AssociatioAnalysis

Load Groceries dataset from arules pack and check the transaction data

```
library(arules)
```

```
## Warning: package 'arules' was built under R version 3.4.3
```

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

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

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

```
data(Groceries)
class(Groceries)
```

```
## [1] "transactions"
## attr(,"package")
## [1] "arules"
```

```
inspect(head(Groceries,3))
```

```
##     items
## [1] {citrus fruit,
##      semi-finished bread,
##      margarine,
##      ready soups}
## [2] {tropical fruit,
##      yogurt,
##      coffee}
## [3] {whole milk}
```

check the most frequent items,and we can see that whole milk are most frequent item

```
frequentitem<-eclat(Groceries,parameter=list(supp=0.07,maxlen=15))
```

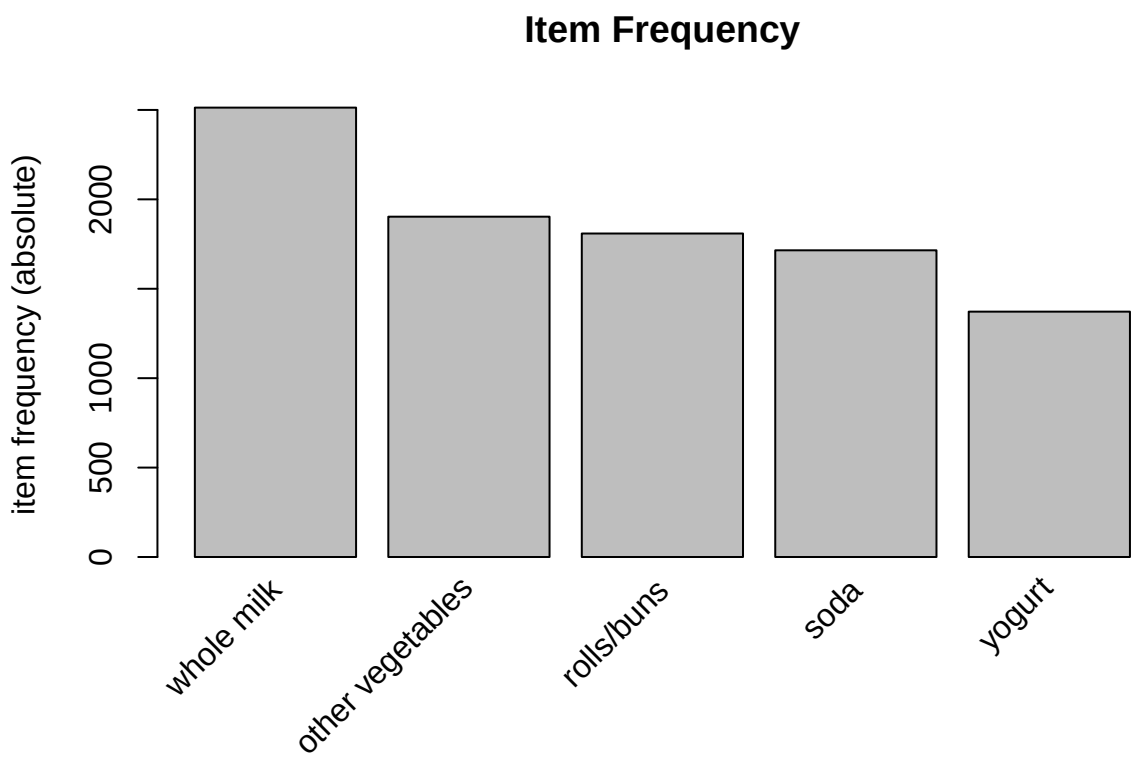
```
## Eclat
##
## parameter specification:
##  tidLists support minlen maxlen            target   ext
##     FALSE    0.07      1     15 frequent itemsets FALSE
##
## algorithmic control:
##  sparse sort verbose
##       7   -2    TRUE
##
## Absolute minimum support count: 688
##
## create itemset ...
## set transactions ...[169 item(s), 9835 transaction(s)] done [0.00s].
## sorting and recoding items ... [18 item(s)] done [0.00s].
## creating sparse bit matrix ... [18 row(s), 9835 column(s)] done [0.00s].
## writing  ... [19 set(s)] done [0.00s].
```

```
## Creating S4 object  ... done [0.00s].
```

```
inspect(frequentitem)
```

```
##      items                          support    count
## [1]  {other vegetables,whole milk} 0.07483477  736
## [2]  {whole milk}                  0.25551601 2513
## [3]  {other vegetables}            0.19349263 1903
## [4]  {rolls/buns}                  0.18393493 1809
## [5]  {yogurt}                      0.13950178 1372
## [6]  {soda}                        0.17437722 1715
## [7]  {root vegetables}             0.10899847 1072
## [8]  {tropical fruit}              0.10493137 1032
## [9]  {bottled water}               0.11052364 1087
## [10] {sausage}                     0.09395018  924
## [11] {shopping bags}               0.09852567  969
## [12] {citrus fruit}                0.08276563  814
## [13] {pastry}                      0.08896797  875
## [14] {pip fruit}                   0.07564820  744
## [15] {whipped/sour cream}          0.07168277  705
## [16] {fruit/vegetable juice}       0.07229283  711
## [17] {newspapers}                  0.07981698  785
## [18] {bottled beer}                0.08052872  792
## [19] {canned beer}                 0.07768175  764
```

```
itemFrequencyPlot(Groceries,topN=5,type="absolute",main="Item Frequency")
```



Get the product recommendation rules. Confidence of 1 means when LHS item was purchased, RHS item

was also purchased 100% of the time. High Lift indicates that LHS and RHS item are highly likely purchased together compare to other combinations.

```
rules<-apriori(Groceries,parameter=list(supp=0.001,conf=0.5))
```

```
## Apriori
##
## Parameter specification:
##  confidence minval smax arem  aval originalSupport maxtime support minlen
##         0.5    0.1    1 none FALSE            TRUE       5   0.001      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: 9
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[169 item(s), 9835 transaction(s)] done [0.00s].
## sorting and recoding items ... [157 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
## checking subsets of size 1 2 3 4 5 6 done [0.01s].
## writing ... [5668 rule(s)] done [0.00s].
## creating S4 object  ... done [0.00s].
```

```
rules_conf<-sort(rules,by="confidence",decreasing=TRUE)
inspect(head(rules_conf))
```

```
##     lhs                    rhs                    support confidence     lift count
## [1] {rice,
##      sugar}             => {whole milk}       0.001220132          1 3.913649    12
## [2] {canned fish,
##      hygiene articles}  => {whole milk}       0.001118454          1 3.913649    11
## [3] {root vegetables,
##      butter,
##      rice}              => {whole milk}       0.001016777          1 3.913649    10
## [4] {root vegetables,
##      whipped/sour cream,
##      flour}             => {whole milk}       0.001728521          1 3.913649    17
## [5] {butter,
##      soft cheese,
##      domestic eggs}     => {whole milk}       0.001016777          1 3.913649    10
## [6] {citrus fruit,
##      root vegetables,
##      soft cheese}       => {other vegetables} 0.001016777          1 5.168156    10
```

```
rules_lift<-sort(rules,by="lift",decreasing=TRUE)
inspect(head(rules_lift))
```

```
##     lhs                        rhs                  support confidence     lift count
## [1] {Instant food products,
##      soda}                 => {hamburger meat} 0.001220132  0.6315789 18.99565    12
## [2] {soda,
##      popcorn}              => {salty snack}    0.001220132  0.6315789 16.69779    12
```

```
## [3] {flour,
##      baking powder}         => {sugar}          0.001016777  0.5555556 16.40807    10
## [4] {ham,
##      processed cheese}      => {white bread}    0.001931876  0.6333333 15.04549    19
## [5] {whole milk,
##      Instant food products} => {hamburger meat} 0.001525165  0.5000000 15.03823    15
## [6] {other vegetables,
##      curd,
##      yogurt,
##      whipped/sour cream}    => {cream cheese }  0.001016777  0.5882353 14.83409    10
```

Find the rules leading to purchase 'Whole Milk',we can see people who purchase rice, sugar,canned fish,etc will also buy whole milk.

```
rules<-apriori(Groceries,parameter=list(supp=0.001,conf=0.08),appearance=list(default='lhs',rhs="whole m
rulesconf<-sort(rules,by='confidence',decreasing=TRUE)
inspect(head(rules_conf))
```

```
##     lhs                    rhs                    support confidence     lift count
## [1] {rice,
##      sugar}             => {whole milk}       0.001220132          1 3.913649    12
## [2] {canned fish,
##      hygiene articles}  => {whole milk}       0.001118454          1 3.913649    11
## [3] {root vegetables,
##      butter,
##      rice}              => {whole milk}       0.001016777          1 3.913649    10
## [4] {root vegetables,
##      whipped/sour cream,
##      flour}             => {whole milk}       0.001728521          1 3.913649    17
## [5] {butter,
##      soft cheese,
##      domestic eggs}     => {whole milk}       0.001016777          1 3.913649    10
## [6] {citrus fruit,
##      root vegetables,
##      soft cheese}       => {other vegetables} 0.001016777          1 5.168156    10
```

To check what customer purchase when purchase 'Whole milk',we can see customer also purchase other vegetables,rolls/buns,etc

```
rules<-apriori(Groceries,parameter=list(supp=0.001,conf=0.15,minlen=2),appearance = list(default='rhs',l
rules_conf<-sort(rules,by='confidence',decreasing=TRUE)
inspect(head(rules_conf))
```

```
##     lhs             rhs                support    confidence lift
## [1] {whole milk} => {other vegetables} 0.07483477 0.2928770  1.5136341
## [2] {whole milk} => {rolls/buns}       0.05663447 0.2216474  1.2050318
## [3] {whole milk} => {yogurt}           0.05602440 0.2192598  1.5717351
## [4] {whole milk} => {root vegetables}  0.04890696 0.1914047  1.7560310
## [5] {whole milk} => {tropical fruit}   0.04229792 0.1655392  1.5775950
## [6] {whole milk} => {soda}             0.04006101 0.1567847  0.8991124
##     count
## [1] 736
## [2] 557
## [3] 551
## [4] 481
## [5] 416
```

```
## [6] 394
```