Market_Basket_Optimization

```
library(arules)
library(arulesViz)
library(readr)
library(csv)

products <- read.transactions("/home/sas/Downloads/Market_Basket_Optimization.csv", sep = ',', rm.duplic
```

```
## distribution of transactions with duplicates:
## 1
## 5
```

```
summary(products)
```

```
## transactions as itemMatrix in sparse format with
##  7501 rows (elements/itemsets/transactions) and
##  119 columns (items) and a density of 0.03288973
##
## most frequent items:
## mineral water          eggs     spaghetti  french fries     chocolate
##          1788          1348          1306          1282          1229
##       (Other)
##         22405
##
## element (itemset/transaction) length distribution:
## sizes
##    1    2    3    4    5    6    7    8    9   10   11   12   13   14   15
## 1754 1358 1044  816  667  493  391  324  259  139  102   67   40   22   17
##   16   18   19   20
##    4    1    2    1
##
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   1.000   2.000   3.000   3.914   5.000  20.000
##
## includes extended item information - examples:
##              labels
## 1           almonds
## 2 antioxydant juice
## 3         asparagus
```

```
print(products@itemInfo)
```

```
##                   labels
## 1                almonds
## 2      antioxydant juice
## 3              asparagus
## 4                avocado
## 5            babies food
## 6                  bacon
## 7          barbecue sauce
## 8              black tea
## 9            blueberries
## 10            body spray
```

```
## 11               bramble
## 12              brownies
## 13             bug spray
## 14               burgers
## 15          burger sauce
## 16                butter
## 17                  cake
## 18             candy bars
## 19                carrots
## 20           cauliflower
## 21                cereals
## 22             champagne
## 23               chicken
## 24                 chili
## 25             chocolate
## 26       chocolate bread
## 27               chutney
## 28                 cider
## 29   clothes accessories
## 30               cookies
## 31           cooking oil
## 32                  corn
## 33        cottage cheese
## 34                 cream
## 35          dessert wine
## 36              eggplant
## 37                  eggs
## 38            energy bar
## 39          energy drink
## 40              escalope
## 41  extra dark chocolate
## 42             flax seed
## 43          french fries
## 44           french wine
## 45           fresh bread
## 46            fresh tuna
## 47         fromage blanc
## 48       frozen smoothie
## 49     frozen vegetables
## 50       gluten free bar
## 51         grated cheese
## 52           green beans
## 53          green grapes
## 54             green tea
## 55           ground beef
## 56                 gums
## 57                  ham
## 58      hand protein bar
## 59         herb & pepper
## 60                honey
## 61              hot dogs
## 62               ketchup
## 63           light cream
## 64            light mayo
```

```
## 65        low fat yogurt
## 66             magazines
## 67         mashed potato
## 68            mayonnaise
## 69             meatballs
## 70                melons
## 71                  milk
## 72         mineral water
## 73                  mint
## 74        mint green tea
## 75               muffins
## 76  mushroom cream sauce
## 77               napkins
## 78           nonfat milk
## 79               oatmeal
## 80                   oil
## 81             olive oil
## 82              pancakes
## 83       parmesan cheese
## 84                 pasta
## 85                pepper
## 86              pet food
## 87               pickles
## 88           protein bar
## 89              red wine
## 90                  rice
## 91                 salad
## 92                salmon
## 93                  salt
## 94              sandwich
## 95               shallot
## 96               shampoo
## 97                shrimp
## 98                  soda
## 99                  soup
## 100            spaghetti
## 101      sparkling water
## 102              spinach
## 103        strawberries
## 104        strong cheese
## 105                  tea
## 106             tomatoes
## 107         tomato juice
## 108         tomato sauce
## 109           toothpaste
## 110               turkey
## 111       vegetables mix
## 112          water spray
## 113           white wine
## 114     whole weat flour
## 115    whole wheat pasta
## 116     whole wheat rice
## 117                 yams
## 118          yogurt cake
```

```
## 119             zucchini
```

```
products@itemInfo
```

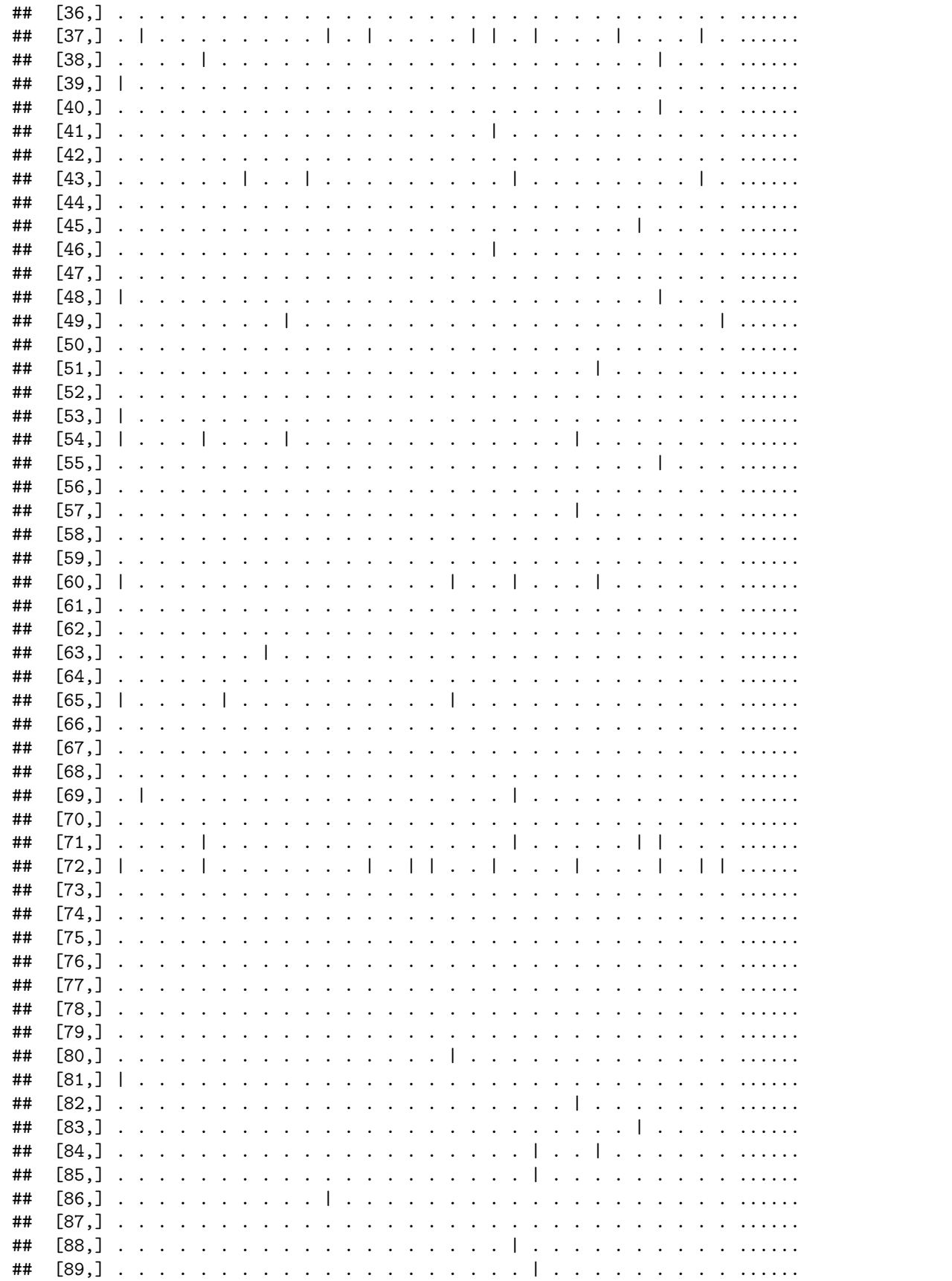
```
##                   labels
## 1                 almonds
## 2       antioxydant juice
## 3               asparagus
## 4                 avocado
## 5             babies food
## 6                   bacon
## 7          barbecue sauce
## 8               black tea
## 9             blueberries
## 10             body spray
## 11                bramble
## 12               brownies
## 13              bug spray
## 14                burgers
## 15           burger sauce
## 16                 butter
## 17                   cake
## 18             candy bars
## 19                carrots
## 20            cauliflower
## 21                cereals
## 22              champagne
## 23                chicken
## 24                  chili
## 25              chocolate
## 26        chocolate bread
## 27                chutney
## 28                  cider
## 29   clothes accessories
## 30                cookies
## 31            cooking oil
## 32                   corn
## 33         cottage cheese
## 34                  cream
## 35          dessert wine
## 36              eggplant
## 37                  eggs
## 38            energy bar
## 39          energy drink
## 40              escalope
## 41  extra dark chocolate
## 42             flax seed
## 43          french fries
## 44           french wine
## 45           fresh bread
## 46            fresh tuna
## 47         fromage blanc
## 48       frozen smoothie
## 49     frozen vegetables
## 50       gluten free bar
```

```
## 51         grated cheese
## 52           green beans
## 53          green grapes
## 54             green tea
## 55           ground beef
## 56                  gums
## 57                   ham
## 58      hand protein bar
## 59         herb & pepper
## 60                 honey
## 61              hot dogs
## 62               ketchup
## 63           light cream
## 64            light mayo
## 65        low fat yogurt
## 66             magazines
## 67         mashed potato
## 68            mayonnaise
## 69             meatballs
## 70                melons
## 71                  milk
## 72         mineral water
## 73                  mint
## 74        mint green tea
## 75               muffins
## 76  mushroom cream sauce
## 77               napkins
## 78           nonfat milk
## 79               oatmeal
## 80                   oil
## 81             olive oil
## 82              pancakes
## 83       parmesan cheese
## 84                 pasta
## 85                pepper
## 86              pet food
## 87               pickles
## 88           protein bar
## 89              red wine
## 90                  rice
## 91                 salad
## 92                salmon
## 93                  salt
## 94              sandwich
## 95               shallot
## 96               shampoo
## 97                shrimp
## 98                  soda
## 99                  soup
## 100            spaghetti
## 101      sparkling water
## 102              spinach
## 103        strawberries
## 104        strong cheese
```

```
## 105                 tea
## 106            tomatoes
## 107        tomato juice
## 108        tomato sauce
## 109          toothpaste
## 110              turkey
## 111      vegetables mix
## 112         water spray
## 113          white wine
## 114    whole weat flour
## 115   whole wheat pasta
## 116    whole wheat rice
## 117               yams
## 118         yogurt cake
## 119            zucchini
```

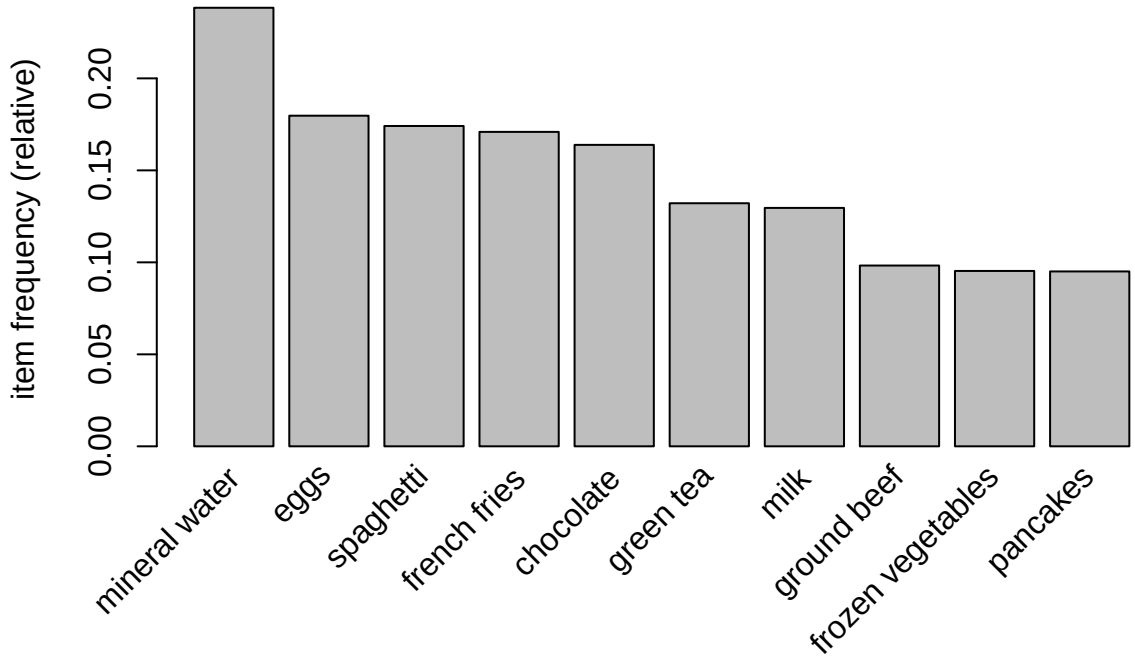
```
products@data
```

```
## 119 x 7501 sparse Matrix of class "ngCMatrix"
##
##   [1,] | . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##   [2,] | . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##   [3,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##   [4,] | . . | . . . . . . . . . . . . . . . . . . . . . . . . . . . | . | . . . . .....
##   [5,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##   [6,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##   [7,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##   [8,] . . . . . . . . . . . . . . . . . . . . | . . . . . . . | . . . . . .....
##   [9,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [10,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | . . . . . .....
##  [11,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [12,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [13,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [14,] . | . . . . . . . . . . . | . . . . . . . . . . | . . . . . .....
##  [15,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [16,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [17,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [18,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [19,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [20,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [21,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [22,] . . . . . . . . . . . . . . . | . . . . . . . . . . . . . . . . . . . . .....
##  [23,] . . . . . . . . . . . . . . . . . . . | . | . . . . . . . . . . | . .....
##  [24,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [25,] . . . . . . . . . . . . . . . . . . . | . . . | . . . . . . . | . .....
##  [26,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [27,] . . | . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [28,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [29,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [30,] . . . . . . . . . . . . . | . | . . . . . . . . . . . . . . . . . . . .....
##  [31,] . . . . . . . . . . . . . | . . . | . . . . . . . . . . . . . . . . . .....
##  [32,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [33,] | . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [34,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [35,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
```



```
##  [90,] . . . . . . . . . . . . . . . . . . . . . . . . | . . . . . . . . .....
##  [91,] | . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [92,] | . . . . . . . . . . . . . . | . . . | . . . . . . | . . . . . .....
##  [93,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [94,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [95,] . . . . . . . . | . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [96,] . . . . . . . . . . . . . . . . . . . . . . . . | . . . . . . . . .....
##  [97,] | . . . . . . . . . . . . . . . . . | . . . | . . | . . . . . .....
##  [98,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##  [99,] . . . . . . . . | . . . . . . . . . . . . . . . . . | . . . . .....
## [100,] . . . . . . . . . | . . . . | . . . . | . . . | . . | | . . | .....
## [101,] . . . . . . . . . . . . . . . . . . . . . . . . | . . . . . | . . .....
## [102,] | . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [103,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [104,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [105,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [106,] . . . . . . . . . . . . . . . . . . . . . . | . . . . . . . . . .....
## [107,] | . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [108,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [109,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | . . . . . .....
## [110,] . . . | . . . . . . . . | . . . . | | . . . . . . . . . . . . . .....
## [111,] | . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [112,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [113,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | . . . . . .....
## [114,] | . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [115,] . . . . . . . | . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [116,] . . . . | . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [117,] | . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | .....
## [118,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
## [119,] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .....
##
##  .....suppressing columns in show(); maybe adjust 'options(max.print= *, width = *)'
##  ..............................
```

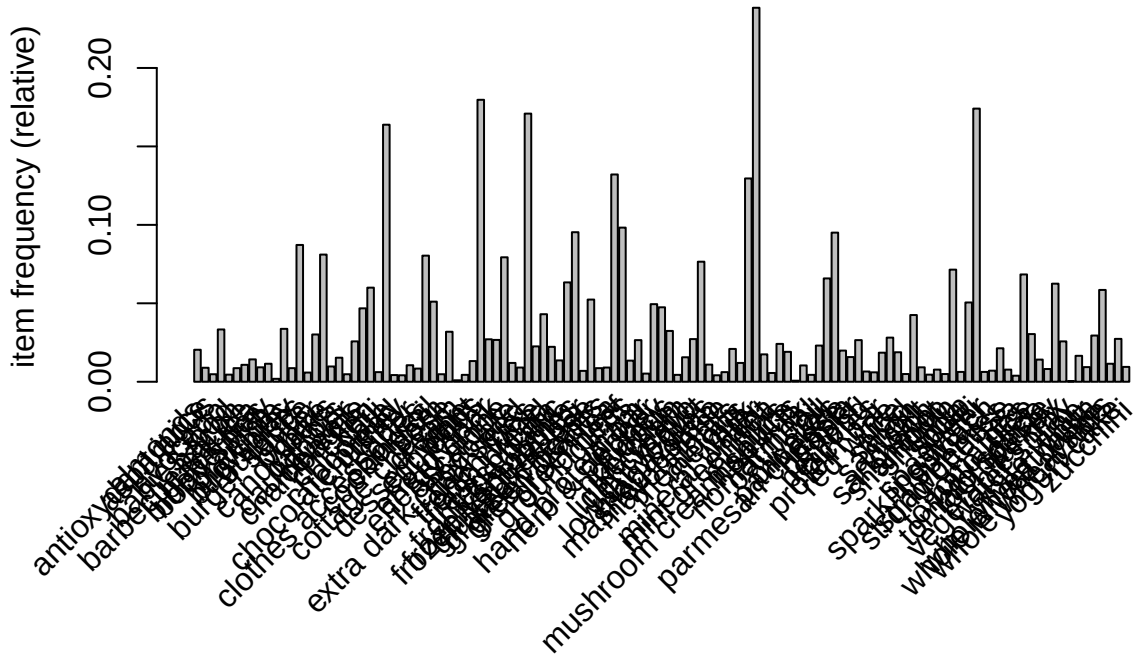
```
itemFrequencyPlot(products,topN=10)
```



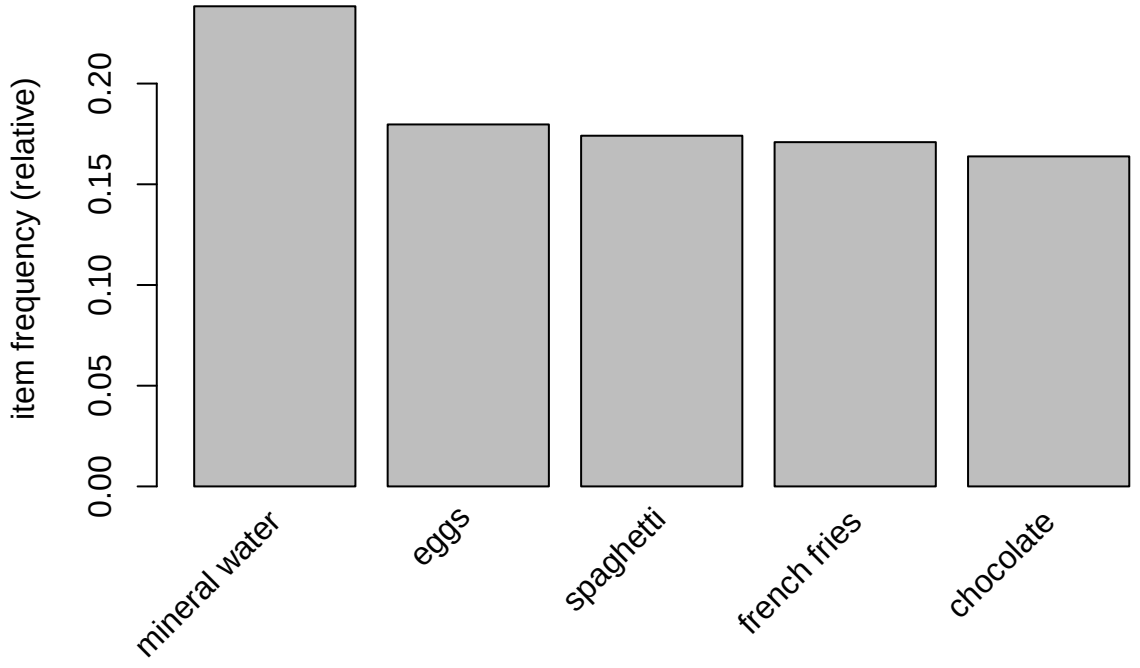

```
summary(products)
```

```
## transactions as itemMatrix in sparse format with
##  7501 rows (elements/itemsets/transactions) and
##  119 columns (items) and a density of 0.03288973
##
## most frequent items:
## mineral water          eggs     spaghetti  french fries     chocolate
##          1788          1348          1306          1282          1229
##       (Other)
##         22405
##
## element (itemset/transaction) length distribution:
## sizes
##    1    2    3    4    5    6    7    8    9   10   11   12   13   14   15
## 1754 1358 1044  816  667  493  391  324  259  139  102   67   40   22   17
##   16   18   19   20
##    4    1    2    1
##
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   1.000   2.000   3.000   3.914   5.000  20.000
##
## includes extended item information - examples:
##              labels
## 1           almonds
## 2 antioxydant juice
## 3         asparagus
```

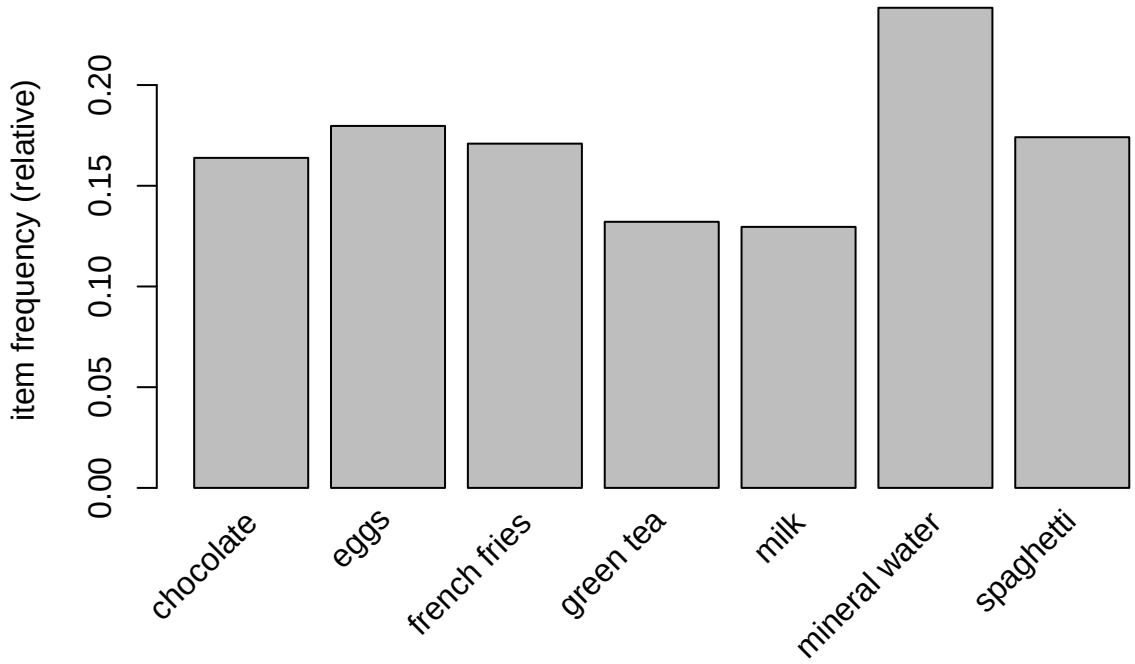
```
itemFrequencyPlot(products)
```




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




```
itemFrequencyPlot(products, support = 0.1)
```




```
products.apriori <- apriori(products, parameter=list(support=0.01, confidence = 0.3,  minlen=2, maxlen =
```

```
## Apriori
##
## Parameter specification:
##  confidence minval smax arem  aval originalSupport maxtime support minlen
##         0.3    0.1    1 none FALSE            TRUE       5    0.01      2
##  maxlen target   ext
##       5  rules FALSE
##
## Algorithmic control:
##  filter tree heap memopt load sort verbose
##     0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 75
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[119 item(s), 7501 transaction(s)] done [0.00s].
## sorting and recoding items ... [75 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4 done [0.00s].
## writing ... [63 rule(s)] done [0.00s].
## creating S4 object  ... done [0.00s].
```

```
summary(products.apriori)
```

```
## set of 63 rules
##
## rule length distribution (lhs + rhs):sizes
##  2  3
## 37 26
##
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   2.000   2.000   2.000   2.413   3.000   3.000
```

```
##
## summary of quality measures:
##     support          confidence          lift
##  Min.   :0.01013   Min.   :0.3004   Min.   :1.288
##  1st Qu.:0.01147   1st Qu.:0.3207   1st Qu.:1.547
##  Median :0.01586   Median :0.3482   Median :1.758
##  Mean   :0.01901   Mean   :0.3683   Mean   :1.774
##  3rd Qu.:0.02186   3rd Qu.:0.4052   3rd Qu.:1.912
##  Max.   :0.05973   Max.   :0.5067   Max.   :3.292
##
## mining info:
##      data ntransactions support confidence
##  products          7501    0.01        0.3
```

```
inspect(products.apriori)
```

```
##      lhs                                rhs             support
## [1]  {cereals}                       => {mineral water} 0.01026530
## [2]  {red wine}                      => {spaghetti}     0.01026530
## [3]  {red wine}                      => {mineral water} 0.01093188
## [4]  {avocado}                       => {mineral water} 0.01159845
## [5]  {fresh bread}                   => {mineral water} 0.01333156
## [6]  {salmon}                        => {spaghetti}     0.01346487
## [7]  {salmon}                        => {mineral water} 0.01706439
## [8]  {honey}                         => {mineral water} 0.01506466
## [9]  {herb & pepper}                 => {ground beef}   0.01599787
## [10] {herb & pepper}                 => {spaghetti}     0.01626450
## [11] {herb & pepper}                 => {mineral water} 0.01706439
## [12] {grated cheese}                 => {spaghetti}     0.01653113
## [13] {grated cheese}                 => {mineral water} 0.01746434
## [14] {soup}                          => {milk}          0.01519797
## [15] {soup}                          => {mineral water} 0.02306359
## [16] {cooking oil}                   => {spaghetti}     0.01586455
## [17] {cooking oil}                   => {mineral water} 0.02013065
## [18] {whole wheat rice}              => {mineral water} 0.02013065
## [19] {turkey}                        => {eggs}          0.01946407
## [20] {turkey}                        => {mineral water} 0.01919744
## [21] {chicken}                       => {mineral water} 0.02279696
## [22] {frozen smoothie}               => {mineral water} 0.02026396
## [23] {low fat yogurt}                => {mineral water} 0.02399680
## [24] {tomatoes}                      => {spaghetti}     0.02093054
## [25] {tomatoes}                      => {mineral water} 0.02439675
## [26] {olive oil}                     => {spaghetti}     0.02293028
## [27] {olive oil}                     => {mineral water} 0.02759632
## [28] {shrimp}                        => {mineral water} 0.02359685
## [29] {cake}                          => {mineral water} 0.02746300
## [30] {burgers}                       => {eggs}          0.02879616
## [31] {pancakes}                      => {mineral water} 0.03372884
## [32] {frozen vegetables}             => {mineral water} 0.03572857
## [33] {ground beef}                   => {spaghetti}     0.03919477
## [34] {ground beef}                   => {mineral water} 0.04092788
## [35] {milk}                          => {mineral water} 0.04799360
## [36] {chocolate}                     => {mineral water} 0.05265965
## [37] {spaghetti}                     => {mineral water} 0.05972537
## [38] {olive oil,spaghetti}           => {mineral water} 0.01026530
```

```
## [39] {mineral water,olive oil}         => {spaghetti}     0.01026530
## [40] {pancakes,spaghetti}              => {mineral water} 0.01146514
## [41] {mineral water,pancakes}          => {spaghetti}     0.01146514
## [42] {frozen vegetables,milk}          => {mineral water} 0.01106519
## [43] {frozen vegetables,mineral water} => {milk}          0.01106519
## [44] {frozen vegetables,spaghetti}     => {mineral water} 0.01199840
## [45] {frozen vegetables,mineral water} => {spaghetti}     0.01199840
## [46] {ground beef,milk}                => {mineral water} 0.01106519
## [47] {chocolate,ground beef}           => {mineral water} 0.01093188
## [48] {eggs,ground beef}                => {mineral water} 0.01013198
## [49] {ground beef,spaghetti}           => {mineral water} 0.01706439
## [50] {ground beef,mineral water}       => {spaghetti}     0.01706439
## [51] {chocolate,milk}                  => {spaghetti}     0.01093188
## [52] {milk,spaghetti}                  => {chocolate}     0.01093188
## [53] {chocolate,milk}                  => {mineral water} 0.01399813
## [54] {eggs,milk}                       => {mineral water} 0.01306492
## [55] {milk,spaghetti}                  => {mineral water} 0.01573124
## [56] {milk,mineral water}              => {spaghetti}     0.01573124
## [57] {french fries,spaghetti}          => {mineral water} 0.01013198
## [58] {french fries,mineral water}      => {spaghetti}     0.01013198
## [59] {chocolate,eggs}                  => {spaghetti}     0.01053193
## [60] {chocolate,eggs}                  => {mineral water} 0.01346487
## [61] {chocolate,spaghetti}             => {mineral water} 0.01586455
## [62] {chocolate,mineral water}         => {spaghetti}     0.01586455
## [63] {eggs,spaghetti}                  => {mineral water} 0.01426476
##      confidence lift
## [1]  0.3989637  1.673729
## [2]  0.3649289  2.095966
## [3]  0.3886256  1.630358
## [4]  0.3480000  1.459926
## [5]  0.3095975  1.298820
## [6]  0.3166144  1.818472
## [7]  0.4012539  1.683336
## [8]  0.3174157  1.331619
## [9]  0.3234501  3.291994
## [10] 0.3288410  1.888695
## [11] 0.3450135  1.447397
## [12] 0.3155216  1.812196
## [13] 0.3333333  1.398397
## [14] 0.3007916  2.321232
## [15] 0.4564644  1.914955
## [16] 0.3107050  1.784531
## [17] 0.3942559  1.653978
## [18] 0.3439636  1.442993
## [19] 0.3113006  1.732245
## [20] 0.3070362  1.288075
## [21] 0.3800000  1.594172
## [22] 0.3200000  1.342461
## [23] 0.3135889  1.315565
## [24] 0.3060429  1.757755
## [25] 0.3567251  1.496530
## [26] 0.3481781  1.999758
## [27] 0.4190283  1.757904
## [28] 0.3302239  1.385352
```

```
## [29] 0.3388158  1.421397
## [30] 0.3302752  1.837830
## [31] 0.3548387  1.488616
## [32] 0.3748252  1.572463
## [33] 0.3989145  2.291162
## [34] 0.4165536  1.747522
## [35] 0.3703704  1.553774
## [36] 0.3213995  1.348332
## [37] 0.3430322  1.439085
## [38] 0.4476744  1.878079
## [39] 0.3719807  2.136468
## [40] 0.4550265  1.908923
## [41] 0.3399209  1.952333
## [42] 0.4689266  1.967236
## [43] 0.3097015  2.389991
## [44] 0.4306220  1.806541
## [45] 0.3358209  1.928784
## [46] 0.5030303  2.110308
## [47] 0.4739884  1.988472
## [48] 0.5066667  2.125563
## [49] 0.4353741  1.826477
## [50] 0.4169381  2.394681
## [51] 0.3402490  1.954217
## [52] 0.3082707  1.881480
## [53] 0.4356846  1.827780
## [54] 0.4242424  1.779778
## [55] 0.4436090  1.861024
## [56] 0.3277778  1.882589
## [57] 0.3671498  1.540263
## [58] 0.3003953  1.725318
## [59] 0.3172691  1.822232
## [60] 0.4056225  1.701663
## [61] 0.4047619  1.698053
## [62] 0.3012658  1.730318
## [63] 0.3905109  1.638268
```

```
inspect(sort(products.apriori, by="support")[1:10])
```

```
##      lhs                    rhs             support    confidence lift
## [1]  {spaghetti}         => {mineral water} 0.05972537 0.3430322  1.439085
## [2]  {chocolate}         => {mineral water} 0.05265965 0.3213995  1.348332
## [3]  {milk}              => {mineral water} 0.04799360 0.3703704  1.553774
## [4]  {ground beef}       => {mineral water} 0.04092788 0.4165536  1.747522
## [5]  {ground beef}       => {spaghetti}     0.03919477 0.3989145  2.291162
## [6]  {frozen vegetables} => {mineral water} 0.03572857 0.3748252  1.572463
## [7]  {pancakes}          => {mineral water} 0.03372884 0.3548387  1.488616
## [8]  {burgers}           => {eggs}          0.02879616 0.3302752  1.837830
## [9]  {olive oil}         => {mineral water} 0.02759632 0.4190283  1.757904
## [10] {cake}              => {mineral water} 0.02746300 0.3388158  1.421397
```

```
inspect(sort(products.apriori, by=c("support","confidence"))[1:10])
```

```
##      lhs                    rhs             support    confidence lift
## [1]  {spaghetti}         => {mineral water} 0.05972537 0.3430322  1.439085
## [2]  {chocolate}         => {mineral water} 0.05265965 0.3213995  1.348332
```

```
## [3]  {milk}              => {mineral water} 0.04799360 0.3703704  1.553774
## [4]  {ground beef}       => {mineral water} 0.04092788 0.4165536  1.747522
## [5]  {ground beef}       => {spaghetti}     0.03919477 0.3989145  2.291162
## [6]  {frozen vegetables} => {mineral water} 0.03572857 0.3748252  1.572463
## [7]  {pancakes}          => {mineral water} 0.03372884 0.3548387  1.488616
## [8]  {burgers}           => {eggs}          0.02879616 0.3302752  1.837830
## [9]  {olive oil}         => {mineral water} 0.02759632 0.4190283  1.757904
## [10] {cake}              => {mineral water} 0.02746300 0.3388158  1.421397
```

```
inspect(sort(products.apriori, by="lift")[1:5])
```

```
##     lhs                                rhs           support
## [1] {herb & pepper}                 => {ground beef} 0.01599787
## [2] {ground beef,mineral water}     => {spaghetti}   0.01706439
## [3] {frozen vegetables,mineral water} => {milk}      0.01106519
## [4] {soup}                          => {milk}        0.01519797
## [5] {ground beef}                   => {spaghetti}   0.03919477
##     confidence lift
## [1] 0.3234501  3.291994
## [2] 0.4169381  2.394681
## [3] 0.3097015  2.389991
## [4] 0.3007916  2.321232
## [5] 0.3989145  2.291162
```

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

```
##                     {cereals,mineral water}
##                                           1
##                        {red wine,spaghetti}
##                                           2
##                    {mineral water,red wine}
##                                           3
##                     {avocado,mineral water}
##                                           4
##                  {fresh bread,mineral water}
##                                           5
##                           {salmon,spaghetti}
##                                           6
##                       {mineral water,salmon}
##                                           7
##                        {honey,mineral water}
##                                           8
##                  {ground beef,herb & pepper}
##                                           9
##                    {herb & pepper,spaghetti}
##                                          10
##                {herb & pepper,mineral water}
##                                          11
##                    {grated cheese,spaghetti}
##                                          12
##                {grated cheese,mineral water}
##                                          13
##                                {milk,soup}
```

```
##                                       14
##                         {mineral water,soup}
##                                       15
##                       {cooking oil,spaghetti}
##                                       16
##                   {cooking oil,mineral water}
##                                       17
##              {mineral water,whole wheat rice}
##                                       18
##                                {eggs,turkey}
##                                       19
##                        {mineral water,turkey}
##                                       20
##                       {chicken,mineral water}
##                                       21
##               {frozen smoothie,mineral water}
##                                       22
##                {low fat yogurt,mineral water}
##                                       23
##                          {spaghetti,tomatoes}
##                                       24
##                      {mineral water,tomatoes}
##                                       25
##                         {olive oil,spaghetti}
##                                       26
##                    {mineral water,olive oil}
##                                       27
##                       {mineral water,shrimp}
##                                       28
##                         {cake,mineral water}
##                                       29
##                                {burgers,eggs}
##                                       30
##                      {mineral water,pancakes}
##                                       31
##             {frozen vegetables,mineral water}
##                                       32
##                       {ground beef,spaghetti}
##                                       33
##                   {ground beef,mineral water}
##                                       34
##                         {milk,mineral water}
##                                       35
##                    {chocolate,mineral water}
##                                       36
##                    {mineral water,spaghetti}
##                                       37
##           {mineral water,olive oil,spaghetti}
##                                       38
##           {mineral water,olive oil,spaghetti}
##                                       39
##            {mineral water,pancakes,spaghetti}
##                                       40
##            {mineral water,pancakes,spaghetti}
```

```
##                                          41
##      {frozen vegetables,milk,mineral water}
##                                          42
##      {frozen vegetables,milk,mineral water}
##                                          43
## {frozen vegetables,mineral water,spaghetti}
##                                          44
## {frozen vegetables,mineral water,spaghetti}
##                                          45
##            {ground beef,milk,mineral water}
##                                          46
##       {chocolate,ground beef,mineral water}
##                                          47
##            {eggs,ground beef,mineral water}
##                                          48
##       {ground beef,mineral water,spaghetti}
##                                          49
##       {ground beef,mineral water,spaghetti}
##                                          50
##                  {chocolate,milk,spaghetti}
##                                          51
##                  {chocolate,milk,spaghetti}
##                                          52
##              {chocolate,milk,mineral water}
##                                          53
##                   {eggs,milk,mineral water}
##                                          54
##              {milk,mineral water,spaghetti}
##                                          55
##              {milk,mineral water,spaghetti}
##                                          56
##      {french fries,mineral water,spaghetti}
##                                          57
##      {french fries,mineral water,spaghetti}
##                                          58
##                  {chocolate,eggs,spaghetti}
##                                          59
##              {chocolate,eggs,mineral water}
##                                          60
##         {chocolate,mineral water,spaghetti}
##                                          61
##         {chocolate,mineral water,spaghetti}
##                                          62
##              {eggs,mineral water,spaghetti}
##                                          63
```

```
summary(products)
```

```
## transactions as itemMatrix in sparse format with
##  7501 rows (elements/itemsets/transactions) and
##  119 columns (items) and a density of 0.03288973
##
## most frequent items:
## mineral water          eggs     spaghetti  french fries     chocolate
##          1788          1348          1306          1282          1229
```

```
##       (Other)
##         22405
##
## element (itemset/transaction) length distribution:
## sizes
##    1    2    3    4    5    6    7    8    9   10   11   12   13   14   15
## 1754 1358 1044  816  667  493  391  324  259  139  102   67   40   22   17
##   16   18   19   20
##    4    1    2    1
##
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   1.000   2.000   3.000   3.914   5.000  20.000
##
## includes extended item information - examples:
##              labels
## 1           almonds
## 2 antioxydant juice
## 3         asparagus
```

```
products.apriori.mineral_water <- apriori(products, parameter=list(support=0.01, confidence = 0.1,  mini
                                    appearance = list(rhs=c("mineral water"), default = "lhs"))
```

```
## Apriori
##
## Parameter specification:
##  confidence minval smax arem  aval originalSupport maxtime support minlen
##         0.1    0.1    1 none FALSE            TRUE       5    0.01      2
##  maxlen target   ext
##       5  rules FALSE
##
## Algorithmic control:
##  filter tree heap memopt load sort verbose
##     0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 75
##
## set item appearances ...[1 item(s)] done [0.00s].
## set transactions ...[119 item(s), 7501 transaction(s)] done [0.00s].
## sorting and recoding items ... [75 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4 done [0.00s].
## writing ... [45 rule(s)] done [0.00s].
## creating S4 object  ... done [0.00s].
```

```
inspect(sort(products.apriori.mineral_water, by="lift"))
```

```
##      lhs                              rhs             support
## [1]  {eggs,ground beef}            => {mineral water} 0.01013198
## [2]  {ground beef,milk}            => {mineral water} 0.01106519
## [3]  {chocolate,ground beef}       => {mineral water} 0.01093188
## [4]  {frozen vegetables,milk}      => {mineral water} 0.01106519
## [5]  {soup}                        => {mineral water} 0.02306359
## [6]  {pancakes,spaghetti}          => {mineral water} 0.01146514
## [7]  {olive oil,spaghetti}         => {mineral water} 0.01026530
## [8]  {milk,spaghetti}              => {mineral water} 0.01573124
```

```
## [9]  {chocolate,milk}              => {mineral water} 0.01399813
## [10] {ground beef,spaghetti}       => {mineral water} 0.01706439
## [11] {frozen vegetables,spaghetti} => {mineral water} 0.01199840
## [12] {eggs,milk}                   => {mineral water} 0.01306492
## [13] {olive oil}                   => {mineral water} 0.02759632
## [14] {ground beef}                 => {mineral water} 0.04092788
## [15] {chocolate,eggs}              => {mineral water} 0.01346487
## [16] {chocolate,spaghetti}         => {mineral water} 0.01586455
## [17] {salmon}                      => {mineral water} 0.01706439
## [18] {cereals}                     => {mineral water} 0.01026530
## [19] {cooking oil}                 => {mineral water} 0.02013065
## [20] {eggs,spaghetti}              => {mineral water} 0.01426476
## [21] {red wine}                    => {mineral water} 0.01093188
## [22] {chicken}                     => {mineral water} 0.02279696
## [23] {frozen vegetables}           => {mineral water} 0.03572857
## [24] {milk}                        => {mineral water} 0.04799360
## [25] {french fries,spaghetti}      => {mineral water} 0.01013198
## [26] {tomatoes}                    => {mineral water} 0.02439675
## [27] {pancakes}                    => {mineral water} 0.03372884
## [28] {avocado}                     => {mineral water} 0.01159845
## [29] {herb & pepper}               => {mineral water} 0.01706439
## [30] {whole wheat rice}            => {mineral water} 0.02013065
## [31] {spaghetti}                   => {mineral water} 0.05972537
## [32] {cake}                        => {mineral water} 0.02746300
## [33] {grated cheese}               => {mineral water} 0.01746434
## [34] {shrimp}                      => {mineral water} 0.02359685
## [35] {chocolate}                   => {mineral water} 0.05265965
## [36] {frozen smoothie}             => {mineral water} 0.02026396
## [37] {honey}                       => {mineral water} 0.01506466
## [38] {low fat yogurt}              => {mineral water} 0.02399680
## [39] {fresh bread}                 => {mineral water} 0.01333156
## [40] {turkey}                      => {mineral water} 0.01919744
## [41] {eggs}                        => {mineral water} 0.05092654
## [42] {burgers}                     => {mineral water} 0.02439675
## [43] {green tea}                   => {mineral water} 0.03106252
## [44] {escalope}                    => {mineral water} 0.01706439
## [45] {french fries}                => {mineral water} 0.03372884
##      confidence lift
## [1]  0.5066667  2.1255630
## [2]  0.5030303  2.1103078
## [3]  0.4739884  1.9884716
## [4]  0.4689266  1.9672361
## [5]  0.4564644  1.9149549
## [6]  0.4550265  1.9089225
## [7]  0.4476744  1.8780793
## [8]  0.4436090  1.8610242
## [9]  0.4356846  1.8277799
## [10] 0.4353741  1.8264773
## [11] 0.4306220  1.8065412
## [12] 0.4242424  1.7797776
## [13] 0.4190283  1.7579036
## [14] 0.4165536  1.7475215
## [15] 0.4056225  1.7016635
## [16] 0.4047619  1.6980532
```

```
## [17] 0.4012539  1.6833365
## [18] 0.3989637  1.6737287
## [19] 0.3942559  1.6539784
## [20] 0.3905109  1.6382677
## [21] 0.3886256  1.6303583
## [22] 0.3800000  1.5941723
## [23] 0.3748252  1.5724629
## [24] 0.3703704  1.5537741
## [25] 0.3671498  1.5402631
## [26] 0.3567251  1.4965298
## [27] 0.3548387  1.4886159
## [28] 0.3480000  1.4599262
## [29] 0.3450135  1.4473971
## [30] 0.3439636  1.4429925
## [31] 0.3430322  1.4390851
## [32] 0.3388158  1.4213967
## [33] 0.3333333  1.3983967
## [34] 0.3302239  1.3853520
## [35] 0.3213995  1.3483321
## [36] 0.3200000  1.3424609
## [37] 0.3174157  1.3316193
## [38] 0.3135889  1.3155649
## [39] 0.3095975  1.2988205
## [40] 0.3070362  1.2880754
## [41] 0.2833828  1.1888447
## [42] 0.2798165  1.1738835
## [43] 0.2351160  0.9863565
## [44] 0.2151261  0.9024947
## [45] 0.1973479  0.8279119
```

```
products.eclat <- eclat(products, parameter=list(support=0.003,  minlen=2, maxlen =5))
```

```
## Eclat
##
## parameter specification:
##  tidLists support minlen maxlen            target   ext
##     FALSE   0.003      2      5 frequent itemsets FALSE
##
## algorithmic control:
##  sparse sort verbose
##       7   -2    TRUE
##
## Absolute minimum support count: 22
##
## create itemset ...
## set transactions ...[119 item(s), 7501 transaction(s)] done [0.00s].
## sorting and recoding items ... [115 item(s)] done [0.00s].
## creating sparse bit matrix ... [115 row(s), 7501 column(s)] done [0.00s].
## writing  ... [1328 set(s)] done [0.02s].
## Creating S4 object  ... done [0.00s].
```

```
summary(products.eclat)
```

```
## set of 1328 itemsets
##
```

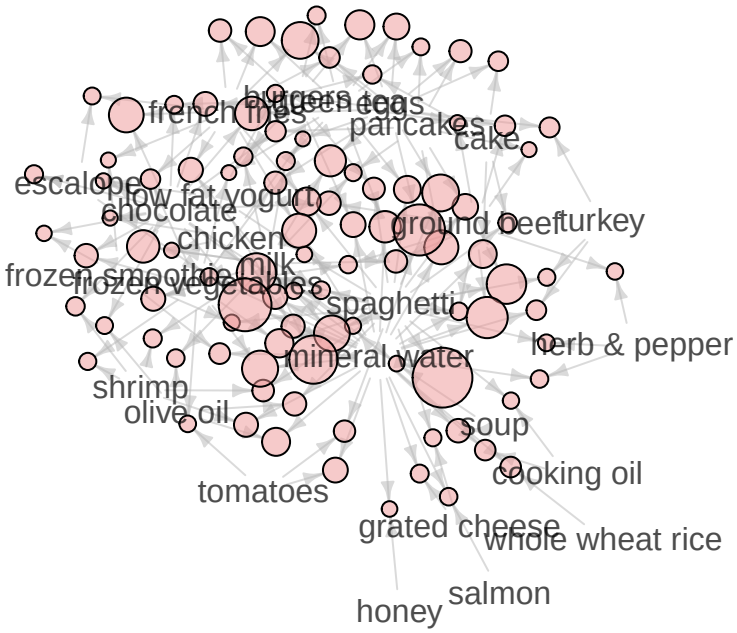
```
## most frequent items:
## mineral water     spaghetti          milk     chocolate          eggs
##           312           268           198           196           176
##       (Other)
##          2086
##
## element (itemset/transaction) length distribution:sizes
##   2   3   4
## 786 504  38
##
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   2.000   2.000   2.000   2.437   3.000   4.000
##
## summary of quality measures:
##     support
##  Min.   :0.003066
##  1st Qu.:0.003600
##  Median :0.004799
##  Mean   :0.006712
##  3rd Qu.:0.007066
##  Max.   :0.059725
##
## includes transaction ID lists: FALSE
##
## mining info:
##      data ntransactions support
##  products          7501   0.003
```

```
inspect(sort(products.eclat,by='support')[1:10])
```

```
##      items                              support
## [1]  {mineral water,spaghetti}          0.05972537
## [2]  {chocolate,mineral water}          0.05265965
## [3]  {eggs,mineral water}               0.05092654
## [4]  {milk,mineral water}               0.04799360
## [5]  {ground beef,mineral water}        0.04092788
## [6]  {ground beef,spaghetti}            0.03919477
## [7]  {chocolate,spaghetti}              0.03919477
## [8]  {eggs,spaghetti}                   0.03652846
## [9]  {eggs,french fries}                0.03639515
## [10] {frozen vegetables,mineral water} 0.03572857
```

```
plot(products.eclat,method = "graph")
```

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


Graph for 100 itemsets
size: support (0.014 − 0.06)
burgers
eggs
french fries
pancakes
cake
escalope
low fat yogurt
chocolate
ground beef
turkey
chicken
milk
frozen smoothie
frozen vegetables
spaghetti
herb & pepper
mineral water
shrimp
olive oil
soup
cooking oil
tomatoes
grated cheese
whole wheat rice
salmon
honey