     0          0      0    0        0
## 45           0       0     0       0     0          1      0    0        0
## 46           0       0     0       0     0          0      0    0        0
## 47           0       0     0       0     0          1      0    0        0
## 48           0       0     0       0     0          0      0    0        0
```

```
## 49          0     0     0     0     0          0     0     0          0
## 50          0     0     0     0     0          1     0     0          0
## 51          0     0     0     0     0          1     0     0          0
## 52          0     0     0     0     0          0     0     0          0
## 53          0     0     0     0     0          1     0     0          0
## 54          0     0     0     0     0          0     0     0          0
## 55          0     0     0     0     0          0     0     0          0
## 56          0     0     0     0     0          1     0     0          0
## 57          0     0     0     0     0          0     0     0          0
## 58          0     0     0     0     0          0     0     0          0
## 59          0     0     0     0     0          0     0     0          0
## 60          0     0     0     0     0          0     0     0          0
## 61          0     0     0     0     1          0     0     0          0
## 62          0     0     0     0     0          0     0     0          0
## 63          0     0     0     0     0          0     0     0          0
## 64          0     0     0     0     0          0     0     0          0
## 65          0     0     0     0     0          0     0     0          0
## 66          0     0     0     0     0          0     0     0          0
## 67          0     0     0     0     0          0     0     0          0
## 68          0     0     0     0     0          0     0     0          0
## 69          0     0     0     0     1          0     0     0          0
## 70          0     0     0     0     0          1     0     0          0
## 71          0     0     0     0     1          0     0     0          0
## 72          0     0     0     0     0          0     0     0          0
## 73          0     0     0     0     0          0     0     0          0
## 74          0     0     0     0     0          0     0     0          0
## 75          0     0     0     0     0          0     0     0          0
## 76          0     0     0     0     1          0     0     0          0
## 77          0     0     0     0     0          0     0     0          0
## 78          0     0     0     0     0          0     0     0          0
## 79          0     0     0     0     1          0     0     0          0
## 80          0     0     0     0     0          0     0     0          0
## 81          0     0     0     0     0          1     0     0          0
## 82          0     0     0     0     0          0     0     0          0
## 83          0     0     0     0     0          0     0     0          0
## 84          0     0     0     0     0          0     0     0          0
## 85          0     0     0     0     0          1     0     0          0
## 86          0     0     0     0     0          0     0     0          0
## 87          0     0     0     0     0          0     0     0          0
## 88          0     0     0     0     0          0     0     0          0
## 89          0     0     0     0     0          1     0     0          0
## 90          0     0     0     0     0          0     0     0          0
## 91          0     0     0     0     0          0     0     0          0
## 92          0     0     0     0     0          1     0     0          0
## 93          0     0     0     0     0          1     0     0          0
## 94          0     0     0     0     1          0     0     0          0
## 95          0     0     0     0     0          0     0     0          0
## 96          0     0     0     0     0          0     0     0          0
## 97          0     0     0     0     0          0     0     0          0
## 98          0     0     0     0     0          0     0     0          0
```

```
## 99          0      0      0      0      0      1      0      0           0
## 100         0      0      0      0      0      0      0      0           0
## 101         0      0      0      0      0      0      0      0           0
## 102         0      0      0      0      0      1      0      0           0
## 103         0      0      0      0      0      0      0      0           0
## 104         0      0      0      0      0      0      0      0           0
## 105         0      0      0      0      1      0      0      0           0
## 106         0      0      0      0      0      0      0      0           0
## 107         0      0      0      0      0      0      0      0           0
## 108         0      0      0      0      0      0      0      0           0
## 109         0      0      0      0      0      0      0      0           0
## 110         0      0      1      0      0      0      0      0           0
## 111         0      0      0      0      0      0      0      0           0
## 112         0      0      0      0      0      1      0      0           0
## 113         0      0      0      0      0      0      0      0           0
## 114         0      0      0      0      0      0      0      0           0
## 115         0      0      0      0      0      1      0      0           0
## 116         0      0      0      0      0      0      0      0           0
## 117         0      0      0      0      0      0      0      0           0
## 118         0      0      0      0      0      0      0      0           0
## 119         0      0      0      0      0      0      0      0           0
## 120         0      0      0      0      0      0      0      0           0
## 121         0      0      0      0      0      0      0      0           0
## 122         0      0      0      0      0      0      0      0           0
## 123         0      0      0      0      0      0      0      0           0
## 124         0      0      0      0      0      0      0      0           0
## 125         0      0      0      0      0      1      0      0           0
## 126         0      0      0      0      1      0      0      0           0
## 127         0      0      0      0      1      0      0      0           0
## 128         0      0      0      0      0      0      0      0           0
## 129         0      0      0      0      0      0      0      0           0
## 130         0      0      0      0      1      0      0      0           0
## 131         0      0      0      0      0      0      0      0           0
## 132         0      0      0      0      0      0      0      0           0
## 133         0      0      0      0      0      0      0      0           0
## 134         0      0      0      0      0      0      0      0           0
## 135         0      0      0      0      0      0      0      0           0
## 136         0      0      0      0      0      0      0      0           0
## 137         0      0      0      0      0      0      0      0           0
## 138         0      0      0      0      0      0      0      0           0
## 139         0      0      0      0      0      0      0      0           0
## 140         0      0      0      0      0      0      0      0           0
## 141         0      0      0      0      0      1      0      0           0
## 142         0      0      0      0      0      0      0      0           0
## 143         0      0      0      0      0      0      0      0           0
## 144         0      0      0      0      0      0      0      0           0
## 145         0      0      0      0      0      1      0      0           0
## 146         0      0      0      0      0      1      0      0           0
## 147         0      0      0      0      0      0      0      0           0
##      denver dessert digestif dill dinner dip diwali dominican.republic
```

```
## 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    1    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
## 11     0    0    0    0    0    0    0         0
## 12     0    0    0    0    0    0    0         0
## 13     0    1    0    0    0    0    0         0
## 14     0    0    0    0    0    0    0         0
## 15     0    0    0    0    0    0    0         0
## 16     0    0    0    0    0    0    0         0
## 17     0    1    0    0    0    0    0         0
## 18     0    0    0    0    0    0    0         0
## 19     0    0    0    0    0    0    0         0
## 20     0    0    0    0    0    0    0         0
## 21     0    0    0    0    0    0    0         0
## 22     0    0    0    0    0    0    0         0
## 23     0    0    0    0    1    0    0         0
## 24     0    0    0    0    1    0    0         0
## 25     0    0    0    0    0    0    0         0
## 26     0    0    0    0    0    0    0         0
## 27     0    0    0    0    1    0    0         0
## 28     0    0    0    0    0    0    0         0
## 29     0    0    0    0    0    0    0         0
## 30     0    1    0    0    0    0    0         0
## 31     0    0    0    0    1    0    0         0
## 32     0    0    0    0    0    0    0         0
## 33     0    0    0    0    0    0    0         0
## 34     0    0    0    0    0    0    0         0
## 35     0    0    0    0    1    0    0         0
## 36     0    0    0    0    1    0    0         0
## 37     0    1    0    0    0    0    0         0
## 38     0    0    0    0    0    0    0         0
## 39     0    0    0    0    0    0    0         0
## 40     0    0    0    0    0    0    0         0
## 41     0    1    0    0    0    0    0         0
## 42     0    0    0    0    0    0    0         0
## 43     0    0    0    0    0    0    0         0
## 44     0    0    0    0    0    0    0         0
## 45     0    0    0    0    1    0    0         0
## 46     0    0    0    0    0    0    0         0
## 47     0    0    0    0    0    0    0         0
## 48     0    0    0    0    1    0    0         0
## 49     0    0    0    0    0    0    0         0
## 50     0    0    0    0    0    0    0         0
```

```
## 51       0    0    0    0    0    0    0              0
## 52       0    0    0    0    0    0    0              0
## 53       0    0    0    0    1    0    0              0
## 54       0    0    0    0    1    0    0              0
## 55       0    1    0    0    0    0    0              0
## 56       0    0    0    0    1    0    0              0
## 57       0    0    0    0    0    0    0              0
## 58       0    0    0    0    0    0    0              0
## 59       0    0    0    0    0    0    0              0
## 60       0    0    0    0    0    0    0              0
## 61       0    0    0    0    0    0    0              0
## 62       0    0    0    0    0    0    0              0
## 63       0    0    0    0    0    0    0              0
## 64       0    0    0    0    0    0    0              0
## 65       0    1    0    0    0    0    0              0
## 66       0    1    0    0    0    0    0              0
## 67       0    0    0    0    1    0    0              0
## 68       0    0    0    0    0    0    0              0
## 69       0    1    0    0    0    0    0              0
## 70       0    0    0    0    0    0    0              0
## 71       0    0    0    0    1    0    0              0
## 72       0    0    0    0    0    0    0              0
## 73       0    1    0    0    0    0    0              0
## 74       0    0    0    0    0    0    0              0
## 75       0    0    0    0    0    0    0              0
## 76       0    1    0    0    0    0    0              0
## 77       0    0    0    0    0    0    0              0
## 78       0    0    0    0    0    0    0              0
## 79       0    1    0    0    0    0    0              0
## 80       0    0    0    0    0    0    0              0
## 81       0    0    0    0    1    0    0              0
## 82       0    0    0    1    0    0    0              0
## 83       0    0    0    0    0    0    0              0
## 84       0    0    0    0    0    0    0              0
## 85       0    0    0    0    1    0    0              0
## 86       0    0    0    0    0    0    0              0
## 87       0    0    0    0    0    0    0              0
## 88       0    0    0    0    1    0    0              0
## 89       0    0    0    0    0    0    0              0
## 90       0    0    0    0    0    0    0              0
## 91       0    0    0    0    0    0    0              0
## 92       0    0    0    0    1    0    0              0
## 93       0    0    0    0    1    0    0              0
## 94       0    0    0    0    0    0    0              0
## 95       0    0    0    0    0    0    0              0
## 96       0    0    0    0    0    0    0              0
## 97       0    0    0    0    0    0    0              0
## 98       0    0    0    0    0    0    0              0
## 99       0    0    0    0    0    0    0              0
## 100      0    0    0    0    0    0    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 ]
```

```r
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
```

```
## [13300] 4.375 4.375 3.750 4.375 4.375 4.375 4.375 3.750 3.750 4.375 4.375
## [13311] 0.000 4.375 3.750 4.375 3.750 4.375 0.000 5.000 4.375 0.000 3.125
## [13322] 4.375 3.750 3.750 3.125 4.375 5.000 3.750 4.375 4.375 4.375 4.375
## [13333] 0.000 3.750 4.375 3.125 2.500 5.000 3.750 5.000 5.000 4.375 3.125
## [13344] 3.750 4.375 3.125 4.375 5.000 3.750 4.375 4.375 4.375 3.750 4.375
## [13355] 3.750 3.750 4.375 3.750 5.000 4.375 3.750 3.750 3.750 4.375 5.000
## [13366] 5.000 4.375 4.375 2.500 4.375 4.375 3.750 3.750 4.375 3.750 4.375
## [13377] 4.375 5.000 0.000 4.375 5.000 4.375 5.000 0.000 5.000 3.750 4.375
## [13388] 0.000 3.750 4.375 0.000 4.375 3.750 3.750 4.375 0.000 4.375 3.750
## [13399] 4.375 3.125 1.250 0.000 4.375 4.375 0.000 5.000 4.375 0.000 5.000
## [13410] 3.750 4.375 2.500 4.375 4.375 4.375 4.375 4.375 5.000 5.000 3.750
## [13421] 4.375 3.750 3.750 4.375 3.750 3.125 4.375 4.375 4.375 4.375 4.375
## [13432] 4.375 0.000 3.750 4.375 3.750 4.375 3.750 5.000 4.375 4.375 4.375
## [13443] 5.000 3.750 3.750 3.125 4.375 5.000 4.375 4.375 3.750 0.000 3.750
## [13454] 5.000 4.375 5.000 3.125 4.375 4.375 0.000 3.750 4.375 0.000 3.750
## [13465] 4.375 3.750 4.375 1.250 4.375 4.375 4.375 3.750 5.000 4.375 4.375
## [13476] 0.000 4.375 4.375 3.750 4.375 4.375 3.750 3.125 3.750 0.000 3.750
## [13487] 4.375 4.375 4.375 4.375 0.000 5.000 3.750 0.000 4.375 4.375 4.375
## [13498] 3.750 3.750 5.000 3.750 5.000 4.375 3.750 4.375 3.750 4.375 4.375
## [13509] 4.375 3.750 4.375 4.375 0.000 4.375 4.375 3.750 5.000 4.375 4.375
## [13520] 4.375 5.000 2.500 3.750 4.375 0.000 4.375 3.125 3.750 3.750 4.375
## [13531] 4.375 4.375 5.000 3.750 3.750 1.875 4.375 4.375 4.375 5.000 5.000
## [13542] 3.125 4.375 0.000 3.750 5.000 5.000 4.375 4.375 3.750 0.000 5.000
## [13553] 4.375 2.500 3.750 3.750 1.875 4.375 3.750 3.750 3.750 0.000 0.000
## [13564] 0.000 4.375 3.750 3.125 4.375 3.750 4.375 4.375 3.750 4.375 5.000
## [13575] 0.000 5.000 3.750 3.750 4.375 5.000 3.750 3.750 4.375 3.750 0.000
## [13586] 2.500 3.750 3.750 0.000 1.875 4.375 4.375 0.000 4.375 4.375 4.375
## [13597] 4.375 4.375 4.375 3.125 4.375 5.000 4.375 3.750 3.750 4.375 4.375
## [13608] 3.750 4.375 4.375 4.375 4.375 4.375 5.000 4.375 3.750 4.375 3.750
## [13619] 4.375 3.750 0.000 4.375 3.125 3.750 5.000 3.750 3.750 4.375 3.750
## [13630] 4.375 4.375 4.375 4.375 4.375 5.000 3.750 3.750 4.375 4.375 3.125
## [13641] 2.500 4.375 4.375 3.750 4.375 3.125 3.125 4.375 4.375 3.750 4.375
## [13652] 3.125 4.375 4.375 4.375 3.750 3.125 0.000 5.000 0.000 4.375 5.000
## [13663] 3.750 3.750 4.375 4.375 4.375 0.000 0.000 4.375 3.750 0.000 4.375
## [13674] 4.375 5.000 4.375 4.375 3.125 3.750 5.000 4.375 4.375 4.375 4.375
## [13685] 3.125 1.250 1.875 3.125 1.250 2.500 3.750 3.750 3.750 3.750 4.375
## [13696] 1.250 4.375 4.375 5.000 3.125 4.375 4.375 4.375 4.375 5.000 4.375
## [13707] 4.375 3.750 3.750 3.750 3.750 3.750 3.125 5.000 1.875 3.125 3.750
## [13718] 4.375 3.750 5.000 3.750 5.000 0.000 4.375 4.375 4.375 5.000 0.000
## [13729] 3.125 3.750 4.375 3.750 4.375 4.375 4.375 3.750 0.000 4.375 0.000
## [13740] 3.750 4.375 5.000 4.375 5.000 5.000 4.375 4.375 3.750 4.375 4.375
## [13751] 4.375 2.500 4.375 4.375 3.125 4.375 4.375 5.000 4.375 4.375 4.375
## [13762] 5.000 4.375 4.375 4.375 4.375 4.375 5.000 0.000 4.375 3.750 5.000
## [13773] 3.125 3.750 3.750 4.375 3.750 4.375 5.000 3.750 3.125 3.750 4.375
## [13784] 5.000 4.375 0.000 3.750 4.375 4.375 5.000 3.125 4.375 4.375 4.375
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## [18261] 4.375 4.375 5.000 0.000 3.750 4.375 4.375 0.000 4.375 2.500 0.000
## [18272] 4.375 3.750 4.375 3.125 4.375 3.750 4.375 0.000 4.375 2.500 4.375
## [18283] 3.750 4.375 5.000 4.375 4.375 4.375 5.000 3.750 3.750 4.375 4.375
## [18294] 5.000 2.500 4.375 4.375 3.750 4.375 4.375 4.375 4.375 0.000 0.000
## [18305] 4.375 4.375 2.500 3.125 5.000 3.125 3.750 4.375 3.750 4.375 3.750
## [18316] 5.000 3.750 3.750 4.375 4.375 4.375 3.125 0.000 3.125 4.375 4.375
## [18327] 3.125 3.750 5.000 4.375 4.375 4.375 5.000 0.000 3.750 4.375 4.375
## [18338] 4.375 5.000 3.750 3.750 4.375 3.750 4.375 2.500 0.000 4.375 4.375
## [18349] 3.125 3.750 3.750 4.375 3.750 3.750 3.750 5.000 3.750 3.750 4.375
## [18360] 5.000 3.750 4.375 5.000 4.375 5.000 3.750 3.750 4.375 3.750 2.500
## [18371] 3.750 5.000 3.125 4.375 3.750 0.000 3.750 4.375 0.000 3.750 4.375
## [18382] 1.250 3.750 0.000 4.375 3.750 2.500 3.125 0.000 3.125 5.000 3.125
## [18393] 4.375 3.125 3.750 3.750 3.750 4.375 4.375 5.000 2.500 5.000 4.375
## [18404] 3.750 0.000 5.000 3.750 1.250 3.750 4.375 0.000 5.000 4.375 4.375
## [18415] 3.750 4.375 4.375 3.125 3.750 3.750 3.125 4.375 3.750 3.125 4.375
## [18426] 4.375 4.375 0.000 1.875 4.375 4.375 4.375 4.375 4.375 4.375 4.375
## [18437] 5.000 0.000 4.375 0.000 4.375 3.750 1.250 4.375 0.000 4.375 3.750
## [18448] 4.375 0.000 0.000 4.375 0.000 3.750 0.000 3.125 5.000 4.375 4.375
## [18459] 4.375 4.375 4.375 0.000 4.375 3.750 4.375 3.750 3.125 3.125 3.125
## [18470] 4.375 3.750 3.750 4.375 4.375 5.000 4.375 3.125 2.500 4.375 4.375
## [18481] 0.000 4.375 5.000 4.375 4.375 4.375 4.375 4.375 3.750 4.375 4.375
## [18492] 5.000 4.375 3.750 4.375 4.375 4.375 0.000 4.375 4.375 3.750 5.000
## [18503] 4.375 5.000 4.375 4.375 3.750 4.375 3.125 3.750 3.125 3.750 5.000
## [18514] 3.750 0.000 4.375 0.000 4.375 5.000 3.750 4.375 4.375 3.750 4.375
## [18525] 5.000 4.375 2.500 4.375 4.375 5.000 3.125 0.000 3.750 4.375 3.750
## [18536] 4.375 3.750 4.375 3.125 4.375 4.375 0.000 4.375 3.125 0.000 0.000
## [18547] 4.375 5.000 2.500 5.000 1.875 2.500 3.750 4.375 4.375 4.375 4.375
## [18558] 4.375 5.000 4.375 3.750 4.375 5.000 0.000 3.750 4.375 2.500 4.375
## [18569] 4.375 0.000 4.375 3.750 5.000 4.375 3.750 4.375 5.000 3.750 5.000
## [18580] 3.750 4.375 4.375 5.000 3.750 3.750 4.375 4.375 4.375 4.375 3.750
## [18591] 3.750 0.000 0.000 3.750 4.375 4.375 3.750 5.000 3.750 3.125 5.000
## [18602] 5.000 4.375 3.125 4.375 3.750 3.750 3.750 3.750 0.000 2.500 0.000
## [18613] 3.125 4.375 0.000 4.375 5.000 4.375 5.000 3.125 0.000 4.375 2.500
## [18624] 4.375 5.000 4.375 5.000 4.375 0.000 4.375 4.375 4.375 5.000 3.125
## [18635] 4.375 2.500 4.375 4.375 4.375 4.375 3.125 5.000 0.000 2.500 4.375
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## [18657] 0.000 3.750 4.375 4.375 3.750 0.000 4.375 3.750 2.500 5.000 3.750
## [18668] 4.375 0.000 5.000 5.000 3.125 0.000 0.000 0.000 3.750 2.500 0.000
## [18679] 4.375 5.000 3.125 3.750 4.375 1.875 4.375 3.125 3.750 5.000 5.000
## [18690] 3.750 0.000 3.750 3.750 3.750 5.000 4.375 4.375 3.125 5.000 4.375
## [18701] 5.000 1.250 4.375 4.375 3.750 4.375 5.000 3.125 3.750 5.000 5.000
## [18712] 4.375 3.125 3.750 3.750 3.750 4.375 0.000 4.375 3.750 4.375 0.000
## [18723] 4.375 0.000 0.000 4.375 3.750 4.375 4.375 4.375 4.375 4.375 0.000
## [18734] 4.375 0.000 4.375 5.000 3.750 0.000 4.375 5.000 3.125 4.375 4.375
## [18745] 0.000 3.125 4.375 3.750 5.000 3.750 3.750 3.750 3.750 4.375 4.375
## [18756] 3.125 4.375 5.000 5.000 3.750 3.125 3.750 5.000 5.000 2.500 3.750
## [18767] 1.875 5.000 4.375 0.000 4.375 5.000 4.375 4.375 4.375 3.750 2.500
## [18778] 5.000 3.750 3.750 5.000 4.375 4.375 4.375 4.375 3.750 0.000 0.000
## [18789] 3.750 4.375 4.375 4.375 3.750 3.750 3.125 4.375 5.000 4.375 5.000
```

```
## [18800] 4.375 3.750 5.000 5.000 3.125 4.375 3.125 3.750 4.375 5.000 5.000
## [18811] 4.375 3.125 4.375 4.375 4.375 5.000 4.375 4.375 3.125 3.125 3.125
## [18822] 0.000 3.125 4.375 3.750 3.125 5.000 3.125 4.375 5.000 3.750 2.500
## [18833] 4.375 0.000 4.375 3.750 4.375 3.125 4.375 3.750 3.750 3.750 3.750
## [18844] 5.000 4.375 0.000 5.000 4.375 2.500 4.375 3.750 5.000 0.000 0.000
## [18855] 4.375 3.750 3.750 3.750 5.000 3.750 4.375 4.375 0.000 4.375 4.375
## [18866] 3.750 1.875 3.125 4.375 4.375 4.375 3.750 0.000 0.000 0.000 3.750
## [18877] 4.375 4.375 4.375 4.375 4.375 1.250 3.750 5.000 0.000 4.375 4.375
## [18888] 5.000 5.000 4.375 4.375 5.000 0.000 4.375 2.500 5.000 3.750 4.375
## [18899] 4.375 4.375 5.000 4.375 4.375 4.375 4.375 4.375 3.125 4.375 5.000
## [18910] 3.750 4.375 4.375 3.125 3.750 4.375 3.750 4.375 4.375 3.125 3.750
## [18921] 4.375 4.375 1.250 4.375 0.000 4.375 5.000 4.375 3.750 4.375 5.000
## [18932] 3.750 3.750 3.750 0.000 4.375 5.000 4.375 2.500 3.750 4.375 4.375
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## [18954] 0.000 3.750 5.000 4.375 4.375 3.750 4.375 0.000 4.375 2.500 4.375
## [18965] 3.125 4.375 3.750 4.375 4.375 4.375 3.750 4.375 4.375 0.000 3.750
## [18976] 4.375 4.375 4.375 4.375 5.000 0.000 0.000 4.375 3.750 4.375 0.000
## [18987] 4.375 5.000 3.750 5.000 4.375 3.750 3.750 4.375 3.750 4.375 4.375
## [18998] 0.000 4.375 0.000 0.000 1.250 4.375 3.750 0.000 4.375 3.125 4.375
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## [19042] 4.375 3.750 4.375 3.125 0.000 3.750 4.375 4.375 3.750 5.000 3.750
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## [19086] 0.000 4.375 3.750 3.750 4.375 3.750 4.375 4.375 4.375 3.750 5.000
## [19097] 4.375 3.750 5.000 4.375 3.125 4.375 3.750 5.000 4.375 3.750 4.375
## [19108] 4.375 4.375 3.125 4.375 5.000 4.375 4.375 4.375 4.375 4.375 3.750
## [19119] 0.000 3.750 0.000 5.000 4.375 3.125 4.375 4.375 4.375 4.375 4.375
## [19130] 0.000 4.375 3.125 4.375 3.750 5.000 4.375 4.375 4.375 5.000 5.000
## [19141] 3.125 4.375 5.000 4.375 5.000 3.125 4.375 5.000 5.000 0.000 0.000
## [19152] 3.750 5.000 4.375 3.750 1.875 3.125 4.375 4.375 4.375 5.000 3.750
## [19163] 4.375 3.750 0.000 3.750 3.125 0.000 3.125 3.750 3.750 4.375 3.750
## [19174] 2.500 4.375 3.750 3.750 3.750 3.750 4.375 0.000 4.375 4.375 3.750
## [19185] 4.375 5.000 3.125 5.000 0.000 3.750 5.000 4.375 3.125 1.250 0.000
## [19196] 3.750 5.000 5.000 4.375 4.375 4.375 4.375 3.750 4.375 4.375 5.000
## [19207] 4.375 3.750 4.375 3.125 5.000 4.375 4.375 4.375 0.000 2.500 0.000
## [19218] 4.375 4.375 4.375 3.750 4.375 4.375 4.375 4.375 4.375 4.375 3.750
## [19229] 4.375 4.375 3.125 4.375 3.125 3.750 3.750 3.750 3.750 3.750 4.375
## [19240] 3.125 3.750 4.375 3.750 4.375 2.500 5.000 0.000 4.375 4.375 1.250
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## [19284] 4.375 5.000 3.750 3.750 4.375 0.000 3.750 4.375 3.750 4.375 4.375
## [19295] 4.375 5.000 4.375 3.750 3.750 3.750 0.000 3.125 3.750 3.750 4.375
## [19306] 4.375 4.375 3.750 5.000 4.375 3.125 3.125 3.750 3.750 4.375 3.750
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## [19328] 3.750 4.375 3.750 3.750 3.750 2.500 3.125 3.750 4.375 3.750 4.375
## [19339] 4.375 4.375 3.750 5.000 3.750 4.375 4.375 4.375 3.750 0.000 3.125
```

```
## [19350] 3.750 3.750 5.000 4.375 3.750 4.375 1.250 4.375 3.125 3.750 5.000
## [19361] 4.375 4.375 3.125 3.125 3.750 3.125 4.375 4.375 5.000 4.375 0.000
## [19372] 3.750 4.375 3.750 4.375 3.750 4.375 3.750 5.000 3.125 5.000 5.000
## [19383] 5.000 5.000 4.375 4.375 1.250 3.750 5.000 0.000 5.000 3.750 5.000
## [19394] 3.750 4.375 5.000 3.125 3.750 5.000 4.375 5.000 4.375 4.375 3.750
## [19405] 0.000 4.375 4.375 5.000 1.250 4.375 5.000 3.750 4.375 3.750 0.000
## [19416] 3.750 4.375 4.375 3.750 4.375 5.000 3.125 4.375 4.375 4.375 4.375
## [19427] 5.000 4.375 3.750 3.750 0.000 5.000 2.500 3.750 4.375 4.375 4.375
## [19438] 4.375 4.375 3.125 5.000 0.000 3.750 4.375 4.375 4.375 4.375 4.375
## [19449] 3.750 4.375 3.750 3.750 5.000 3.750 5.000 4.375 4.375 4.375 3.750
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## [19471] 3.750 3.125 3.750 4.375 4.375 3.750 3.750 2.500 3.750 4.375 4.375
## [19482] 3.125 3.125 4.375 3.125 3.750 5.000 3.125 4.375 2.500 3.125 3.750
## [19493] 0.000 5.000 3.125 4.375 0.000 5.000 4.375 4.375 4.375 4.375 3.750
## [19504] 4.375 3.750 3.750 5.000 5.000 4.375 0.000 3.750 4.375 3.750 3.750
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## [19526] 0.000 4.375 3.750 4.375 4.375 3.125 4.375 3.750 4.375 1.875 2.500
## [19537] 0.000 5.000 3.750 3.750 4.375 0.000 4.375 3.750 4.375 2.500 3.750
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## [19636] 3.125 4.375 5.000 3.125 4.375 3.750 3.125 3.750 3.750 4.375 3.750
## [19647] 4.375 4.375 5.000 4.375 4.375 4.375 4.375 3.125 4.375 0.000 4.375
## [19658] 3.125 4.375 3.750 4.375 3.750 4.375 3.750 4.375 4.375 4.375 5.000
## [19669] 3.750 4.375 4.375 4.375 4.375 3.125 5.000 4.375 3.750 4.375 4.375
## [19680] 4.375 4.375 4.375 4.375 5.000 3.125 3.125 4.375 3.125 4.375 4.375
## [19691] 4.375 4.375 4.375 3.750 5.000 0.000 3.750 4.375 4.375 5.000 5.000
## [19702] 4.375 3.125 3.750 4.375 4.375 3.750 3.750 3.750 4.375 4.375 5.000
## [19713] 4.375 4.375 3.750 4.375 0.000 4.375 3.750 4.375 4.375 3.750 5.000
## [19724] 3.750 5.000 2.500 4.375 3.750 3.125 4.375 0.000 3.125 2.500 0.000
## [19735] 3.750 4.375 1.250 5.000 3.750 2.500 4.375 4.375 4.375 4.375 4.375
## [19746] 3.750 0.000 4.375 4.375 3.750 5.000 4.375 3.125 3.125 5.000 4.375
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## [19779] 5.000 4.375 4.375 3.750 5.000 4.375 3.750 4.375 4.375 5.000 4.375
## [19790] 4.375 3.750 4.375 0.000 4.375 4.375 4.375 3.750 4.375 5.000 3.750
## [19801] 3.750 4.375 4.375 5.000 1.250 3.750 4.375 4.375 3.125 4.375 4.375
## [19812] 3.750 4.375 1.250 0.000 3.125 3.125 4.375 2.500 5.000 3.125 3.750
## [19823] 4.375 4.375 4.375 5.000 5.000 4.375 4.375 5.000 5.000 2.500 4.375
## [19834] 3.750 3.125 4.375 0.000 0.000 4.375 4.375 4.375 4.375 4.375 4.375
## [19845] 3.750 5.000 0.000 4.375 0.000 3.125 4.375 3.750 4.375 0.000 0.000
## [19856] 3.125 3.750 4.375 3.125 5.000 2.500 3.125 4.375 4.375 4.375 3.750
## [19867] 4.375 4.375 4.375 4.375 4.375 0.000 5.000 4.375 4.375 4.375 3.750
## [19878] 4.375 4.375 3.750 4.375 4.375 3.750 2.500 4.375 3.125 4.375 4.375
## [19889] 0.000 4.375 3.750 4.375 1.250 4.375 3.750 3.750 5.000 5.000 3.750
```

```
## [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
```

```r
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
```

```r
# 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
```

```r
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)
```
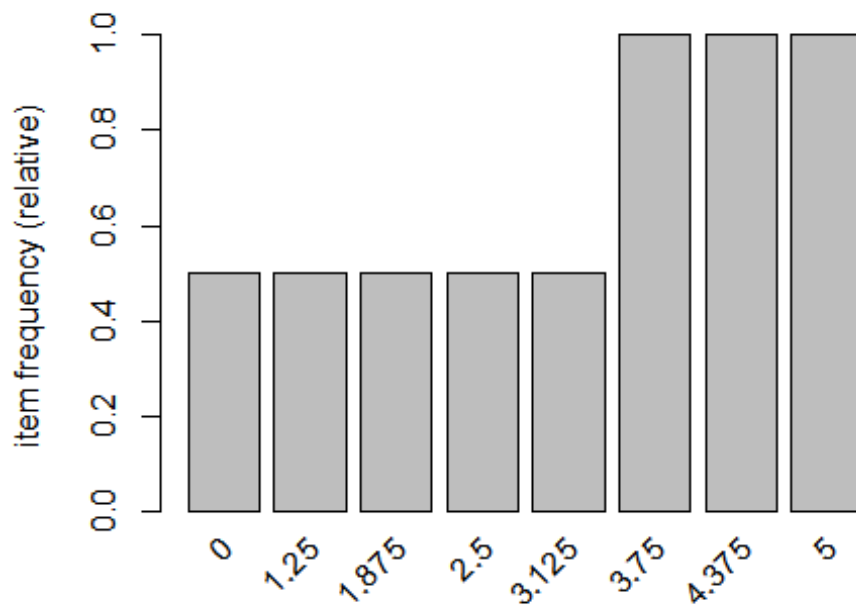
item frequency (relative)

1.0

0.8

0.6

0.4

0.2

0.0

0   1.25   1.875   2.5   3.125   3.75   4.375   5

```
# 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=",")
```

```
# 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

# 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

# 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
```

```r
plot(rules)
```

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


Scatter plot for 472 rules
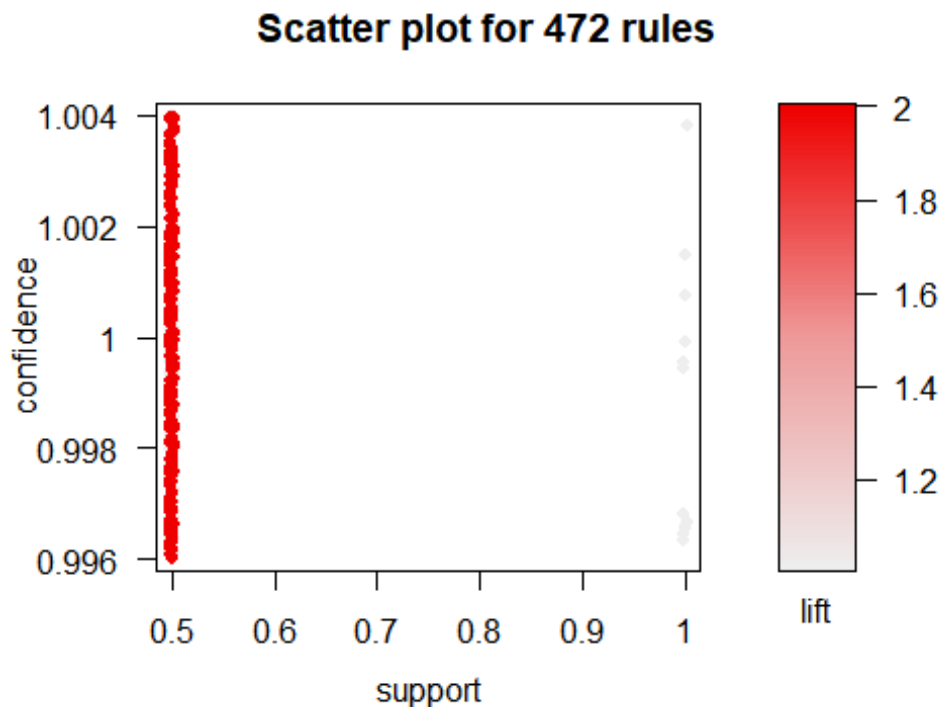
```r
plot(rules, method = "graph", interactive = T)
```

```
## 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)
```

```r
# 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
```

```r
# 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
```

```r
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
```

```r
rules
```

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

```r
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
```

```r
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
```

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

Number of rules at different support %
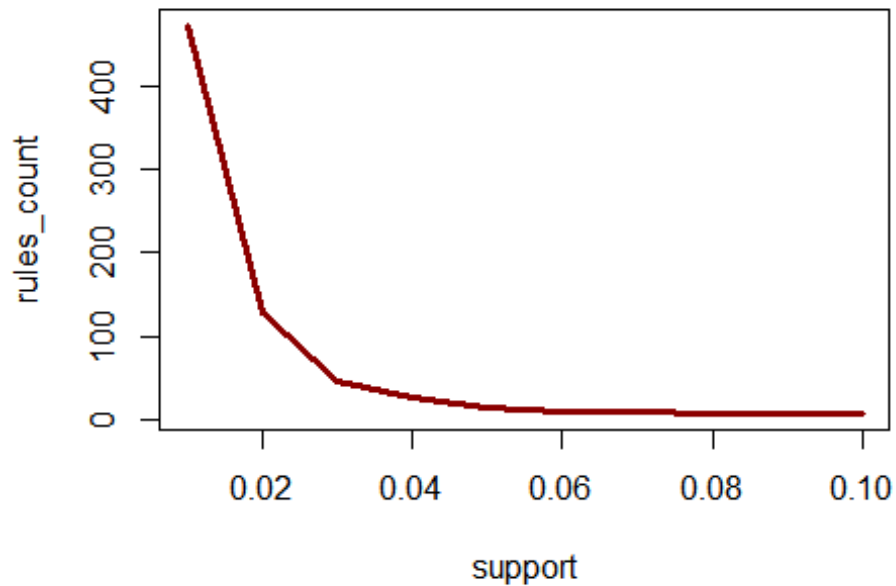

```
conf<-seq(0.10,1.0,0.10)
conf

##  [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)
```

Number of rules at different confidence %


```r
#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
```

```r
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
```

```r
###########################################
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 JÃcama 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 Soufflé
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
Jalapeño-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 Sauté
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
```

```
## 62     4.4  3.7e+02    6   32 1.1e+02        0        0
## 63     5.0  2.9e+02    7   15 5.6e+02        0        0
## 64     0.0  5.2e+02    8   19 6.9e+02        0        0
## 65     3.8  2.5e+02    4    7 8.9e+01        0        0
## 67     3.1  2.2e+02   21   12 3.4e+02        0        0
## 68     3.8  1.8e+02    0   20 1.6e+02        0        0
## 69     4.4  8.3e+02    9   59 1.5e+02        0        0
## 70     0.0  2.0e+02    7    5 4.7e+02        0        0
## 71     4.4  6.8e+02   21   42 6.4e+02        0        0
## 72     4.4  6.4e+02   39   37 9.1e+02        0        0
## 73     3.8  5.4e+02    8   36 2.3e+02        0        0
## 74     3.8  2.6e+02    7   24 8.4e+01        0        0
## 75     3.8  3.6e+02   19   14 6.0e+02        0        0
## 76     4.4  9.3e+02    9   56 5.7e+02        0        0
## 77     3.1  2.6e+01    1    0 3.6e+02        0        0
## 78     3.8  2.3e+02    2    7 9.0e+00        0        0
## 79     4.4  1.6e+02    3    8 5.1e+01        0        0
## 81     4.4  1.2e+03   54   73 2.2e+02        0        0
## 82     4.4  3.0e+02    6   12 2.0e+02        0        0
## 83     4.4  6.8e+02   36   57 9.1e+02        0        0
## 84     5.0  5.2e+02    7   18 2.0e+01        0        0
## 85     4.4  8.6e+02   45   54 1.8e+03        0        0
## 86     4.4  6.0e+02   48   28 1.0e+03        0        0
## 88     0.0  1.1e+03   63   77 3.1e+02        0        0
## 89     4.4  1.3e+02    4   11 1.5e+02        0        0
## 92     4.4  5.7e+02   36   37 1.1e+02        0        0
## 93     4.4  5.1e+02   45   17 8.3e+02        0        0
## 94     3.8  6.2e+01    2    3 6.0e+02        0        0
## 95     3.1  1.1e+03   92   70 1.2e+03        0        0
## 96     0.0  3.1e+02    0   34 3.0e+02        0        0
## 97     4.4  2.1e+02    5    8 7.7e+01        0        0
## 98     3.1  6.4e+02   22   52 3.2e+02        0        0
## 99     3.1  1.3e+02    3    9 4.6e+01        0        0
## 100    4.4  1.3e+02    2    8 9.1e+01        0        0
## 101    4.4  2.8e+02   19    7 6.4e+02        0        0
## 103    4.4  3.1e+02    3   25 8.9e+01        0        0
## 105    3.1  2.5e+02    3   10 7.3e+01        0        0
## 106    5.0  2.5e+02    5   10 1.8e+02        0        0
## 107    3.8  2.0e+02    4   11 2.1e+02        0        0
## 108    5.0  5.2e+02   14   25 1.2e+03        0        0
## 110    3.8  1.1e+03   11   73 1.5e+02        0        0
## 111    4.4  3.4e+02   15   18 5.2e+02        0        0
## 112    4.4  3.0e+02    1    0 1.4e+03        0        0
## 114    3.1  2.8e+02   13   18 5.9e+02        0        0
## 115    3.8  1.7e+02    1    0 6.0e+00        0        0
## 117    5.0  2.3e+02    1    0 2.6e+01        0        0
## 118    3.8  9.6e+02   21   60 1.5e+03        0        0
## 119    4.4  1.3e+02    1    0 2.0e+00        0        0
## 120    2.5  1.1e+02    0    0 0.0e+00        0        0
## 121    3.8  8.6e+01    3    1 3.4e+02        0        0
```

```
## 122      3.8  6.8e+02     55     36 3.3e+02          0          0
## 123      0.0  1.1e+02      2      7 1.2e+01          0          0
## 125      3.8  1.2e+02      5      7 6.0e+02          0          0
## 126      0.0  2.7e+02      2     28 5.0e+00          0          0
## 127      5.0  2.3e+02      3     16 9.9e+01          0          0
## 129      4.4  7.2e+02     21     28 1.1e+03          0          0
## 130      4.4  7.5e+02     17     58 1.1e+03          0          0
## 131      4.4  3.2e+02     16     23 6.6e+02          0          0
## 133      2.5  4.5e+02     10     22 5.3e+02          0          0
## 134      5.0  2.4e+02     13     19 3.9e+02          0          0
## 135      3.8  2.4e+02     12     16 3.7e+02          0          0
## 136      3.8  2.9e+02      4     12 2.0e+02          0          0
## 137      0.0  2.3e+01      2      1 5.4e+01          0          0
## 138      3.8  1.5e+02      0     15 1.9e+02          0          0
## 139      3.8  1.7e+02      2     14 9.0e+00          0          0
## 140      0.0  5.4e+01      4      2 8.7e+02          0          0
## 141      3.8  4.4e+02     20     20 1.8e+03          0          0
## 143      4.4  5.0e+01      3      4 1.1e+02          0          0
## 144      3.1  2.1e+02      0      0 8.0e+00          0          0
## 146      3.8  6.7e+01      2      4 6.6e+01          0          0
## 147      4.4  7.5e+02    118     21 4.8e+02          0          0
## 148      4.4  3.5e+02     16     22 9.3e+02          0          0
## 149      3.1  3.5e+02     16     31 4.9e+02          0          0
## 150      3.8  6.6e+02      7     39 2.1e+02          0          0
## 151      4.4  1.4e+02      9     11 1.8e+02          0          0
## 152      4.4  4.3e+02      9     28 4.1e+02          0          0
## 153      4.4  4.1e+02      5     37 3.1e+02          0          0
## 155      3.8  2.7e+02      4     10 1.1e+02          0          0
## 156      4.4  6.3e+02     28     52 2.9e+02          0          0
## 157      3.8  6.1e+02      0     68 1.2e+02          0          0
## 159      5.0  2.0e+02      1      2 2.0e+02          0          0
## 161      4.4  6.5e+02     10     55 2.2e+02          0          0
## 162      3.8  6.1e+02     30     43 1.2e+03          0          0
## 163      5.0  9.5e+02     14     66 7.7e+02          0          0
## 165      4.4  4.8e+02      4     19 2.3e+02          0          0
## 166      3.8  2.3e+02      4      9 1.7e+01          0          0
## 167      4.4  9.7e+01      2      4 8.1e+01          0          0
## 168      4.4  1.5e+02     11     11 2.2e+01          0          0
## 169      4.4  4.6e+01      3      3 1.2e+02          0          0
## 170      0.0  3.7e+02     16     19 5.9e+02          0          0
## 171      3.8  9.4e+02    100     38 8.0e+02          0          0
## 173      4.4  2.4e+02      9     21 2.3e+02          0          0
## 175      4.4  1.7e+02      5     11 3.1e+01          0          0
## 177      4.4  2.5e+02      3     23 2.1e+02          0          0
## 178      4.4  3.3e+02      4     18 8.7e+01          0          0
## 179      4.4  4.7e+02     23     19 9.7e+02          0          0
## 180      5.0  1.3e+02      2      9 1.1e+02          0          0
## 181      4.4  2.9e+02      5     14 3.1e+02          0          0
## 185      5.0  1.0e+02      1      8 4.0e+00          0          0
## 186      3.8  4.0e+02     11      4 1.2e+03          0          0
```

```
## 188          4.4  7.4e+02          41          60 1.1e+03              0              0
## 189          3.8  6.9e+02          85          34 7.2e+02              0              0
## 191          4.4  4.4e+02           5          30 7.4e+01              0              0
##       X22.minute.meals X3.ingredient.recipes X30.days.of.groceries
## 1                    0                     0                     0
## 2                    0                     0                     0
## 3                    0                     0                     0
## 5                    0                     0                     0
## 6                    0                     0                     0
## 9                    0                     0                     0
## 10                   0                     0                     0
## 11                   0                     0                     0
## 13                   0                     0                     0
## 14                   0                     0                     0
## 15                   0                     0                     0
## 16                   0                     0                     0
## 17                   0                     0                     0
## 18                   0                     0                     0
## 19                   0                     0                     0
## 20                   0                     0                     0
## 21                   0                     0                     0
## 25                   0                     0                     0
## 26                   0                     0                     0
## 27                   0                     0                     0
## 28                   0                     0                     0
## 29                   0                     0                     0
## 30                   0                     0                     0
## 33                   0                     0                     0
## 34                   0                     0                     0
## 36                   0                     0                     0
## 38                   0                     0                     0
## 39                   0                     0                     0
## 40                   0                     0                     0
## 41                   0                     0                     0
## 42                   0                     0                     0
## 46                   0                     0                     0
## 47                   0                     0                     0
## 49                   0                     0                     0
## 50                   0                     0                     0
## 51                   0                     0                     0
## 52                   0                     0                     0
## 54                   0                     0                     0
## 55                   0                     0                     0
## 57                   0                     0                     0
## 58                   0                     0                     0
## 59                   0                     0                     0
## 60                   0                     0                     0
## 61                   0                     0                     0
## 62                   0                     0                     0
## 63                   0                     0                     0
```

```
## 64                    0                    0                    0
## 65                    0                    0                    0
## 67                    0                    0                    0
## 68                    0                    0                    0
## 69                    0                    0                    0
## 70                    0                    0                    0
## 71                    0                    0                    0
## 72                    0                    0                    0
## 73                    0                    0                    0
## 74                    0                    0                    0
## 75                    0                    0                    0
## 76                    0                    0                    0
## 77                    0                    0                    0
## 78                    0                    0                    0
## 79                    0                    0                    0
## 81                    0                    0                    0
## 82                    0                    0                    0
## 83                    0                    0                    0
## 84                    0                    0                    0
## 85                    0                    0                    0
## 86                    0                    0                    0
## 88                    0                    0                    0
## 89                    0                    0                    0
## 92                    0                    0                    0
## 93                    0                    0                    0
## 94                    0                    0                    0
## 95                    0                    0                    0
## 96                    0                    0                    0
## 97                    0                    0                    0
## 98                    0                    0                    0
## 99                    0                    0                    0
## 100                   0                    0                    0
## 101                   0                    0                    0
## 103                   0                    0                    0
## 105                   0                    0                    0
## 106                   0                    0                    0
## 107                   0                    0                    0
## 108                   0                    0                    0
## 110                   0                    0                    0
## 111                   0                    0                    0
## 112                   0                    0                    0
## 114                   0                    0                    0
## 115                   0                    0                    0
## 117                   0                    0                    0
## 118                   0                    0                    1
## 119                   0                    0                    0
## 120                   0                    0                    0
## 121                   0                    0                    0
## 122                   0                    0                    0
## 123                   0                    0                    0
```

```
## 125                    0                   0                   0
## 126                    0                   0                   0
## 127                    0                   0                   0
## 129                    0                   0                   0
## 130                    0                   0                   0
## 131                    0                   0                   0
## 133                    0                   0                   0
## 134                    0                   0                   0
## 135                    0                   0                   0
## 136                    0                   0                   0
## 137                    0                   0                   0
## 138                    0                   0                   0
## 139                    0                   0                   0
## 140                    0                   0                   0
## 141                    0                   0                   0
## 143                    0                   0                   0
## 144                    0                   0                   0
## 146                    0                   0                   0
## 147                    0                   0                   0
## 148                    0                   0                   0
## 149                    0                   0                   0
## 150                    0                   0                   0
## 151                    0                   0                   0
## 152                    0                   0                   0
## 153                    0                   0                   0
## 155                    0                   0                   0
## 156                    0                   0                   0
## 157                    0                   0                   0
## 159                    0                   0                   0
## 161                    0                   0                   0
## 162                    0                   0                   0
## 163                    0                   0                   0
## 165                    0                   0                   0
## 166                    0                   0                   0
## 167                    0                   0                   0
## 168                    0                   0                   0
## 169                    0                   0                   0
## 170                    0                   0                   0
## 171                    0                   0                   0
## 173                    0                   0                   0
## 175                    0                   0                   0
## 177                    0                   0                   0
## 178                    0                   0                   0
## 179                    0                   0                   0
## 180                    0                   0                   0
## 181                    0                   0                   0
## 185                    0                   0                   0
## 186                    0                   0                   0
## 188                    0                   0                   0
## 189                    0                   0                   0
```

```
## 191                         0                        0                          0
##      advance.prep.required alabama alaska alcoholic almond amaretto
## 1                        0       0      0         0      0        0
## 2                        0       0      0         0      0        0
## 3                        0       0      0         0      0        0
## 5                        0       0      0         0      0        0
## 6                        0       0      0         0      0        0
## 9                        0       0      0         0      0        0
## 10                       0       0      0         0      0        0
## 11                       0       0      0         0      0        0
## 13                       0       0      0         0      0        0
## 14                       0       0      0         0      0        0
## 15                       0       0      0         0      0        0
## 16                       0       0      0         0      0        0
## 17                       0       0      0         0      0        0
## 18                       0       0      0         0      0        0
## 19                       0       0      0         0      0        0
## 20                       0       0      0         0      0        0
## 21                       0       0      0         0      0        0
## 25                       0       0      0         0      0        0
## 26                       0       0      0         0      0        0
## 27                       1       0      0         0      0        0
## 28                       0       0      0         0      0        0
## 29                       0       0      0         0      0        0
## 30                       0       0      0         0      0        0
## 33                       0       0      0         0      0        0
## 34                       0       0      0         0      0        0
## 36                       0       0      0         0      0        0
## 38                       0       0      0         0      0        0
## 39                       0       0      0         0      0        0
## 40                       0       0      0         0      0        0
## 41                       0       0      0         0      0        0
## 42                       0       0      0         0      0        0
## 46                       0       0      0         0      0        0
## 47                       0       0      0         0      0        0
## 49                       0       0      0         0      0        0
## 50                       0       0      0         0      0        0
## 51                       0       0      0         0      0        0
## 52                       0       0      0         0      0        0
## 54                       0       0      0         0      0        0
## 55                       0       0      0         0      0        0
## 57                       0       0      0         0      0        0
## 58                       0       0      0         0      0        0
## 59                       0       0      0         0      0        0
## 60                       0       0      0         0      0        0
## 61                       0       0      0         0      0        0
## 62                       0       0      0         0      0        0
## 63                       0       0      0         0      0        0
## 64                       0       0      0         0      0        0
## 65                       0       0      0         0      0        0
```

```
## 67                                  0    0    0    0    0    0
## 68                                  0    0    0    0    0    0
## 69                                  0    0    0    0    0    0
## 70                                  0    0    0    0    0    0
## 71                                  0    0    0    0    0    0
## 72                                  0    0    0    0    0    0
## 73                                  0    0    0    0    0    0
## 74                                  0    0    0    0    1    0
## 75                                  0    0    0    0    0    0
## 76                                  0    0    0    0    0    0
## 77                                  0    0    0    0    0    0
## 78                                  0    0    0    0    0    0
## 79                                  0    0    0    0    0    0
## 81                                  1    0    0    0    1    0
## 82                                  0    0    0    0    0    0
## 83                                  0    0    0    0    0    0
## 84                                  0    0    0    0    1    0
## 85                                  0    0    0    0    0    0
## 86                                  0    0    0    0    0    0
## 88                                  0    0    0    0    0    0
## 89                                  0    0    0    0    0    0
## 92                                  0    0    0    0    0    0
## 93                                  0    0    0    0    0    0
## 94                                  0    0    0    0    0    0
## 95                                  0    0    0    0    0    0
## 96                                  0    0    0    0    0    0
## 97                                  0    0    0    0    0    0
## 98                                  0    0    0    0    0    0
## 99                                  0    0    0    0    0    0
## 100                                 0    0    0    0    0    0
## 101                                 0    0    0    0    0    0
## 103                                 0    0    0    0    0    0
## 105                                 0    0    0    0    0    0
## 106                                 0    0    0    0    0    0
## 107                                 0    0    0    0    0    0
## 108                                 0    0    0    0    0    0
## 110                                 0    0    0    0    0    0
## 111                                 0    0    0    0    0    0
## 112                                 0    0    0    0    0    0
## 114                                 0    0    0    0    0    0
## 115                                 0    0    0    0    0    0
## 117                                 0    0    0    1    0    0
## 118                                 0    0    0    0    0    0
## 119                                 0    0    0    0    0    0
## 120                                 0    0    0    1    0    0
## 121                                 0    0    0    0    0    0
## 122                                 0    0    0    0    0    0
## 123                                 0    0    0    0    0    0
## 125                                 0    0    0    0    0    0
## 126                                 0    0    0    0    1    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 ]
```

```r
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)
```
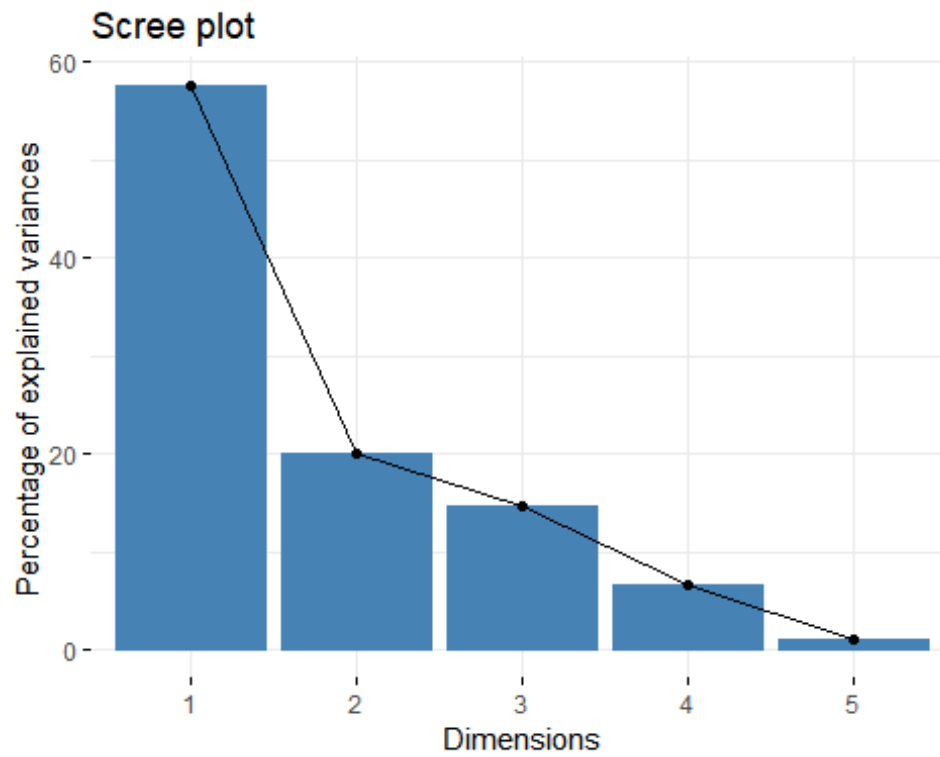
Scree plot


```r
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
)
```

```r
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
)
```

Variables - PCA

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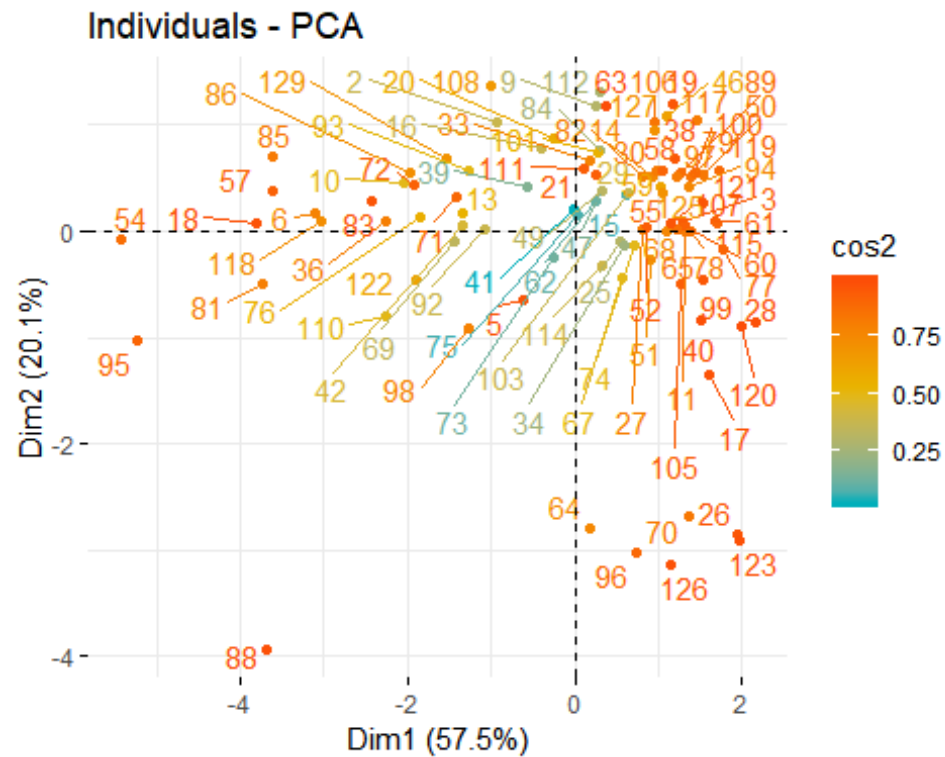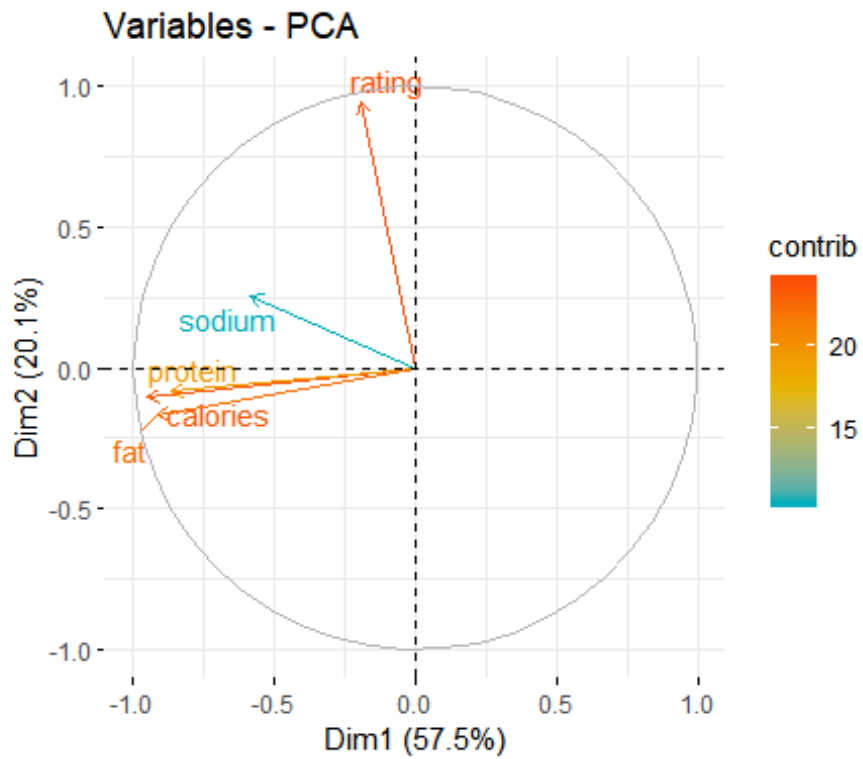
PCA - Biplot
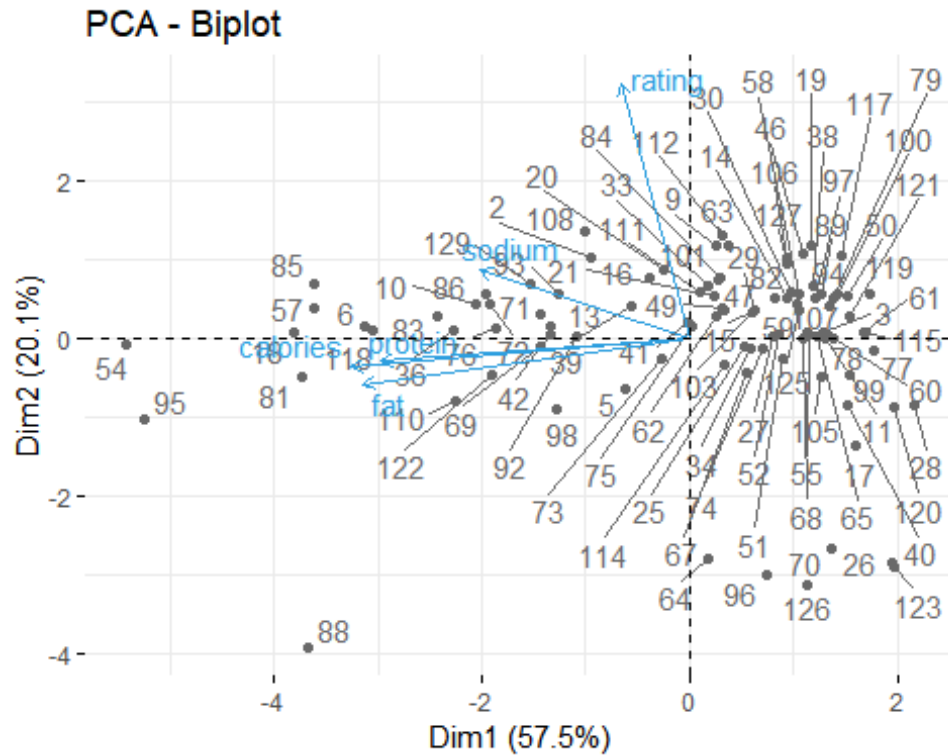

```r
library(factoextra)
# Eigenvalues
eig.val <- get_eigenvalue(res.pca)
eig.val

##        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
```
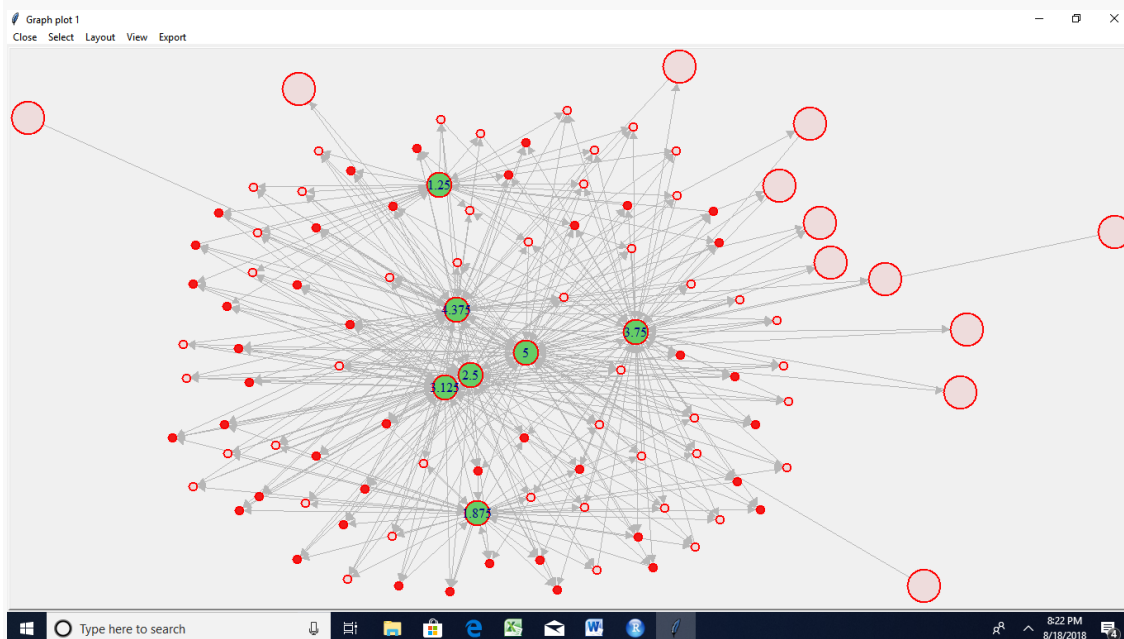
Random type
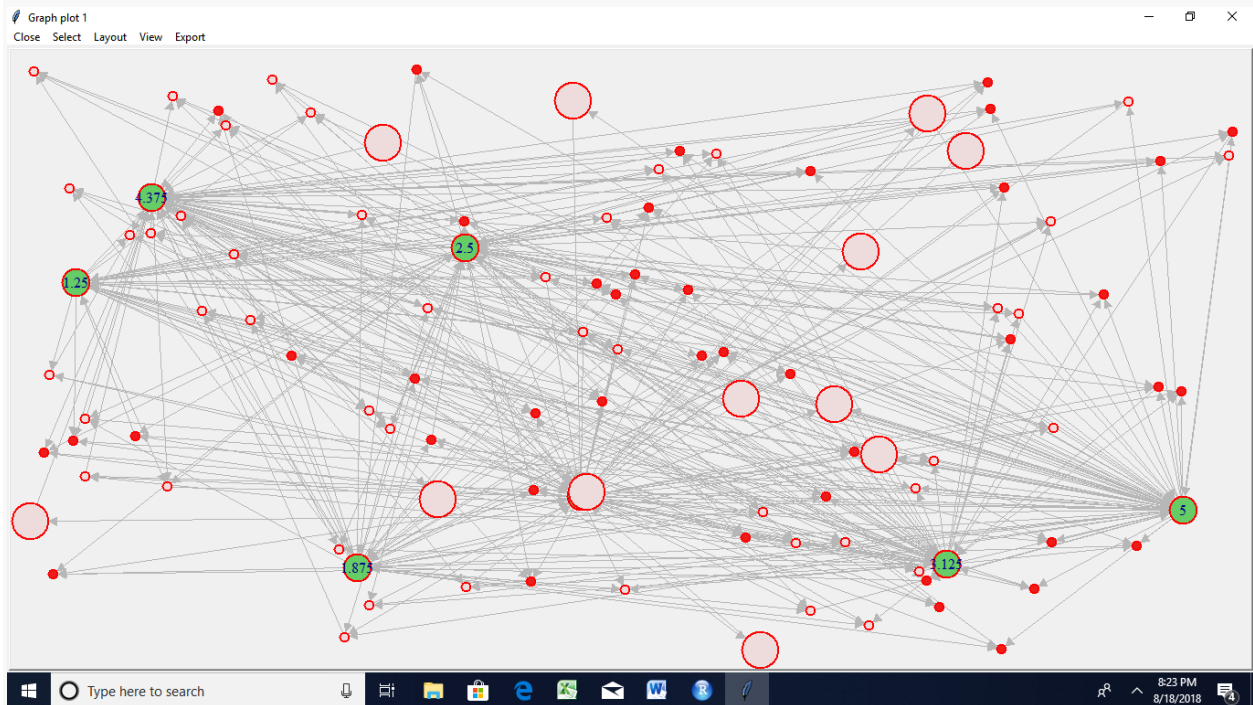
Circle
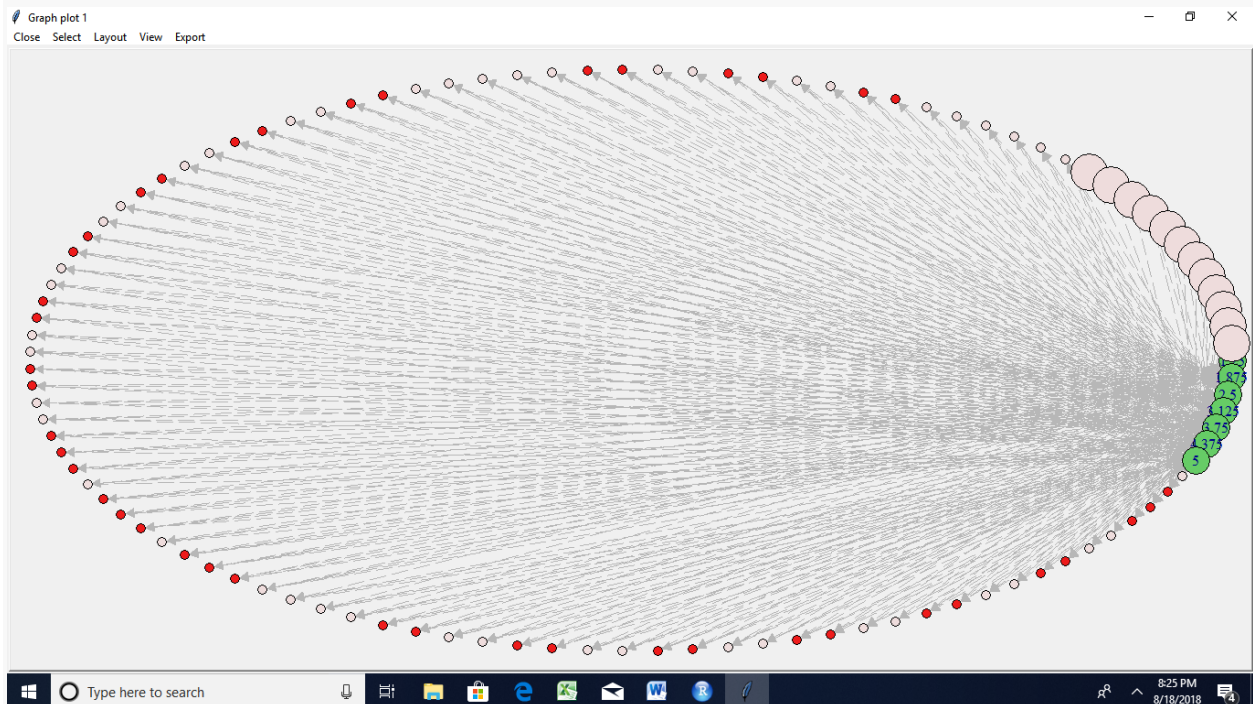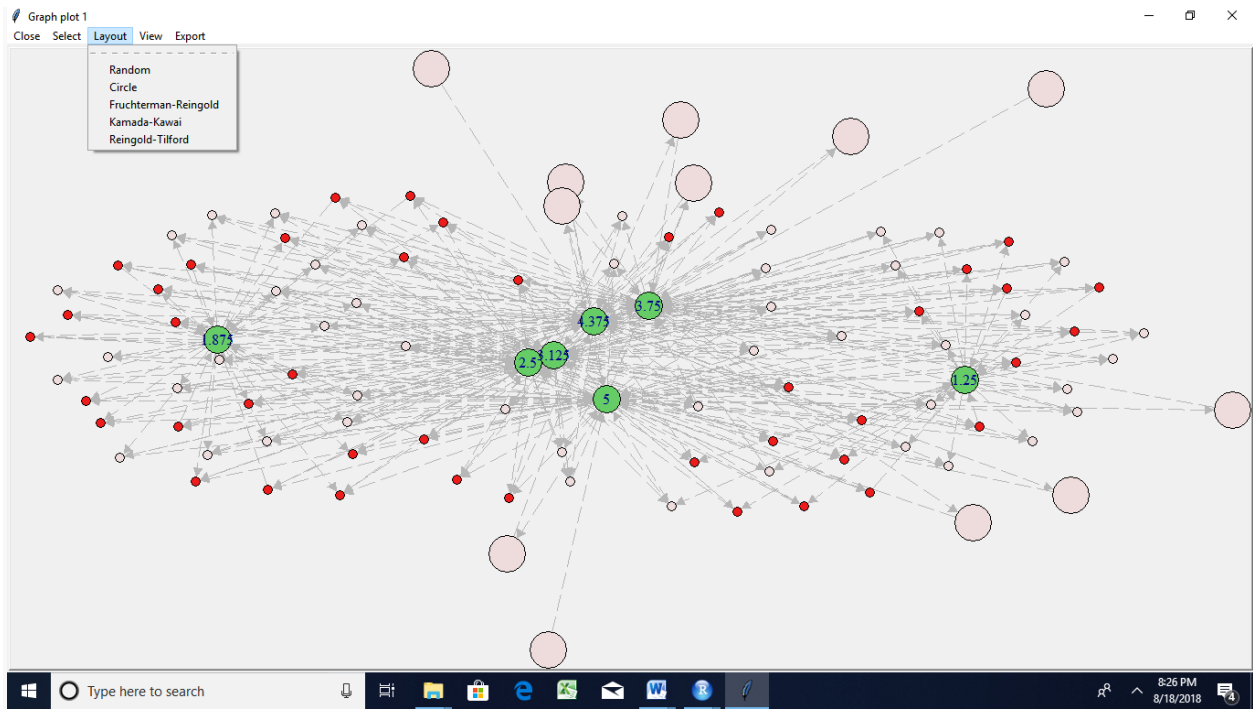
Kamada kawai
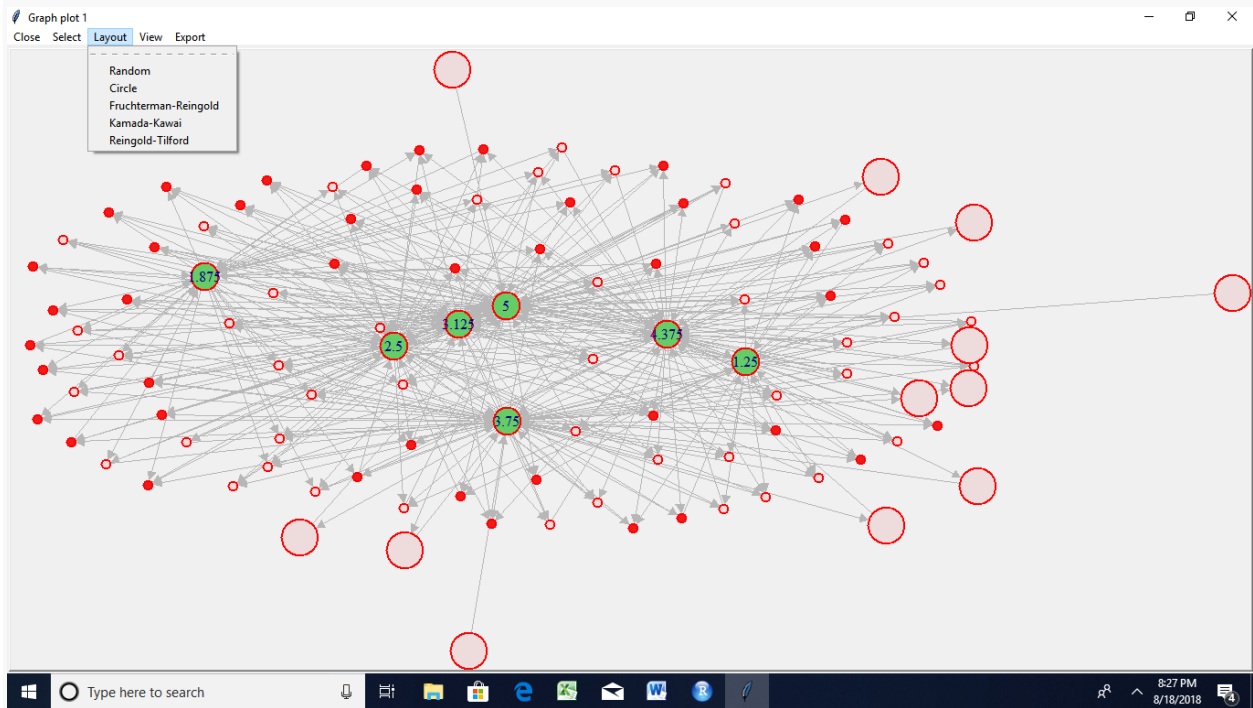
Reingold
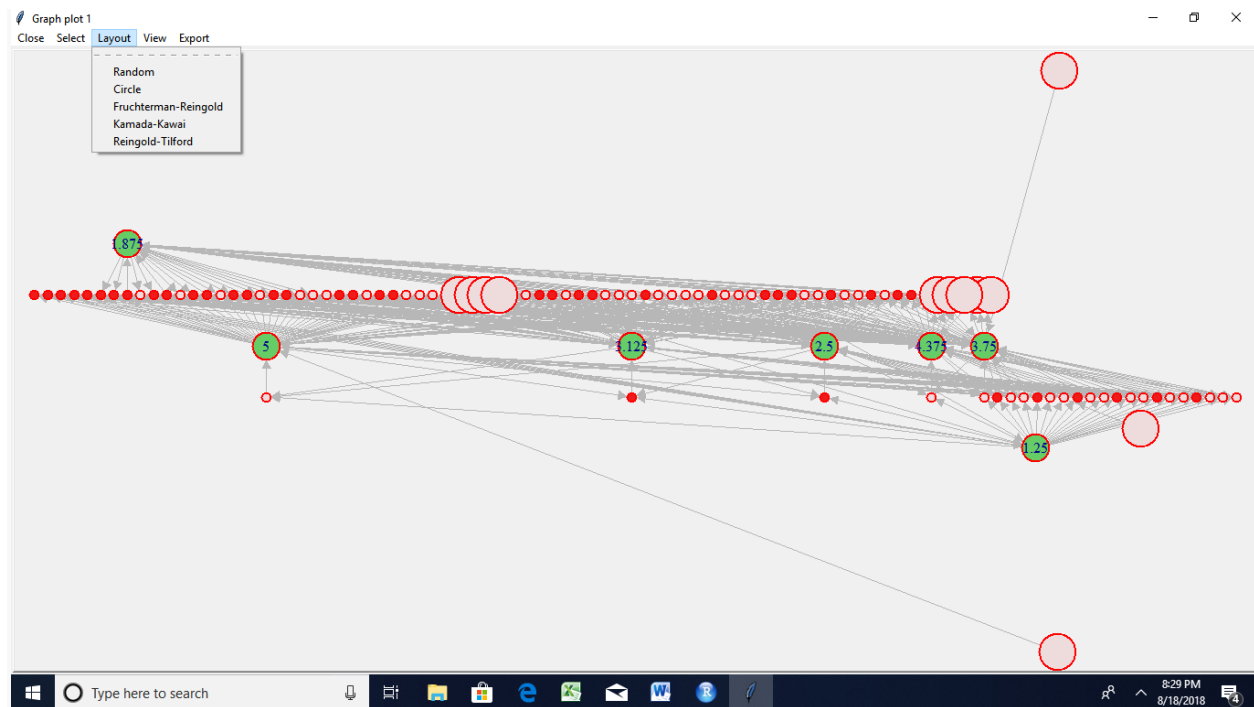
Session 21 Assignment 2nd additional exercise

session21_pci.R

Seshan

Thu Aug 16 15:46:09 2018

```r
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
```

```r
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")
```
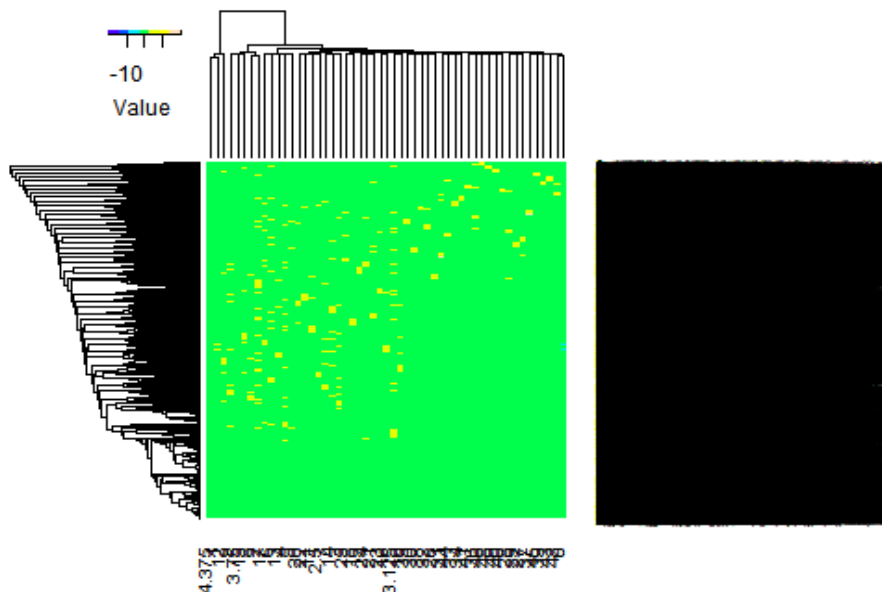


```r
## PCA and biplot
p <- princomp(final_imp)
biplot(p,pc.biplot=TRUE, col=c("black","red"), cex=c(0.9,0.8),xlim=c(-2.5,2.5
```

```
), xlab="PC1, 39.7% explained variance", ylab="PC2, 24.5% explained variance"
)
```


PC1, 39.7% explained variance