

Habits

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August 14, 2022

```
## -- Attaching packages ----- tidyverse 1.3.2 --
## v ggplot2 3.3.6      v purrr  0.3.4
## v tibble  3.1.7      v dplyr  1.0.9
## v tidyr   1.2.0      v stringr 1.4.0
## v readr   2.1.2      v forcats 0.5.1
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
##
## Attaching package: 'igraph'
##
##
## The following objects are masked from 'package:dplyr':
##
##   as_data_frame, groups, union
##
## The following objects are masked from 'package:purrr':
##
##   compose, simplify
##
## The following object is masked from 'package:tidyr':
##
##   crossing
##
## The following object is masked from 'package:tibble':
##
##   as_data_frame
##
## The following objects are masked from 'package:stats':
##
##   decompose, spectrum
##
## The following object is masked from 'package:base':
##
##   union
##
##
```

```

## Loading required package: Matrix
##
##
## Attaching package: 'Matrix'
##
##
## The following objects are masked from 'package:tidyr':
##
##     expand, pack, unpack
##
##
## Attaching package: 'arules'
##
##
## The following object is masked from 'package:dplyr':
##
##     recode
##
## The following objects are masked from 'package:base':
##
##     abbreviate, write

grocery_trans = read.transactions("D:/Summer/STA2/datasets/groceries.txt",sep=',',format="basket",rm.dup

summary(grocery_trans)

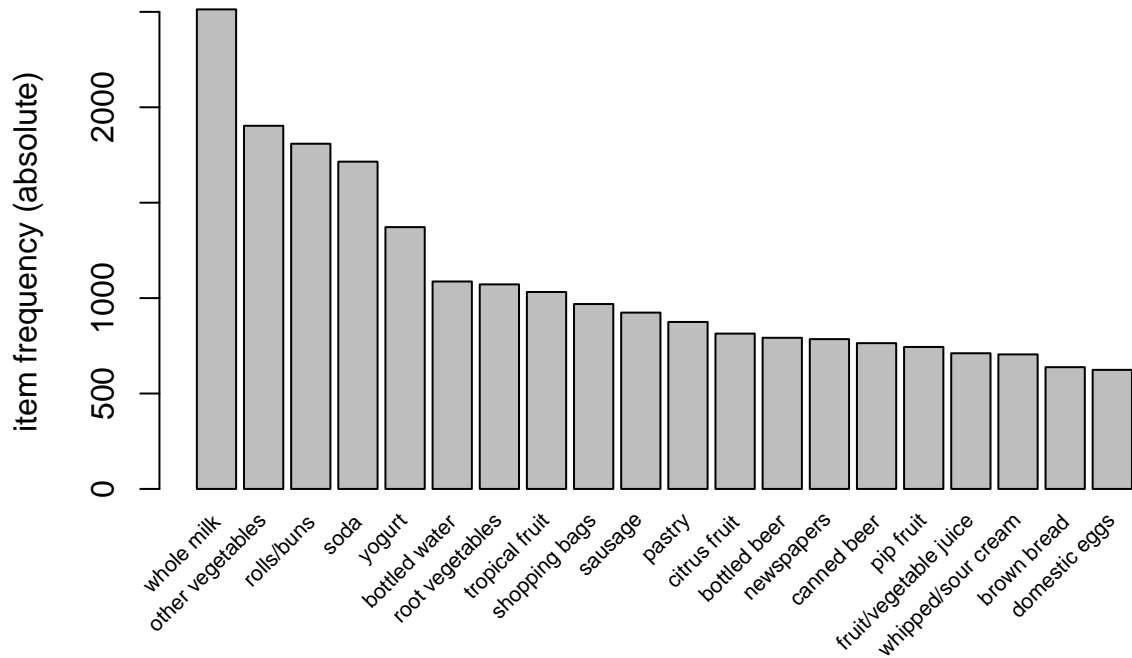
## transactions as itemMatrix in sparse format with
## 9835 rows (elements/itemsets/transactions) and
## 169 columns (items) and a density of 0.02609146
##
## most frequent items:
##      whole milk other vegetables      rolls/buns      soda
##      2513      1903      1809      1715
##      yogurt      (Other)
##      1372      34055
##
## element (itemset/transaction) length distribution:
## sizes
##      1      2      3      4      5      6      7      8      9     10     11     12     13     14     15     16
## 2159 1643 1299 1005  855  645  545  438  350  246  182  117  78  77  55  46
##      17     18     19     20     21     22     23     24     26     27     28     29     32
##      29     14     14      9     11      4      6      1      1      1      1      3      1
##
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##      1.000  2.000   3.000   4.409   6.000  32.000
##
## includes extended item information - examples:
##      labels
## 1 abrasive cleaner
## 2 artif. sweetener
## 3  baby cosmetics

```

Our dataset contains 9835 itemsets/transactions and 169 items. Most frequently purchased items include -Wholemilk, other vegetables, rolls/buns, soda, yogurt and Others.

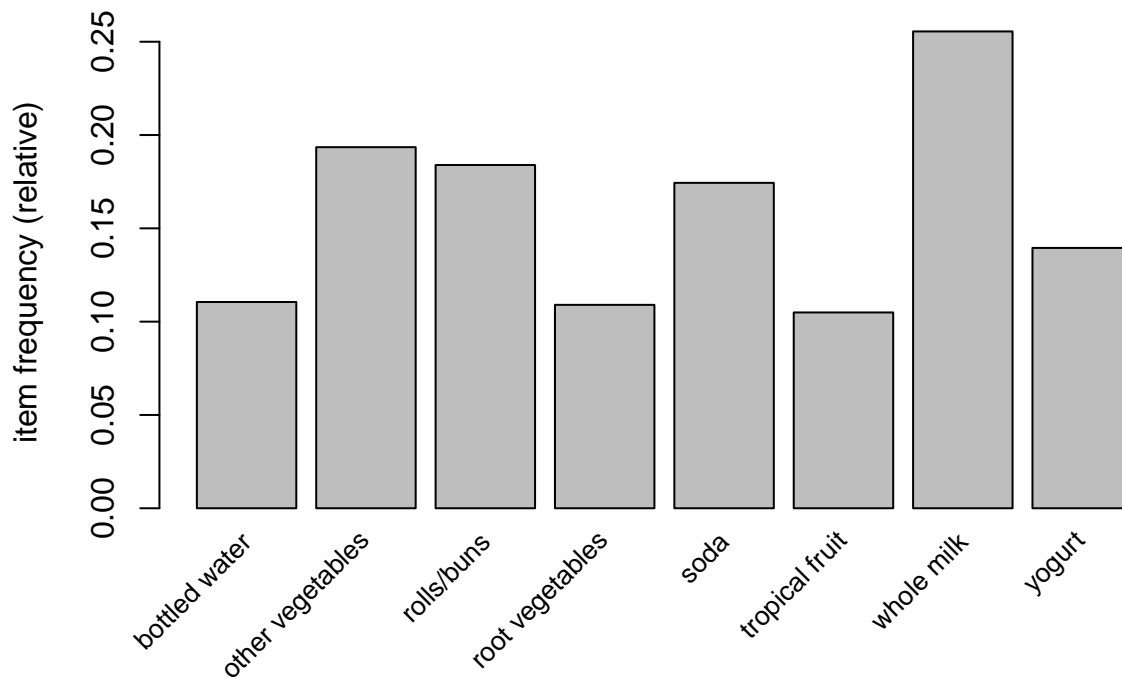
Minimum items bought - 1. Maximum no. of items bought were - 32.

```
# Create an item frequency plot for the top 20 items  
itemFrequencyPlot(grocery_trans,topN=20,type="absolute", cex.names=0.7)
```



As can be seen from above graph, Whole milk has the highest frequency of nearly 2500 among all items in the itemset.

```
itemFrequencyPlot(grocery_trans, support=0.1, cex.names=0.8)
```



We find that whole milk has the highest frequency with support = 0.1. It being set to 0.1 means that the item must occur at least 10 times in 100 transactions.

Applying the rules to our transactions :-

```
grocery_rules = apriori(grocery_trans,
                        parameter=list(support=.002, confidence=.6))
```

```
## Apriori
##
## Parameter specification:
## confidence minval smax arem aval originalSupport maxtime support minlen
##      0.6      0.1      1 none FALSE                TRUE      5  0.002      1
## maxlen target  ext
##      10  rules TRUE
##
## Algorithmic control:
## filter tree heap memopt load sort verbose
##    0.1 TRUE TRUE  FALSE TRUE    2    TRUE
##
## Absolute minimum support count: 19
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[169 item(s), 9835 transaction(s)] done [0.00s].
## sorting and recoding items ... [147 item(s)] done [0.00s].
## creating transaction tree ... done [0.00s].
```

```
## checking subsets of size 1 2 3 4 5 done [0.00s].
## writing ... [376 rule(s)] done [0.00s].
## creating S4 object ... done [0.00s].
```

```
summary(grocery_rules)
```

```
## set of 376 rules
##
## rule length distribution (lhs + rhs):sizes
##   2   3   4   5
##  2 136 211  27
##
##      Min. 1st Qu.  Median      Mean 3rd Qu.      Max.
##    2.000   3.000   4.000   3.699   4.000   5.000
##
## summary of quality measures:
##      support      confidence      coverage      lift
##  Min.   :0.002034  Min.   :0.6000  Min.   :0.002440  Min.   :2.348
## 1st Qu.:0.002237  1st Qu.:0.6208  1st Qu.:0.003355  1st Qu.:2.491
## Median :0.002491  Median :0.6485  Median :0.003813  Median :2.735
## Mean   :0.002914  Mean   :0.6657  Mean   :0.004435  Mean   :2.912
## 3rd Qu.:0.003254  3rd Qu.:0.6983  3rd Qu.:0.004982  3rd Qu.:3.192
## Max.   :0.009354  Max.   :0.8857  Max.   :0.014642  Max.   :5.838
##      count
##  Min.   :20.00
## 1st Qu.:22.00
## Median :24.50
## Mean   :28.66
## 3rd Qu.:32.00
## Max.   :92.00
##
## mining info:
##      data ntransactions support confidence
## grocery_trans      9835   0.002      0.6
##
##                                     call
## apriori(data = grocery_trans, parameter = list(support = 0.002, confidence = 0.6))
```

Setting support to 0.002 as it was the optimum value at which the apriori could learn some association rules from the transactions. A confidence level of 50% was set as the minimum level of confidence we want to create effective rules.

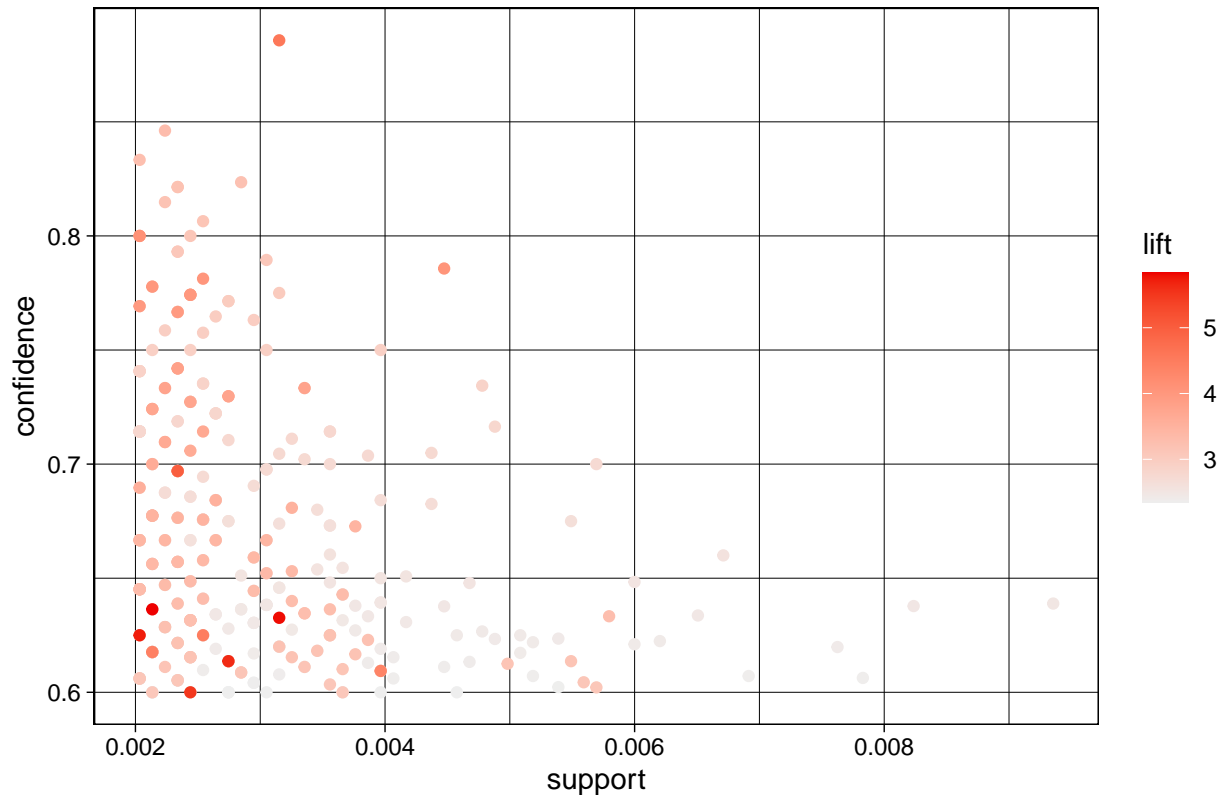
Further, we required an absolute minimum support count of 9 for us to establish the association rules at a support of 0.002 and confidence of 0.5 . Hence, we were able to create 376 rules.

A total of 376 rules generated. Most rules are 4 items long.

Let us plot our rules :

```
plot(grocery_rules, jitter=0)
```

Scatter plot for 376 rules



We observe higher lift for low support values below 0.004

Now, let us inspect the grocery rules :

```
inspect(grocery_rules)
```

	lhs	rhs	support	confidence	coverage	lift
## [1]	{cereals}	=> {whole milk}	0.003660397	0.6428571	0.005693950	2.515917
## [2]	{rice}	=> {whole milk}	0.004677173	0.6133333	0.007625826	2.400371
## [3]	{specialty cheese, yogurt}	=> {whole milk}	0.002033554	0.7142857	0.002846975	2.795464
## [4]	{rice, root vegetables}	=> {other vegetables}	0.002236909	0.7096774	0.003152008	3.667723
## [5]	{rice, root vegetables}	=> {whole milk}	0.002440264	0.7741935	0.003152008	3.029922
## [6]	{other vegetables, rice}	=> {whole milk}	0.002643620	0.6666667	0.003965430	2.609099
## [7]	{frozen fish, yogurt}	=> {whole milk}	0.002236909	0.6875000	0.003253686	2.690634
## [8]	{pasta, root vegetables}	=> {whole milk}	0.002338587	0.6052632	0.003863752	2.368788
## [9]	{herbs, whipped/sour cream}	=> {other vegetables}	0.002033554	0.6451613	0.003152008	3.334294
## [10]	{citrus fruit, herbs}	=> {other vegetables}	0.002135231	0.7241379	0.002948653	3.742457
## [11]	{herbs,					

##	tropical fruit}	=> {whole milk}	0.002338587	0.8214286	0.002846975	3.214783
## [12]	{herbs,	=> {whole milk}	0.002135231	0.6000000	0.003558719	2.348189
##	yogurt}					
## [13]	{herbs,	=> {whole milk}	0.002440264	0.8000000	0.003050330	3.130919
##	rolls/buns}					
## [14]	{processed cheese,	=> {other vegetables}	0.002135231	0.6774194	0.003152008	3.501009
##	root vegetables}					
## [15]	{processed cheese,	=> {whole milk}	0.002033554	0.6451613	0.003152008	2.524935
##	root vegetables}					
## [16]	{semi-finished bread,	=> {other vegetables}	0.002236909	0.6285714	0.003558719	3.248555
##	yogurt}					
## [17]	{detergent,	=> {whole milk}	0.002033554	0.6060606	0.003355363	2.371909
##	tropical fruit}					
## [18]	{detergent,	=> {whole milk}	0.002745297	0.6279070	0.004372140	2.457408
##	root vegetables}					
## [19]	{detergent,	=> {whole milk}	0.002033554	0.6666667	0.003050330	2.609099
##	rolls/buns}					
## [20]	{baking powder,	=> {other vegetables}	0.002541942	0.7142857	0.003558719	3.691540
##	root vegetables}					
## [21]	{baking powder,	=> {whole milk}	0.002338587	0.6571429	0.003558719	2.571827
##	root vegetables}					
## [22]	{baking powder,	=> {whole milk}	0.003253686	0.7111111	0.004575496	2.783039
##	yogurt}					
## [23]	{baking powder,	=> {other vegetables}	0.002135231	0.6000000	0.003558719	3.100893
##	rolls/buns}					
## [24]	{baking powder,	=> {whole milk}	0.002236909	0.6285714	0.003558719	2.460008
##	rolls/buns}					
## [25]	{flour,	=> {whole milk}	0.002541942	0.6250000	0.004067107	2.446031
##	whipped/sour cream}					
## [26]	{flour,	=> {whole milk}	0.002948653	0.6304348	0.004677173	2.467300
##	root vegetables}					
## [27]	{butter,	=> {whole milk}	0.002033554	0.7407407	0.002745297	2.898999
##	soft cheese}					
## [28]	{domestic eggs,	=> {other vegetables}	0.002033554	0.6451613	0.003152008	3.334294
##	soft cheese}					
## [29]	{domestic eggs,	=> {whole milk}	0.002135231	0.6774194	0.003152008	2.651182
##	soft cheese}					
## [30]	{soft cheese,	=> {other vegetables}	0.002236909	0.7333333	0.003050330	3.789981
##	whipped/sour cream}					
## [31]	{soft cheese,	=> {whole milk}	0.002033554	0.6666667	0.003050330	2.609099
##	whipped/sour cream}					
## [32]	{soft cheese,	=> {other vegetables}	0.002135231	0.6562500	0.003253686	3.391602
##	tropical fruit}					
## [33]	{soft cheese,	=> {whole milk}	0.002135231	0.6562500	0.003253686	2.568332
##	tropical fruit}					
## [34]	{root vegetables,	=> {other vegetables}	0.002440264	0.7272727	0.003355363	3.758659
##	soft cheese}					
## [35]	{root vegetables,	=> {whole milk}	0.002338587	0.6969697	0.003355363	2.727695
##	soft cheese}					
## [36]	{grapes,	=> {other vegetables}	0.003660397	0.6000000	0.006100661	3.100893
##	tropical fruit}					
## [37]	{grapes,	=> {other vegetables}	0.002745297	0.6136364	0.004473818	3.171368
##	root vegetables}					
## [38]	{grapes,					

##	yogurt}	=> {other vegetables}	0.002846975	0.6086957	0.004677173	3.145834
## [39]	{cat food,	=> {other vegetables}	0.002846975	0.6086957	0.004677173	3.145834
##	root vegetables}	=> {other vegetables}	0.002846975	0.6086957	0.004677173	3.145834
## [40]	{meat,	=> {whole milk}	0.003152008	0.6200000	0.005083884	2.426462
##	root vegetables}	=> {whole milk}	0.003152008	0.6200000	0.005083884	2.426462
## [41]	{frozen meals,	=> {whole milk}	0.003558719	0.6481481	0.005490595	2.536624
##	tropical fruit}	=> {whole milk}	0.003558719	0.6481481	0.005490595	2.536624
## [42]	{frozen meals,	=> {other vegetables}	0.002541942	0.6578947	0.003863752	3.400102
##	root vegetables}	=> {other vegetables}	0.002541942	0.6578947	0.003863752	3.400102
## [43]	{frozen meals,	=> {whole milk}	0.002643620	0.6842105	0.003863752	2.677760
##	root vegetables}	=> {whole milk}	0.002643620	0.6842105	0.003863752	2.677760
## [44]	{hard cheese,	=> {other vegetables}	0.002745297	0.6136364	0.004473818	3.171368
##	whipped/sour cream}	=> {other vegetables}	0.002745297	0.6136364	0.004473818	3.171368
## [45]	{hard cheese,	=> {other vegetables}	0.003457041	0.6181818	0.005592272	3.194860
##	root vegetables}	=> {other vegetables}	0.003457041	0.6181818	0.005592272	3.194860
## [46]	{hard cheese,	=> {whole milk}	0.004168785	0.6507937	0.006405694	2.546978
##	yogurt}	=> {whole milk}	0.004168785	0.6507937	0.006405694	2.546978
## [47]	{butter milk,	=> {whole milk}	0.002033554	0.7142857	0.002846975	2.795464
##	dessert}	=> {whole milk}	0.002033554	0.7142857	0.002846975	2.795464
## [48]	{butter milk,	=> {other vegetables}	0.002338587	0.6052632	0.003863752	3.128094
##	whipped/sour cream}	=> {other vegetables}	0.002338587	0.6052632	0.003863752	3.128094
## [49]	{butter milk,	=> {whole milk}	0.002948653	0.7631579	0.003863752	2.986732
##	whipped/sour cream}	=> {whole milk}	0.002948653	0.7631579	0.003863752	2.986732
## [50]	{butter milk,	=> {other vegetables}	0.003253686	0.6400000	0.005083884	3.307620
##	pip fruit}	=> {other vegetables}	0.003253686	0.6400000	0.005083884	3.307620
## [51]	{butter milk,	=> {whole milk}	0.003152008	0.6200000	0.005083884	2.426462
##	root vegetables}	=> {whole milk}	0.003152008	0.6200000	0.005083884	2.426462
## [52]	{ham,	=> {whole milk}	0.002643620	0.6341463	0.004168785	2.481826
##	whipped/sour cream}	=> {whole milk}	0.002643620	0.6341463	0.004168785	2.481826
## [53]	{ham,	=> {other vegetables}	0.002643620	0.6666667	0.003965430	3.445437
##	pip fruit}	=> {other vegetables}	0.002643620	0.6666667	0.003965430	3.445437
## [54]	{sliced cheese,	=> {whole milk}	0.002745297	0.7105263	0.003863752	2.780751
##	whipped/sour cream}	=> {whole milk}	0.002745297	0.7105263	0.003863752	2.780751
## [55]	{root vegetables,	=> {other vegetables}	0.003762074	0.6727273	0.005592272	3.476759
##	sliced cheese}	=> {other vegetables}	0.003762074	0.6727273	0.005592272	3.476759
## [56]	{coffee,	=> {other vegetables}	0.002033554	0.6060606	0.003355363	3.132215
##	oil}	=> {other vegetables}	0.002033554	0.6060606	0.003355363	3.132215
## [57]	{beef,	=> {whole milk}	0.002033554	0.6451613	0.003152008	2.524935
##	oil}	=> {whole milk}	0.002033554	0.6451613	0.003152008	2.524935
## [58]	{oil,	=> {whole milk}	0.004473818	0.6376812	0.007015760	2.495660
##	root vegetables}	=> {whole milk}	0.004473818	0.6376812	0.007015760	2.495660
## [59]	{oil,	=> {other vegetables}	0.003253686	0.6153846	0.005287239	3.180403
##	yogurt}	=> {other vegetables}	0.003253686	0.6153846	0.005287239	3.180403
## [60]	{oil,	=> {whole milk}	0.003050330	0.6000000	0.005083884	2.348189
##	rolls/buns}	=> {whole milk}	0.003050330	0.6000000	0.005083884	2.348189
## [61]	{frozen vegetables,	=> {other vegetables}	0.002135231	0.6774194	0.003152008	3.501009
##	onions}	=> {other vegetables}	0.002135231	0.6774194	0.003152008	3.501009
## [62]	{butter,	=> {whole milk}	0.003050330	0.7500000	0.004067107	2.935237
##	onions}	=> {whole milk}	0.003050330	0.7500000	0.004067107	2.935237
## [63]	{onions,	=> {other vegetables}	0.003152008	0.6200000	0.005083884	3.204256
##	whipped/sour cream}	=> {other vegetables}	0.003152008	0.6200000	0.005083884	3.204256
## [64]	{onions,	=> {other vegetables}	0.002135231	0.6176471	0.003457041	3.192096
##	pip fruit}	=> {other vegetables}	0.002135231	0.6176471	0.003457041	3.192096
## [65]	{onions,					

##	pip fruit}	=> {whole milk}	0.002236909	0.6470588	0.003457041	2.532361
## [66]	{citrus fruit,					
##	onions}	=> {other vegetables}	0.003558719	0.6363636	0.005592272	3.288826
## [67]	{onions,					
##	tropical fruit}	=> {other vegetables}	0.003660397	0.6428571	0.005693950	3.322386
## [68]	{onions,					
##	root vegetables}	=> {other vegetables}	0.005693950	0.6021505	0.009456024	3.112008
## [69]	{berries,					
##	butter}	=> {whole milk}	0.002440264	0.6486486	0.003762074	2.538583
## [70]	{chicken,					
##	hamburger meat}	=> {other vegetables}	0.002440264	0.6486486	0.003762074	3.352317
## [71]	{curd,					
##	hamburger meat}	=> {other vegetables}	0.002033554	0.6451613	0.003152008	3.334294
## [72]	{curd,					
##	hamburger meat}	=> {whole milk}	0.002541942	0.8064516	0.003152008	3.156169
## [73]	{hamburger meat,					
##	pork}	=> {other vegetables}	0.002033554	0.6250000	0.003253686	3.230097
## [74]	{hamburger meat,					
##	pork}	=> {whole milk}	0.002135231	0.6562500	0.003253686	2.568332
## [75]	{frankfurter,					
##	hamburger meat}	=> {whole milk}	0.002236909	0.6666667	0.003355363	2.609099
## [76]	{butter,					
##	hamburger meat}	=> {whole milk}	0.003050330	0.6976744	0.004372140	2.730453
## [77]	{domestic eggs,					
##	hamburger meat}	=> {whole milk}	0.002541942	0.6250000	0.004067107	2.446031
## [78]	{hamburger meat,					
##	whipped/sour cream}	=> {whole milk}	0.002643620	0.6190476	0.004270463	2.422735
## [79]	{hamburger meat,					
##	pip fruit}	=> {other vegetables}	0.002948653	0.6590909	0.004473818	3.406284
## [80]	{hamburger meat,					
##	root vegetables}	=> {whole milk}	0.003965430	0.6393443	0.006202339	2.502169
## [81]	{hamburger meat,					
##	yogurt}	=> {whole milk}	0.003965430	0.6093750	0.006507372	2.384880
## [82]	{butter,					
##	hygiene articles}	=> {whole milk}	0.003050330	0.6976744	0.004372140	2.730453
## [83]	{hygiene articles,					
##	pip fruit}	=> {whole milk}	0.003050330	0.6382979	0.004778851	2.498074
## [84]	{hygiene articles,					
##	tropical fruit}	=> {whole milk}	0.004067107	0.6060606	0.006710727	2.371909
## [85]	{hygiene articles,					
##	root vegetables}	=> {whole milk}	0.003558719	0.6603774	0.005388917	2.584485
## [86]	{long life bakery product,					
##	salty snack}	=> {whole milk}	0.002033554	0.6060606	0.003355363	2.371909
## [87]	{cream cheese,					
##	sugar}	=> {whole milk}	0.002033554	0.7407407	0.002745297	2.898999
## [88]	{frozen vegetables,					
##	sugar}	=> {other vegetables}	0.002033554	0.6451613	0.003152008	3.334294
## [89]	{curd,					
##	sugar}	=> {whole milk}	0.002338587	0.6764706	0.003457041	2.647468
## [90]	{napkins,					
##	sugar}	=> {whole milk}	0.002033554	0.6060606	0.003355363	2.371909
## [91]	{butter,					
##	sugar}	=> {whole milk}	0.002135231	0.6774194	0.003152008	2.651182
## [92]	{domestic eggs,					

##	sugar}	=> {whole milk}	0.003558719	0.7142857	0.004982206	2.795464
## [93]	{sugar,					
##	whipped/sour cream}	=> {whole milk}	0.003152008	0.6458333	0.004880529	2.527565
## [94]	{pork,					
##	waffles}	=> {other vegetables}	0.002135231	0.6176471	0.003457041	3.192096
## [95]	{waffles,					
##	whipped/sour cream}	=> {whole milk}	0.003152008	0.6200000	0.005083884	2.426462
## [96]	{long life bakery product,					
##	root vegetables}	=> {other vegetables}	0.003355363	0.6346154	0.005287239	3.279791
## [97]	{cream cheese,					
##	frankfurter}	=> {whole milk}	0.002135231	0.6363636	0.003355363	2.490504
## [98]	{butter,					
##	cream cheese}	=> {whole milk}	0.002745297	0.6750000	0.004067107	2.641713
## [99]	{cream cheese,					
##	domestic eggs}	=> {whole milk}	0.003457041	0.6800000	0.005083884	2.661281
## [100]	{cream cheese,					
##	whipped/sour cream}	=> {whole milk}	0.003965430	0.6190476	0.006405694	2.422735
## [101]	{cream cheese,					
##	pip fruit}	=> {whole milk}	0.003965430	0.6500000	0.006100661	2.543872
## [102]	{chicken,					
##	curd}	=> {whole milk}	0.002236909	0.6470588	0.003457041	2.532361
## [103]	{chicken,					
##	domestic eggs}	=> {whole milk}	0.003965430	0.6393443	0.006202339	2.502169
## [104]	{curd,					
##	white bread}	=> {whole milk}	0.002135231	0.6176471	0.003457041	2.417254
## [105]	{napkins,					
##	white bread}	=> {whole milk}	0.002338587	0.6764706	0.003457041	2.647468
## [106]	{margarine,					
##	white bread}	=> {whole milk}	0.002541942	0.6756757	0.003762074	2.644357
## [107]	{whipped/sour cream,					
##	white bread}	=> {other vegetables}	0.003355363	0.6111111	0.005490595	3.158317
## [108]	{beef,					
##	coffee}	=> {whole milk}	0.002338587	0.6216216	0.003762074	2.432809
## [109]	{coffee,					
##	napkins}	=> {whole milk}	0.002440264	0.6000000	0.004067107	2.348189
## [110]	{butter,					
##	coffee}	=> {whole milk}	0.003355363	0.7021277	0.004778851	2.747881
## [111]	{curd,					
##	frozen vegetables}	=> {whole milk}	0.002846975	0.6363636	0.004473818	2.490504
## [112]	{beef,					
##	frankfurter}	=> {whole milk}	0.002948653	0.6170213	0.004778851	2.414805
## [113]	{beef,					
##	butter}	=> {whole milk}	0.003660397	0.6315789	0.005795628	2.471778
## [114]	{beef,					
##	domestic eggs}	=> {whole milk}	0.003762074	0.6271186	0.005998983	2.454322
## [115]	{beef,					
##	pip fruit}	=> {whole milk}	0.002948653	0.6041667	0.004880529	2.364496
## [116]	{beef,					
##	tropical fruit}	=> {whole milk}	0.004575496	0.6000000	0.007625826	2.348189
## [117]	{butter,					
##	curd}	=> {whole milk}	0.004880529	0.7164179	0.006812405	2.803808
## [118]	{curd,					
##	domestic eggs}	=> {whole milk}	0.004778851	0.7343750	0.006507372	2.874086
## [119]	{curd,					

##	pip fruit}	=> {whole milk}	0.004880529	0.6233766	0.007829181	2.439677
## [120]	{curd,					
##	tropical fruit}	=> {whole milk}	0.006507372	0.6336634	0.010269446	2.479936
## [121]	{butter,					
##	napkins}	=> {whole milk}	0.003152008	0.6326531	0.004982206	2.475982
## [122]	{butter,					
##	pork}	=> {whole milk}	0.003863752	0.7037037	0.005490595	2.754049
## [123]	{domestic eggs,					
##	pork}	=> {whole milk}	0.003457041	0.6181818	0.005592272	2.419347
## [124]	{pip fruit,					
##	pork}	=> {other vegetables}	0.003762074	0.6166667	0.006100661	3.187029
## [125]	{bottled beer,					
##	domestic eggs}	=> {whole milk}	0.002948653	0.6304348	0.004677173	2.467300
## [126]	{brown bread,					
##	whipped/sour cream}	=> {other vegetables}	0.003050330	0.6521739	0.004677173	3.370536
## [127]	{domestic eggs,					
##	margarine}	=> {whole milk}	0.005185562	0.6219512	0.008337570	2.434099
## [128]	{butter,					
##	domestic eggs}	=> {whole milk}	0.005998983	0.6210526	0.009659380	2.430582
## [129]	{butter,					
##	whipped/sour cream}	=> {whole milk}	0.006710727	0.6600000	0.010167768	2.583008
## [130]	{butter,					
##	pip fruit}	=> {whole milk}	0.004473818	0.6111111	0.007320793	2.391674
## [131]	{bottled water,					
##	butter}	=> {whole milk}	0.005388917	0.6022727	0.008947636	2.357084
## [132]	{butter,					
##	tropical fruit}	=> {whole milk}	0.006202339	0.6224490	0.009964413	2.436047
## [133]	{butter,					
##	root vegetables}	=> {whole milk}	0.008235892	0.6377953	0.012913066	2.496107
## [134]	{butter,					
##	yogurt}	=> {whole milk}	0.009354347	0.6388889	0.014641586	2.500387
## [135]	{domestic eggs,					
##	pip fruit}	=> {whole milk}	0.005388917	0.6235294	0.008642603	2.440275
## [136]	{domestic eggs,					
##	tropical fruit}	=> {whole milk}	0.006914082	0.6071429	0.011387900	2.376144
## [137]	{pip fruit,					
##	whipped/sour cream}	=> {other vegetables}	0.005592272	0.6043956	0.009252669	3.123610
## [138]	{pip fruit,					
##	whipped/sour cream}	=> {whole milk}	0.005998983	0.6483516	0.009252669	2.537421
## [139]	{herbs,					
##	other vegetables,					
##	root vegetables}	=> {whole milk}	0.002440264	0.6315789	0.003863752	2.471778
## [140]	{herbs,					
##	other vegetables,					
##	whole milk}	=> {root vegetables}	0.002440264	0.6000000	0.004067107	5.504664
## [141]	{grapes,					
##	tropical fruit,					
##	whole milk}	=> {other vegetables}	0.002033554	0.8000000	0.002541942	4.134524
## [142]	{hard cheese,					
##	other vegetables,					
##	root vegetables}	=> {whole milk}	0.002135231	0.6176471	0.003457041	2.417254
## [143]	{hard cheese,					
##	root vegetables,					
##	whole milk}	=> {other vegetables}	0.002135231	0.6562500	0.003253686	3.391602

## [144]	{hard cheese, other vegetables, yogurt}	=> {whole milk}	0.002033554	0.7142857	0.002846975	2.795464
## [145]	{ham, other vegetables, yogurt}	=> {whole milk}	0.002033554	0.6666667	0.003050330	2.609099
## [146]	{other vegetables, root vegetables, sliced cheese}	=> {whole milk}	0.002440264	0.6486486	0.003762074	2.538583
## [147]	{root vegetables, sliced cheese, whole milk}	=> {other vegetables}	0.002440264	0.7741935	0.003152008	4.001153
## [148]	{oil, other vegetables, root vegetables}	=> {whole milk}	0.002643620	0.6842105	0.003863752	2.677760
## [149]	{oil, other vegetables, yogurt}	=> {whole milk}	0.002236909	0.6875000	0.003253686	2.690634
## [150]	{oil, whole milk, yogurt}	=> {other vegetables}	0.002236909	0.7096774	0.003152008	3.667723
## [151]	{onions, other vegetables, whipped/sour cream}	=> {whole milk}	0.002135231	0.6774194	0.003152008	2.651182
## [152]	{onions, whipped/sour cream, whole milk}	=> {other vegetables}	0.002135231	0.7777778	0.002745297	4.019677
## [153]	{onions, root vegetables, whole milk}	=> {other vegetables}	0.003253686	0.6808511	0.004778851	3.518744
## [154]	{onions, other vegetables, yogurt}	=> {whole milk}	0.002440264	0.6315789	0.003863752	2.471778
## [155]	{onions, whole milk, yogurt}	=> {other vegetables}	0.002440264	0.6315789	0.003863752	3.264098
## [156]	{hygiene articles, other vegetables, yogurt}	=> {whole milk}	0.002135231	0.7500000	0.002846975	2.935237
## [157]	{other vegetables, root vegetables, waffles}	=> {whole milk}	0.002033554	0.6250000	0.003253686	2.446031
## [158]	{long life bakery product, other vegetables, yogurt}	=> {whole milk}	0.002643620	0.7222222	0.003660397	2.826524
## [159]	{cream cheese, whipped/sour cream, yogurt}	=> {whole milk}	0.002338587	0.6969697	0.003355363	2.727695
## [160]	{cream cheese, other vegetables, whipped/sour cream}	=> {whole milk}	0.002338587	0.6969697	0.003355363	2.727695
## [161]	{cream cheese, root vegetables, yogurt}	=> {whole milk}	0.002338587	0.6216216	0.003762074	2.432809

## [162]	{cream cheese, root vegetables, whole milk}	=> {other vegetables}	0.002440264	0.6153846	0.003965430	3.180403
## [163]	{cream cheese, other vegetables, yogurt}	=> {whole milk}	0.003457041	0.6538462	0.005287239	2.558924
## [164]	{chicken, domestic eggs, other vegetables}	=> {whole milk}	0.002440264	0.7272727	0.003355363	2.846290
## [165]	{chicken, domestic eggs, whole milk}	=> {other vegetables}	0.002440264	0.6153846	0.003965430	3.180403
## [166]	{chicken, other vegetables, whipped/sour cream}	=> {whole milk}	0.002338587	0.6052632	0.003863752	2.368788
## [167]	{chicken, whole milk, yogurt}	=> {other vegetables}	0.002541942	0.6410256	0.003965430	3.312920
## [168]	{tropical fruit, white bread, yogurt}	=> {whole milk}	0.002033554	0.7142857	0.002846975	2.795464
## [169]	{coffee, other vegetables, whipped/sour cream}	=> {whole milk}	0.002033554	0.7142857	0.002846975	2.795464
## [170]	{coffee, other vegetables, yogurt}	=> {whole milk}	0.002236909	0.6285714	0.003558719	2.460008
## [171]	{frozen vegetables, fruit/vegetable juice, yogurt}	=> {whole milk}	0.002135231	0.6774194	0.003152008	2.651182
## [172]	{frozen vegetables, whipped/sour cream, yogurt}	=> {other vegetables}	0.002236909	0.6666667	0.003355363	3.445437
## [173]	{frozen vegetables, other vegetables, whipped/sour cream}	=> {whole milk}	0.002440264	0.6153846	0.003965430	2.408399
## [174]	{frozen vegetables, whipped/sour cream, whole milk}	=> {other vegetables}	0.002440264	0.6315789	0.003863752	3.264098
## [175]	{citrus fruit, frozen vegetables, root vegetables}	=> {other vegetables}	0.002033554	0.7692308	0.002643620	3.975504
## [176]	{citrus fruit, frozen vegetables, other vegetables}	=> {root vegetables}	0.002033554	0.6250000	0.003253686	5.734025
## [177]	{citrus fruit, frozen vegetables, other vegetables}	=> {whole milk}	0.002033554	0.6250000	0.003253686	2.446031
## [178]	{frozen vegetables, root vegetables, tropical fruit}	=> {whole milk}	0.002338587	0.7666667	0.003050330	3.000464
## [179]	{frozen vegetables, tropical fruit, yogurt}	=> {other vegetables}	0.002033554	0.6060606	0.003355363	3.132215

## [180]	{frozen vegetables, other vegetables, root vegetables}	=> {whole milk}	0.003863752	0.6333333	0.006100661	2.478644
## [181]	{frozen vegetables, root vegetables, whole milk}	=> {other vegetables}	0.003863752	0.6229508	0.006202339	3.219507
## [182]	{frozen vegetables, other vegetables, yogurt}	=> {whole milk}	0.003558719	0.6730769	0.005287239	2.634187
## [183]	{beef, butter, root vegetables}	=> {whole milk}	0.002033554	0.6896552	0.002948653	2.699068
## [184]	{beef, domestic eggs, other vegetables}	=> {whole milk}	0.002541942	0.7575758	0.003355363	2.964886
## [185]	{beef, domestic eggs, whole milk}	=> {other vegetables}	0.002541942	0.6756757	0.003762074	3.491997
## [186]	{beef, whipped/sour cream, whole milk}	=> {other vegetables}	0.002135231	0.6176471	0.003457041	3.192096
## [187]	{beef, citrus fruit, other vegetables}	=> {root vegetables}	0.002135231	0.6363636	0.003355363	5.838280
## [188]	{beef, citrus fruit, other vegetables}	=> {whole milk}	0.002135231	0.6363636	0.003355363	2.490504
## [189]	{beef, root vegetables, tropical fruit}	=> {other vegetables}	0.002745297	0.7297297	0.003762074	3.771357
## [190]	{beef, other vegetables, tropical fruit}	=> {root vegetables}	0.002745297	0.6136364	0.004473818	5.629770
## [191]	{beef, root vegetables, tropical fruit}	=> {whole milk}	0.002541942	0.6756757	0.003762074	2.644357
## [192]	{beef, rolls/buns, tropical fruit}	=> {whole milk}	0.002135231	0.7777778	0.002745297	3.043949
## [193]	{beef, other vegetables, tropical fruit}	=> {whole milk}	0.002948653	0.6590909	0.004473818	2.579450
## [194]	{beef, tropical fruit, whole milk}	=> {other vegetables}	0.002948653	0.6444444	0.004575496	3.330589
## [195]	{butter, curd, yogurt}	=> {whole milk}	0.002338587	0.7931034	0.002948653	3.103929
## [196]	{butter, curd, other vegetables}	=> {whole milk}	0.002236909	0.7333333	0.003050330	2.870009
## [197]	{curd, domestic eggs, yogurt}	=> {whole milk}	0.002033554	0.7407407	0.002745297	2.898999

## [198]	{curd, domestic eggs, other vegetables}	=> {whole milk}	0.002846975	0.8235294	0.003457041	3.223005
## [199]	{curd, tropical fruit, whipped/sour cream}	=> {whole milk}	0.002033554	0.7142857	0.002846975	2.795464
## [200]	{curd, whipped/sour cream, yogurt}	=> {whole milk}	0.002745297	0.6000000	0.004575496	2.348189
## [201]	{curd, pip fruit, yogurt}	=> {whole milk}	0.002541942	0.6578947	0.003863752	2.574769
## [202]	{curd, other vegetables, pip fruit}	=> {whole milk}	0.002236909	0.6666667	0.003355363	2.609099
## [203]	{curd, pastry, yogurt}	=> {whole milk}	0.002338587	0.7187500	0.003253686	2.812935
## [204]	{citrus fruit, curd, yogurt}	=> {whole milk}	0.002135231	0.7000000	0.003050330	2.739554
## [205]	{curd, root vegetables, tropical fruit}	=> {other vegetables}	0.002033554	0.6451613	0.003152008	3.334294
## [206]	{curd, root vegetables, tropical fruit}	=> {whole milk}	0.002033554	0.6451613	0.003152008	2.524935
## [207]	{curd, tropical fruit, yogurt}	=> {whole milk}	0.003965430	0.7500000	0.005287239	2.935237
## [208]	{curd, tropical fruit, whole milk}	=> {yogurt}	0.003965430	0.6093750	0.006507372	4.368224
## [209]	{curd, root vegetables, yogurt}	=> {whole milk}	0.002948653	0.6304348	0.004677173	2.467300
## [210]	{curd, rolls/buns, yogurt}	=> {whole milk}	0.002541942	0.7352941	0.003457041	2.877683
## [211]	{curd, other vegetables, yogurt}	=> {whole milk}	0.003660397	0.6000000	0.006100661	2.348189
## [212]	{curd, other vegetables, rolls/buns}	=> {whole milk}	0.002440264	0.6666667	0.003660397	2.609099
## [213]	{napkins, other vegetables, whipped/sour cream}	=> {whole milk}	0.002033554	0.6060606	0.003355363	2.371909
## [214]	{butter, other vegetables, pork}	=> {whole milk}	0.002236909	0.8461538	0.002643620	3.311549
## [215]	{domestic eggs, other vegetables, pork}	=> {whole milk}	0.002033554	0.6666667	0.003050330	2.609099

## [216]	{other vegetables, pork, whipped/sour cream}	=> {whole milk}	0.002440264	0.6000000	0.004067107	2.348189
## [217]	{other vegetables, pip fruit, pork}	=> {whole milk}	0.002338587	0.6216216	0.003762074	2.432809
## [218]	{pip fruit, pork, whole milk}	=> {other vegetables}	0.002338587	0.7419355	0.003152008	3.834438
## [219]	{pork, rolls/buns, root vegetables}	=> {whole milk}	0.002033554	0.7142857	0.002846975	2.795464
## [220]	{frankfurter, other vegetables, pip fruit}	=> {whole milk}	0.002338587	0.6388889	0.003660397	2.500387
## [221]	{frankfurter, pip fruit, whole milk}	=> {other vegetables}	0.002338587	0.6969697	0.003355363	3.602048
## [222]	{frankfurter, root vegetables, tropical fruit}	=> {whole milk}	0.002033554	0.7407407	0.002745297	2.898999
## [223]	{frankfurter, tropical fruit, yogurt}	=> {whole milk}	0.002135231	0.7241379	0.002948653	2.834022
## [224]	{frankfurter, other vegetables, tropical fruit}	=> {whole milk}	0.002541942	0.6410256	0.003965430	2.508749
## [225]	{frankfurter, root vegetables, yogurt}	=> {whole milk}	0.002338587	0.7187500	0.003253686	2.812935
## [226]	{bottled beer, domestic eggs, other vegetables}	=> {whole milk}	0.002033554	0.7692308	0.002643620	3.010499
## [227]	{bottled beer, domestic eggs, whole milk}	=> {other vegetables}	0.002033554	0.6896552	0.002948653	3.564245
## [228]	{bottled beer, root vegetables, whole milk}	=> {other vegetables}	0.002440264	0.6153846	0.003965430	3.180403
## [229]	{bottled beer, other vegetables, yogurt}	=> {whole milk}	0.002643620	0.7222222	0.003660397	2.826524
## [230]	{brown bread, other vegetables, tropical fruit}	=> {whole milk}	0.002643620	0.6341463	0.004168785	2.481826
## [231]	{brown bread, other vegetables, root vegetables}	=> {whole milk}	0.003152008	0.7750000	0.004067107	3.033078
## [232]	{brown bread, soda, yogurt}	=> {whole milk}	0.002033554	0.6451613	0.003152008	2.524935
## [233]	{brown bread, other vegetables, soda}	=> {whole milk}	0.002541942	0.6097561	0.004168785	2.386371

## [234]	{butter, margarine, whole milk}	=> {other vegetables}	0.002033554	0.6666667	0.003050330	3.445437
## [235]	{domestic eggs, margarine, other vegetables}	=> {whole milk}	0.002440264	0.6153846	0.003965430	2.408399
## [236]	{margarine, other vegetables, whipped/sour cream}	=> {whole milk}	0.002135231	0.6176471	0.003457041	2.417254
## [237]	{margarine, root vegetables, yogurt}	=> {whole milk}	0.002135231	0.6176471	0.003457041	2.417254
## [238]	{margarine, rolls/buns, root vegetables}	=> {whole milk}	0.002033554	0.7142857	0.002846975	2.795464
## [239]	{margarine, root vegetables, whole milk}	=> {other vegetables}	0.003253686	0.6530612	0.004982206	3.375122
## [240]	{margarine, other vegetables, rolls/buns}	=> {whole milk}	0.003152008	0.6078431	0.005185562	2.378885
## [241]	{butter, domestic eggs, root vegetables}	=> {whole milk}	0.002440264	0.7500000	0.003253686	2.935237
## [242]	{butter, domestic eggs, yogurt}	=> {whole milk}	0.002236909	0.7586207	0.002948653	2.968975
## [243]	{butter, domestic eggs, other vegetables}	=> {whole milk}	0.003050330	0.6666667	0.004575496	2.609099
## [244]	{butter, fruit/vegetable juice, yogurt}	=> {whole milk}	0.002135231	0.6000000	0.003558719	2.348189
## [245]	{butter, tropical fruit, whipped/sour cream}	=> {other vegetables}	0.002338587	0.7666667	0.003050330	3.962253
## [246]	{butter, tropical fruit, whipped/sour cream}	=> {whole milk}	0.002135231	0.7000000	0.003050330	2.739554
## [247]	{butter, root vegetables, whipped/sour cream}	=> {other vegetables}	0.002135231	0.6176471	0.003457041	3.192096
## [248]	{butter, root vegetables, whipped/sour cream}	=> {whole milk}	0.002643620	0.7647059	0.003457041	2.992790
## [249]	{butter, whipped/sour cream, yogurt}	=> {whole milk}	0.002643620	0.6842105	0.003863752	2.677760
## [250]	{butter, other vegetables, whipped/sour cream}	=> {whole milk}	0.003965430	0.6842105	0.005795628	2.677760
## [251]	{butter, other vegetables, pip fruit}	=> {whole milk}	0.002745297	0.6750000	0.004067107	2.641713

## [252]	{butter, pip fruit, whole milk}	=> {other vegetables}	0.002745297	0.6136364	0.004473818	3.171368
## [253]	{butter, citrus fruit, yogurt}	=> {whole milk}	0.002033554	0.6666667	0.003050330	2.609099
## [254]	{butter, citrus fruit, other vegetables}	=> {whole milk}	0.002948653	0.6444444	0.004575496	2.522129
## [255]	{butter, other vegetables, sausage}	=> {whole milk}	0.002338587	0.6052632	0.003863752	2.368788
## [256]	{bottled water, butter, root vegetables}	=> {whole milk}	0.002440264	0.7272727	0.003355363	2.846290
## [257]	{bottled water, butter, other vegetables}	=> {whole milk}	0.002643620	0.7222222	0.003660397	2.826524
## [258]	{butter, root vegetables, tropical fruit}	=> {other vegetables}	0.002338587	0.6571429	0.003558719	3.396217
## [259]	{butter, root vegetables, tropical fruit}	=> {whole milk}	0.002440264	0.6857143	0.003558719	2.683645
## [260]	{butter, tropical fruit, yogurt}	=> {other vegetables}	0.003050330	0.6666667	0.004575496	3.445437
## [261]	{butter, tropical fruit, yogurt}	=> {whole milk}	0.003355363	0.7333333	0.004575496	2.870009
## [262]	{butter, other vegetables, tropical fruit}	=> {whole milk}	0.003355363	0.6111111	0.005490595	2.391674
## [263]	{butter, root vegetables, yogurt}	=> {whole milk}	0.003050330	0.7894737	0.003863752	3.089723
## [264]	{butter, rolls/buns, root vegetables}	=> {other vegetables}	0.002440264	0.6315789	0.003863752	3.264098
## [265]	{butter, rolls/buns, root vegetables}	=> {whole milk}	0.002338587	0.6052632	0.003863752	2.368788
## [266]	{butter, other vegetables, root vegetables}	=> {whole milk}	0.004168785	0.6307692	0.006609049	2.468609
## [267]	{butter, other vegetables, yogurt}	=> {whole milk}	0.004372140	0.6825397	0.006405694	2.671221
## [268]	{citrus fruit, newspapers, whole milk}	=> {other vegetables}	0.002033554	0.6060606	0.003355363	3.132215
## [269]	{domestic eggs, fruit/vegetable juice, other vegetables}	=> {whole milk}	0.002135231	0.6176471	0.003457041	2.417254

## [270]	{domestic eggs, root vegetables, whipped/sour cream}	=> {whole milk}	0.002033554	0.6060606	0.003355363	2.371909
## [271]	{domestic eggs, whipped/sour cream, yogurt}	=> {whole milk}	0.002236909	0.6285714	0.003558719	2.460008
## [272]	{domestic eggs, other vegetables, whipped/sour cream}	=> {whole milk}	0.003558719	0.7000000	0.005083884	2.739554
## [273]	{domestic eggs, whipped/sour cream, whole milk}	=> {other vegetables}	0.003558719	0.6250000	0.005693950	3.230097
## [274]	{domestic eggs, other vegetables, pip fruit}	=> {whole milk}	0.002643620	0.6666667	0.003965430	2.609099
## [275]	{citrus fruit, domestic eggs, other vegetables}	=> {whole milk}	0.002846975	0.6363636	0.004473818	2.490504
## [276]	{domestic eggs, root vegetables, tropical fruit}	=> {whole milk}	0.002745297	0.7714286	0.003558719	3.019101
## [277]	{domestic eggs, tropical fruit, yogurt}	=> {whole milk}	0.002948653	0.6904762	0.004270463	2.702281
## [278]	{domestic eggs, other vegetables, tropical fruit}	=> {whole milk}	0.003050330	0.6382979	0.004778851	2.498074
## [279]	{domestic eggs, root vegetables, yogurt}	=> {whole milk}	0.002541942	0.6944444	0.003660397	2.717812
## [280]	{domestic eggs, other vegetables, root vegetables}	=> {whole milk}	0.004575496	0.6250000	0.007320793	2.446031
## [281]	{fruit/vegetable juice, whipped/sour cream, yogurt}	=> {other vegetables}	0.002338587	0.6052632	0.003863752	3.128094
## [282]	{fruit/vegetable juice, pip fruit, yogurt}	=> {other vegetables}	0.002236909	0.6285714	0.003558719	3.248555
## [283]	{fruit/vegetable juice, pip fruit, yogurt}	=> {whole milk}	0.002338587	0.6571429	0.003558719	2.571827
## [284]	{citrus fruit, fruit/vegetable juice, root vegetables}	=> {other vegetables}	0.002338587	0.6764706	0.003457041	3.496105
## [285]	{fruit/vegetable juice, root vegetables, tropical fruit}	=> {other vegetables}	0.002541942	0.7812500	0.003253686	4.037622
## [286]	{fruit/vegetable juice, root vegetables, yogurt}	=> {other vegetables}	0.002440264	0.7058824	0.003457041	3.648110
## [287]	{fruit/vegetable juice, root vegetables, yogurt}	=> {whole milk}	0.002541942	0.7352941	0.003457041	2.877683

## [288]	{fruit/vegetable juice, other vegetables, root vegetables}	=> {whole milk}	0.003965430	0.6000000	0.006609049	2.348189
## [289]	{fruit/vegetable juice, root vegetables, whole milk}	=> {other vegetables}	0.003965430	0.6093750	0.006507372	3.149345
## [290]	{fruit/vegetable juice, other vegetables, soda}	=> {whole milk}	0.002745297	0.6136364	0.004473818	2.401557
## [291]	{fruit/vegetable juice, other vegetables, yogurt}	=> {whole milk}	0.005083884	0.6172840	0.008235892	2.415833
## [292]	{pip fruit, tropical fruit, whipped/sour cream}	=> {other vegetables}	0.002745297	0.7297297	0.003762074	3.771357
## [293]	{pip fruit, root vegetables, whipped/sour cream}	=> {other vegetables}	0.002033554	0.6666667	0.003050330	3.445437
## [294]	{pip fruit, root vegetables, whipped/sour cream}	=> {whole milk}	0.002338587	0.7666667	0.003050330	3.000464
## [295]	{pip fruit, whipped/sour cream, yogurt}	=> {other vegetables}	0.002236909	0.6111111	0.003660397	3.158317
## [296]	{pip fruit, whipped/sour cream, yogurt}	=> {whole milk}	0.002440264	0.6666667	0.003660397	2.609099
## [297]	{other vegetables, pip fruit, whipped/sour cream}	=> {whole milk}	0.003660397	0.6545455	0.005592272	2.561661
## [298]	{pip fruit, whipped/sour cream, whole milk}	=> {other vegetables}	0.003660397	0.6101695	0.005998983	3.153451
## [299]	{citrus fruit, tropical fruit, whipped/sour cream}	=> {other vegetables}	0.002135231	0.6774194	0.003152008	3.501009
## [300]	{citrus fruit, tropical fruit, whipped/sour cream}	=> {whole milk}	0.002338587	0.7419355	0.003152008	2.903675
## [301]	{citrus fruit, root vegetables, whipped/sour cream}	=> {other vegetables}	0.002338587	0.6969697	0.003355363	3.602048
## [302]	{citrus fruit, root vegetables, whipped/sour cream}	=> {whole milk}	0.002033554	0.6060606	0.003355363	2.371909
## [303]	{citrus fruit, whipped/sour cream, yogurt}	=> {whole milk}	0.002745297	0.6000000	0.004575496	2.348189
## [304]	{citrus fruit, rolls/buns, whipped/sour cream}	=> {whole milk}	0.002033554	0.7142857	0.002846975	2.795464
## [305]	{citrus fruit, other vegetables, whipped/sour cream}	=> {whole milk}	0.003660397	0.6428571	0.005693950	2.515917

## [306] {other vegetables, ## sausage, ## whipped/sour cream}	=> {whole milk}	0.002948653	0.6041667	0.004880529	2.364496
## [307] {root vegetables, ## tropical fruit, ## whipped/sour cream}	=> {other vegetables}	0.003355363	0.7333333	0.004575496	3.789981
## [308] {root vegetables, ## tropical fruit, ## whipped/sour cream}	=> {whole milk}	0.002745297	0.6000000	0.004575496	2.348189
## [309] {rolls/buns, ## tropical fruit, ## whipped/sour cream}	=> {yogurt}	0.002135231	0.6176471	0.003457041	4.427521
## [310] {tropical fruit, ## whipped/sour cream, ## yogurt}	=> {whole milk}	0.004372140	0.7049180	0.006202339	2.758802
## [311] {rolls/buns, ## tropical fruit, ## whipped/sour cream}	=> {whole milk}	0.002135231	0.6176471	0.003457041	2.417254
## [312] {rolls/buns, ## root vegetables, ## whipped/sour cream}	=> {whole milk}	0.002846975	0.6511628	0.004372140	2.548423
## [313] {other vegetables, ## root vegetables, ## whipped/sour cream}	=> {whole milk}	0.005185562	0.6071429	0.008540925	2.376144
## [314] {rolls/buns, ## whipped/sour cream, ## yogurt}	=> {whole milk}	0.003050330	0.6382979	0.004778851	2.498074
## [315] {pastry, ## pip fruit, ## yogurt}	=> {whole milk}	0.002135231	0.6000000	0.003558719	2.348189
## [316] {citrus fruit, ## pip fruit, ## root vegetables}	=> {other vegetables}	0.002643620	0.6842105	0.003863752	3.536106
## [317] {citrus fruit, ## pip fruit, ## root vegetables}	=> {whole milk}	0.002338587	0.6052632	0.003863752	2.368788
## [318] {bottled water, ## other vegetables, ## pip fruit}	=> {whole milk}	0.002033554	0.6666667	0.003050330	2.609099
## [319] {pip fruit, ## root vegetables, ## tropical fruit}	=> {other vegetables}	0.003355363	0.6346154	0.005287239	3.279791
## [320] {pip fruit, ## root vegetables, ## yogurt}	=> {whole milk}	0.003558719	0.6730769	0.005287239	2.634187
## [321] {other vegetables, ## pip fruit, ## root vegetables}	=> {whole milk}	0.005490595	0.6750000	0.008134215	2.641713
## [322] {pip fruit, ## root vegetables, ## whole milk}	=> {other vegetables}	0.005490595	0.6136364	0.008947636	3.171368
## [323] {other vegetables, ## pip fruit, ## yogurt}	=> {whole milk}	0.005083884	0.6250000	0.008134215	2.446031

## [324]	{citrus fruit, pastry, rolls/buns}	=> {whole milk}	0.002033554	0.6666667	0.003050330	2.609099
## [325]	{pastry, tropical fruit, yogurt}	=> {whole milk}	0.003050330	0.6521739	0.004677173	2.552380
## [326]	{pastry, root vegetables, yogurt}	=> {whole milk}	0.002541942	0.6756757	0.003762074	2.644357
## [327]	{other vegetables, pastry, yogurt}	=> {whole milk}	0.004067107	0.6153846	0.006609049	2.408399
## [328]	{bottled water, citrus fruit, root vegetables}	=> {whole milk}	0.002033554	0.6060606	0.003355363	2.371909
## [329]	{citrus fruit, root vegetables, tropical fruit}	=> {other vegetables}	0.004473818	0.7857143	0.005693950	4.060694
## [330]	{citrus fruit, root vegetables, tropical fruit}	=> {whole milk}	0.003558719	0.6250000	0.005693950	2.446031
## [331]	{citrus fruit, tropical fruit, yogurt}	=> {whole milk}	0.003863752	0.6129032	0.006304016	2.398688
## [332]	{citrus fruit, root vegetables, soda}	=> {other vegetables}	0.002135231	0.7000000	0.003050330	3.617709
## [333]	{citrus fruit, root vegetables, yogurt}	=> {whole milk}	0.003152008	0.6458333	0.004880529	2.527565
## [334]	{citrus fruit, rolls/buns, root vegetables}	=> {other vegetables}	0.002236909	0.6470588	0.003457041	3.344101
## [335]	{citrus fruit, root vegetables, whole milk}	=> {other vegetables}	0.005795628	0.6333333	0.009150991	3.273165
## [336]	{citrus fruit, other vegetables, yogurt}	=> {whole milk}	0.004778851	0.6266667	0.007625826	2.452553
## [337]	{root vegetables, shopping bags, yogurt}	=> {other vegetables}	0.002135231	0.7241379	0.002948653	3.742457
## [338]	{root vegetables, sausage, tropical fruit}	=> {whole milk}	0.002745297	0.7714286	0.003558719	3.019101
## [339]	{sausage, tropical fruit, yogurt}	=> {whole milk}	0.003152008	0.6739130	0.004677173	2.637459
## [340]	{root vegetables, sausage, yogurt}	=> {whole milk}	0.003253686	0.6274510	0.005185562	2.455623
## [341]	{bottled water, root vegetables, yogurt}	=> {whole milk}	0.002338587	0.6052632	0.003863752	2.368788

## [342] {root vegetables, ## soda, ## tropical fruit}	=> {other vegetables}	0.002338587	0.6216216	0.003762074	3.212637
## [343] {root vegetables, ## tropical fruit, ## yogurt}	=> {other vegetables}	0.004982206	0.6125000	0.008134215	3.165495
## [344] {root vegetables, ## tropical fruit, ## yogurt}	=> {whole milk}	0.005693950	0.7000000	0.008134215	2.739554
## [345] {rolls/buns, ## root vegetables, ## tropical fruit}	=> {other vegetables}	0.003558719	0.6034483	0.005897306	3.118715
## [346] {rolls/buns, ## root vegetables, ## tropical fruit}	=> {whole milk}	0.003762074	0.6379310	0.005897306	2.496638
## [347] {other vegetables, ## tropical fruit, ## yogurt}	=> {whole milk}	0.007625826	0.6198347	0.012302999	2.425816
## [348] {rolls/buns, ## root vegetables, ## yogurt}	=> {whole milk}	0.004677173	0.6478873	0.007219115	2.535604
## [349] {other vegetables, ## root vegetables, ## yogurt}	=> {whole milk}	0.007829181	0.6062992	0.012913066	2.372842
## [350] {butter, ## other vegetables, ## tropical fruit, ## yogurt}	=> {whole milk}	0.002338587	0.7666667	0.003050330	3.000464
## [351] {butter, ## tropical fruit, ## whole milk, ## yogurt}	=> {other vegetables}	0.002338587	0.6969697	0.003355363	3.602048
## [352] {butter, ## other vegetables, ## tropical fruit, ## whole milk}	=> {yogurt}	0.002338587	0.6969697	0.003355363	4.996135
## [353] {fruit/vegetable juice, ## other vegetables, ## root vegetables, ## yogurt}	=> {whole milk}	0.002033554	0.8333333	0.002440264	3.261374
## [354] {fruit/vegetable juice, ## root vegetables, ## whole milk, ## yogurt}	=> {other vegetables}	0.002033554	0.8000000	0.002541942	4.134524
## [355] {other vegetables, ## tropical fruit, ## whipped/sour cream, ## yogurt}	=> {whole milk}	0.002440264	0.6857143	0.003558719	2.683645
## [356] {other vegetables, ## root vegetables, ## whipped/sour cream, ## yogurt}	=> {whole milk}	0.002338587	0.6764706	0.003457041	2.647468
## [357] {root vegetables, ## whipped/sour cream,					

##	whole milk,					
##	yogurt}	=> {other vegetables}	0.002338587	0.6388889	0.003660397	3.301877
## [358]	{other vegetables,					
##	pip fruit,					
##	root vegetables,					
##	tropical fruit}	=> {whole milk}	0.002440264	0.7272727	0.003355363	2.846290
## [359]	{pip fruit,					
##	root vegetables,					
##	tropical fruit,					
##	whole milk}	=> {other vegetables}	0.002440264	0.7741935	0.003152008	4.001153
## [360]	{other vegetables,					
##	pip fruit,					
##	tropical fruit,					
##	yogurt}	=> {whole milk}	0.002338587	0.6571429	0.003558719	2.571827
## [361]	{pip fruit,					
##	tropical fruit,					
##	whole milk,					
##	yogurt}	=> {other vegetables}	0.002338587	0.6216216	0.003762074	3.212637
## [362]	{other vegetables,					
##	pip fruit,					
##	root vegetables,					
##	yogurt}	=> {whole milk}	0.002338587	0.7931034	0.002948653	3.103929
## [363]	{pip fruit,					
##	root vegetables,					
##	whole milk,					
##	yogurt}	=> {other vegetables}	0.002338587	0.6571429	0.003558719	3.396217
## [364]	{citrus fruit,					
##	other vegetables,					
##	root vegetables,					
##	tropical fruit}	=> {whole milk}	0.003152008	0.7045455	0.004473818	2.757344
## [365]	{citrus fruit,					
##	root vegetables,					
##	tropical fruit,					
##	whole milk}	=> {other vegetables}	0.003152008	0.8857143	0.003558719	4.577509
## [366]	{citrus fruit,					
##	other vegetables,					
##	tropical fruit,					
##	whole milk}	=> {root vegetables}	0.003152008	0.6326531	0.004982206	5.804238
## [367]	{citrus fruit,					
##	other vegetables,					
##	tropical fruit,					
##	yogurt}	=> {whole milk}	0.002440264	0.7741935	0.003152008	3.029922
## [368]	{citrus fruit,					
##	tropical fruit,					
##	whole milk,					
##	yogurt}	=> {other vegetables}	0.002440264	0.6315789	0.003863752	3.264098
## [369]	{citrus fruit,					
##	other vegetables,					
##	root vegetables,					
##	yogurt}	=> {whole milk}	0.002338587	0.8214286	0.002846975	3.214783
## [370]	{citrus fruit,					
##	root vegetables,					
##	whole milk,					
##	yogurt}	=> {other vegetables}	0.002338587	0.7419355	0.003152008	3.834438


```
## [371] {bottled water,
##       other vegetables,
##       tropical fruit,
##       yogurt}                => {whole milk}      0.002033554  0.6666667 0.003050330 2.609099
## [372] {rolls/buns,
##       root vegetables,
##       tropical fruit,
##       yogurt}                => {whole milk}      0.002236909  0.8148148 0.002745297 3.188899
## [373] {other vegetables,
##       root vegetables,
##       tropical fruit,
##       yogurt}                => {whole milk}      0.003558719  0.7142857 0.004982206 2.795464
## [374] {root vegetables,
##       tropical fruit,
##       whole milk,
##       yogurt}                => {other vegetables} 0.003558719  0.6250000 0.005693950 3.230097
## [375] {other vegetables,
##       rolls/buns,
##       tropical fruit,
##       yogurt}                => {whole milk}      0.002541942  0.6756757 0.003762074 2.644357
## [376] {other vegetables,
##       rolls/buns,
##       tropical fruit,
##       whole milk}            => {yogurt}        0.002541942  0.6250000 0.004067107 4.480230
```

We observe that most of the associations created lead to the purchase of whole milk or other vegetables among all items.

Inspecting rules further..

```
inspect(head(sort(grocery_rules, by ="count"),10))
```

	lhs	rhs	support	confidence	coverage	lift	count
## [1]	{butter,	=> {whole milk}	0.009354347	0.6388889	0.014641586	2.500387	92
## [2]	{butter,	=> {whole milk}	0.008235892	0.6377953	0.012913066	2.496107	81
## [3]	{other vegetables,	=> {whole milk}	0.007829181	0.6062992	0.012913066	2.372842	77
## [4]	{other vegetables,	=> {whole milk}	0.007625826	0.6198347	0.012302999	2.425816	75
## [5]	{domestic eggs,	=> {whole milk}	0.006914082	0.6071429	0.011387900	2.376144	68
## [6]	{butter,	=> {whole milk}	0.006710727	0.6600000	0.010167768	2.583008	66
## [7]	{curd,	=> {whole milk}	0.006507372	0.6336634	0.010269446	2.479936	64
## [8]	{butter,	=> {whole milk}	0.006202339	0.6224490	0.009964413	2.436047	61
## [9]	{butter,	=> {whole milk}	0.005998983	0.6210526	0.009659380	2.430582	59
## [10]	{pip fruit,						

```
##      whipped/sour cream} => {whole milk} 0.005998983  0.6483516 0.009252669 2.537421    59
```

Although we observe a high count for whole milk purchases with high values of support and a minimum 60% confidence, the lift value is low ~2.5 . This tells us that we cannot rely upon the confidence factor of whole milk being purchased as there could be various other factors contributing to that value.

Let us sort by lift and check the top 10 association rules created -

```
inspect(head(sort(grocery_rules, by ="lift"),10))
```

##	lhs	rhs	support	confidence	coverage	lift	count
## [1]	{beef,						
##	citrus fruit,						
##	other vegetables}	=> {root vegetables}	0.002135231	0.6363636	0.003355363	5.838280	21
## [2]	{citrus fruit,						
##	other vegetables,						
##	tropical fruit,						
##	whole milk}	=> {root vegetables}	0.003152008	0.6326531	0.004982206	5.804238	31
## [3]	{citrus fruit,						
##	frozen vegetables,						
##	other vegetables}	=> {root vegetables}	0.002033554	0.6250000	0.003253686	5.734025	20
## [4]	{beef,						
##	other vegetables,						
##	tropical fruit}	=> {root vegetables}	0.002745297	0.6136364	0.004473818	5.629770	27
## [5]	{herbs,						
##	other vegetables,						
##	whole milk}	=> {root vegetables}	0.002440264	0.6000000	0.004067107	5.504664	24
## [6]	{butter,						
##	other vegetables,						
##	tropical fruit,						
##	whole milk}	=> {yogurt}	0.002338587	0.6969697	0.003355363	4.996135	23
## [7]	{citrus fruit,						
##	root vegetables,						
##	tropical fruit,						
##	whole milk}	=> {other vegetables}	0.003152008	0.8857143	0.003558719	4.577509	31
## [8]	{other vegetables,						
##	rolls/buns,						
##	tropical fruit,						
##	whole milk}	=> {yogurt}	0.002541942	0.6250000	0.004067107	4.480230	25
## [9]	{rolls/buns,						
##	tropical fruit,						
##	whipped/sour cream}	=> {yogurt}	0.002135231	0.6176471	0.003457041	4.427521	21
## [10]	{curd,						
##	tropical fruit,						
##	whole milk}	=> {yogurt}	0.003965430	0.6093750	0.006507372	4.368224	39

Owing to the high lift values -

Looks like people tend to buy whole milk, beef , various types of fruits (citrus/tropical) and root vegetables together. Possibly diet conscious.

We observe that yogurt is tends to be often purchased bought along with rolls/buns, whipped cream and whole milk.

.....

```
inspect(subset(grocery_rules, subset=lift > 4.5))
```

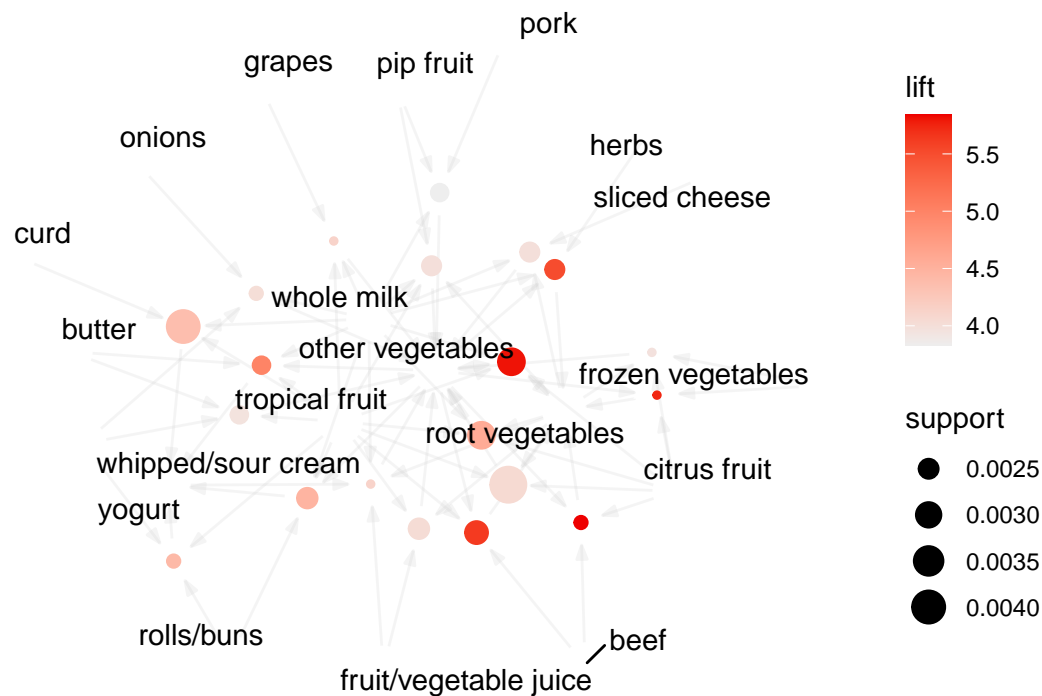
	lhs	rhs	support	confidence	coverage	lift	count
## [1]	{herbs, other vegetables, whole milk}	=> {root vegetables}	0.002440264	0.6000000	0.004067107	5.504664	24
## [2]	{citrus fruit, frozen vegetables, other vegetables}	=> {root vegetables}	0.002033554	0.6250000	0.003253686	5.734025	20
## [3]	{beef, citrus fruit, other vegetables}	=> {root vegetables}	0.002135231	0.6363636	0.003355363	5.838280	21
## [4]	{beef, other vegetables, tropical fruit}	=> {root vegetables}	0.002745297	0.6136364	0.004473818	5.629770	27
## [5]	{butter, other vegetables, tropical fruit, whole milk}	=> {yogurt}	0.002338587	0.6969697	0.003355363	4.996135	23
## [6]	{citrus fruit, root vegetables, tropical fruit, whole milk}	=> {other vegetables}	0.003152008	0.8857143	0.003558719	4.577509	31
## [7]	{citrus fruit, other vegetables, tropical fruit, whole milk}	=> {root vegetables}	0.003152008	0.6326531	0.004982206	5.804238	31

On an average, people do seem to want to have a balanced diet of nutritions and buy root vegetables along with whole milk, beef , various types of fruits (citrus/tropical) .

```
plot(head(sort(grocery_rules, by="lift"), 20),  
      method="graph", control=list(cex=.9))
```

```
## Warning: Unknown control parameters: cex
```

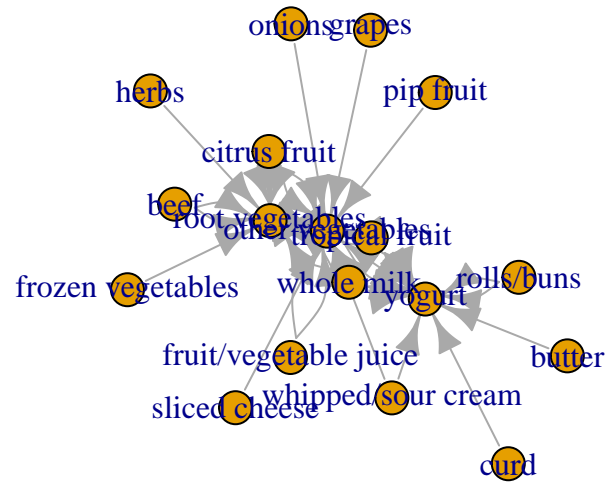
```
## Available control parameters (with default values):  
## layout      = stress  
## circular    = FALSE  
## ggraphdots  = NULL  
## edges       = <environment>  
## nodes       = <environment>  
## nodetext    = <environment>  
## colors      = c("#EE0000FF", "#EEEEEEFF")  
## engine      = ggplot2  
## max         = 100  
## verbose     = FALSE
```



In conclusion, we can assume the following based on the association rule model:

1. Whole Milk is being purchased by most people along with butter, curd, whipped cream fruits and vegetables. However, since the lift is low, we are not sure of the causes leading to this association.
2. Root vegetables and fruits occur often with other vegetables indicating that people tend to make conscious nutritious choices.
3. Citrus fruits and tropical fruits occur together, suggesting that people are preferring fruits that are native to hot and humid climates (tropical countries).
4. Root vegetables are being purchased with a lift > 4.5 indicating that nearly 5 times the chance of people buying it along with buying tropical/citrus fruits, whole milk, beef and other vegetables.
5. From the above point, we observe that people are health conscious and seem to purchase accordingly in order to have a balanced diet.

```
grocery_graph = associations2igraph(subset(grocery_rules, lift>4), associationsAsNodes = FALSE)
igraph::write_graph(grocery_graph, file='grocery.graphml', format = "graphml")
plot(grocery_graph)
```



```
# plot(grocery_rules ,method="graph",interactive=FALSE,shading="lift")
# title(main = "test")
```