P3 KNIT

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#Visual Story Telling 1: GreenBuildings

Regarding the analysis performed by the "stats guru," we believe that he does decent introductory exploration, but neglects a multitude of key factors including leasing rate and building quality in green versus nongreen buildings, which confounds his results.
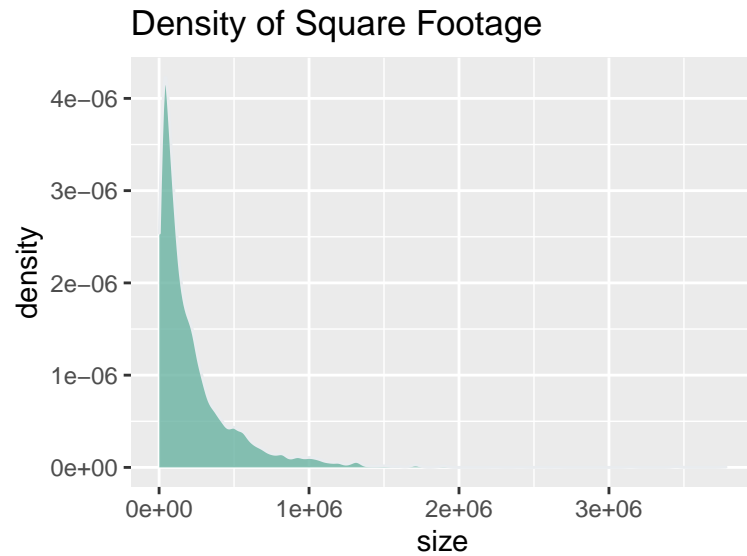
While our study does replicate some of his ideas, we provide a more complete analysis below: We began our exploratory analysis by creating density plots of some explanatory variables.

Rent Density:
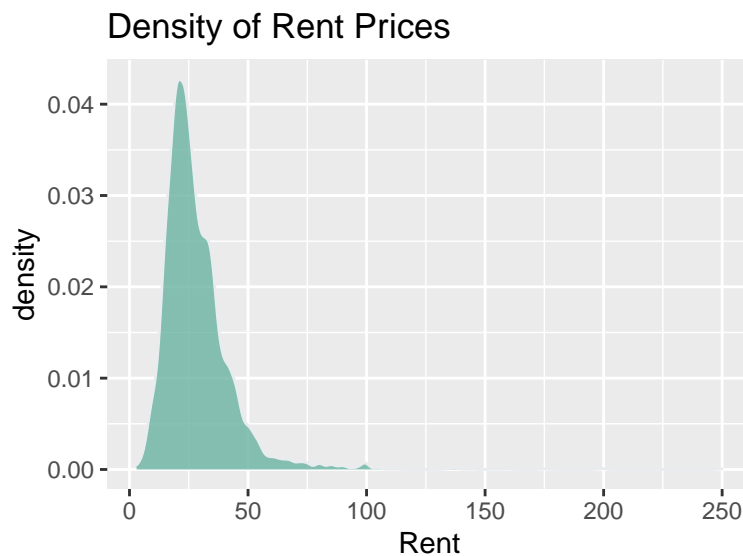
Rent density for all homes appears approxomately normal.

Square Footage Density:

Density of Square Footage

Square footage density is concentrated at the lower end. This seems obvious.

Leasing Rate Density:

Density of occupancy
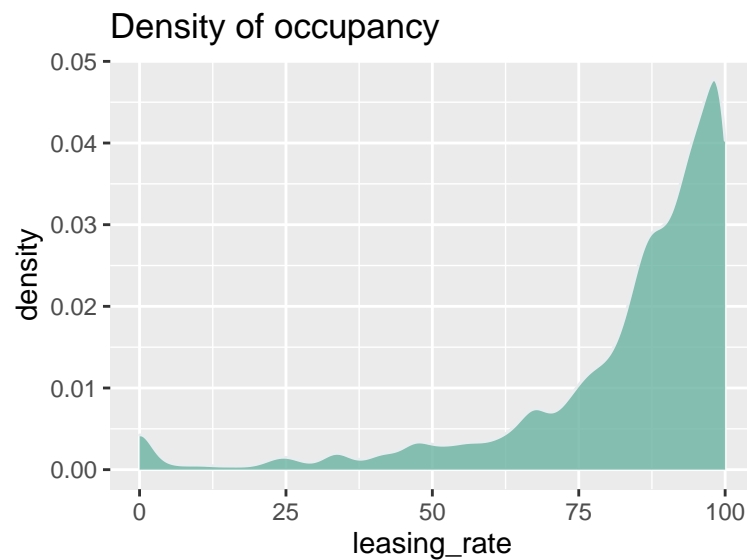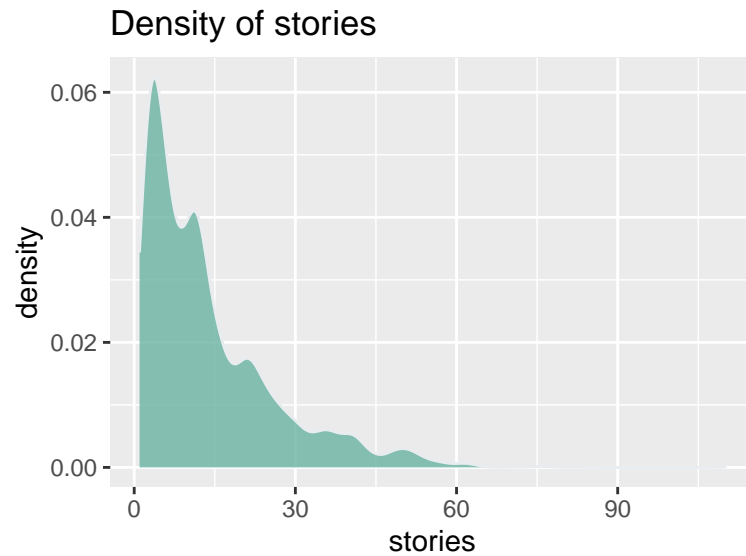

Leasing rate is, for the most part, above 75%.

However, we see what the "status guru" noted: a small but noticeable amount of occupies are below 10%. We also decide to remove these, as they may be unoccupied or typos.

Stories Density:

Density of stories

Nothing unexpected to report here.

Next, we ran a multiple linear regression predicting our Rent variable. This is simply meant to determine variable importances, and give our exploratory analysis some additional context.

Variables that were significant at all levels are:

 *Size

 *Employment Growth

 *Leasing Rate

 *Stories

 *Renovated

 *Class A1

 *Class B1

 *Net Contract Rent

 *Cooling Days

 *Heating Days

 *Precipitation

 *Gas Costs

 *Electricity Costs

Variables that were significant at the 5% level are:

 *Ameneties

 *Age

Surprisingly, LEED, Energystar, and Green Rating are all insignificant.

We assume that this insignificance is because there is multicolinearity between Green Rating and other important variables, like Leasing Rate, Age, Size, Renovated, Gas Costs and Electricity Costs.

Investigating this led us to the realization that, due to the clustered nature of the data, which is averaged by all buildings in the location, we cannot evaluate the Gas Costs, or Electricity Costs for Green versus Non-green buildings. However, Leasing Rate, Age, Size and Renovated are all not subject to clustering averages.

Next, we split the data into Green Buildings and Non-Green Buildings

Now we compare the square footage of Green and Non-Green buildings
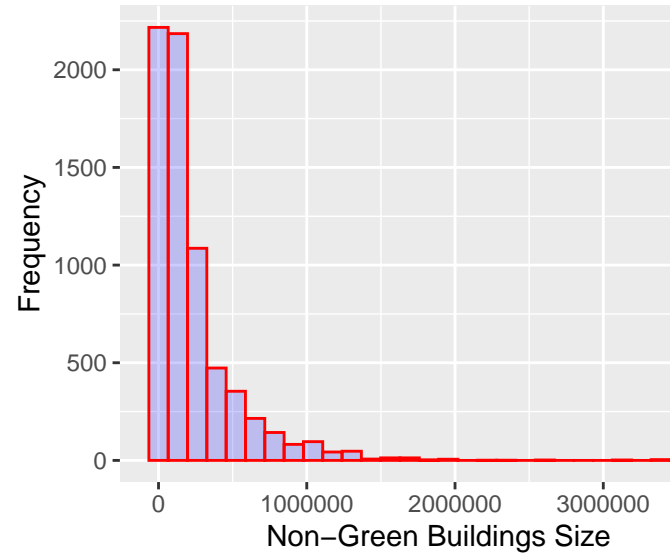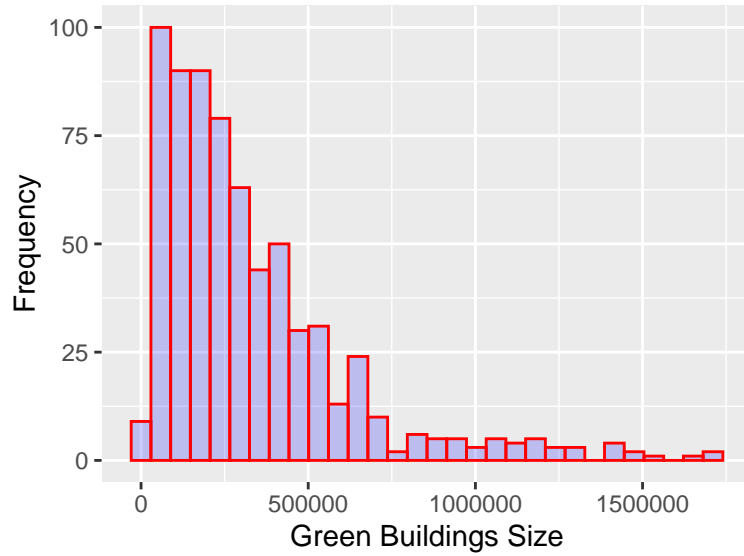
The building sizes are consistent.
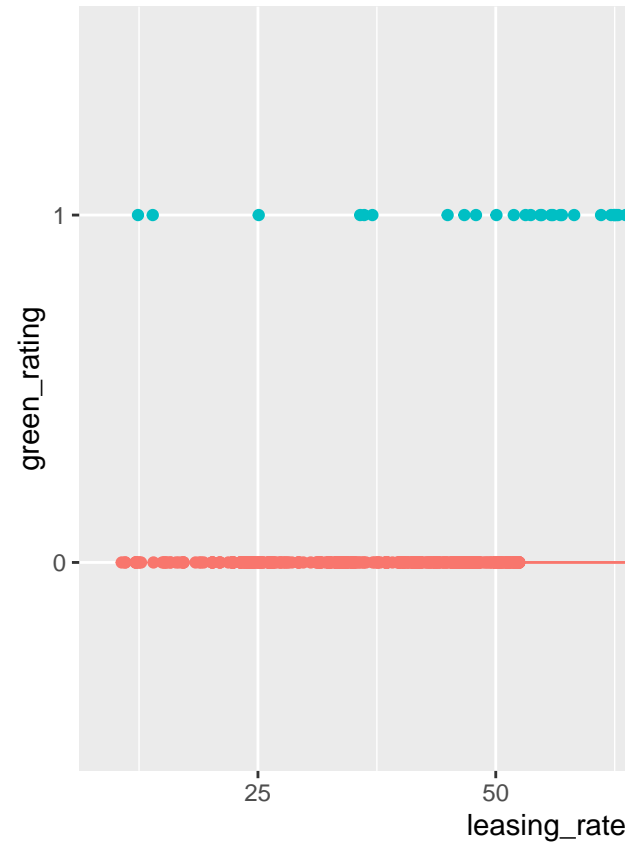
We suspect that green buildings may have a higher average leasing rate.

Leasing rates in green buildings:

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   12.39   85.45   92.92   89.41   97.70  100.00
```

Leasing rates in nongreen buildings:

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   10.68   78.89   89.65   84.44   96.50  100.00
```

Green buildings do have a higher leasing rate, by about 5%. We use the mean to evaluate this, because outliers are not a problem in evaluating leasing rate. This was overlooked by the stats guru. What an idiot.
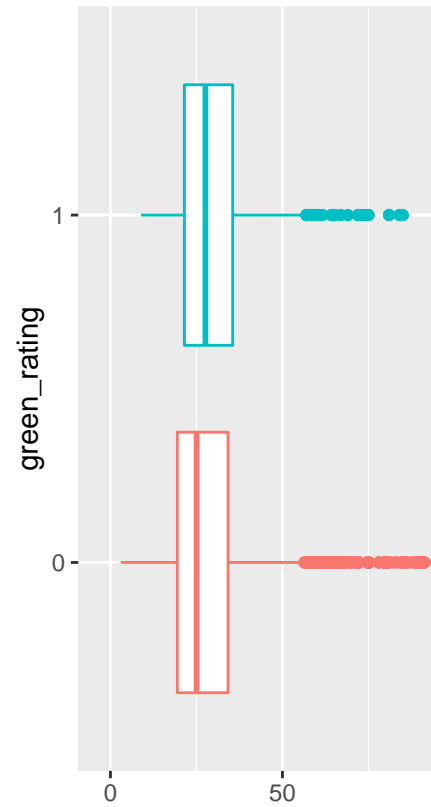
We also suspect that green buildings have higher average rents than non-green buildings.

Rent in green buildings:

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    8.87   21.50   27.60   30.03   35.54  138.07
```

Rent in nongreen buildings:

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    2.98   19.43   25.03   28.44   34.18  250.00
```

They do, by about $2.50, we use median here because rent is subject to outliers. This conclusion is similar to the stats guru.

Next we create a variable called "Expected Rent," which multiplies leasing rate by rent, and determines the expected monthly rent per room.

Visualizing expected rent for green and Non-Green buildings
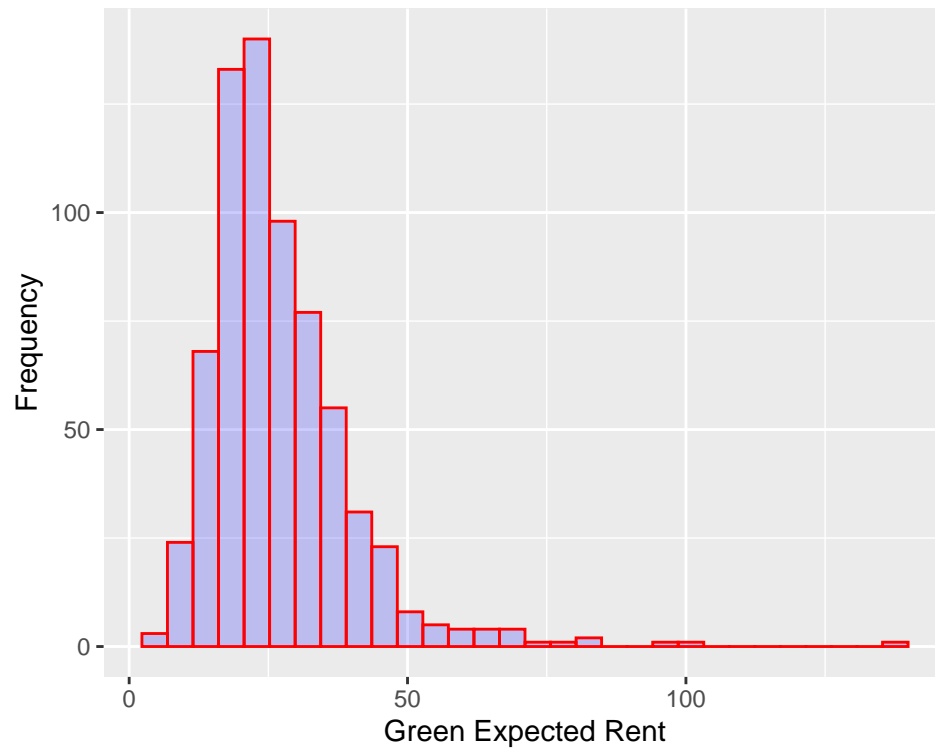
Expected rent in green buildings:

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   4.015  18.777  24.434  27.019  32.676 137.034
```
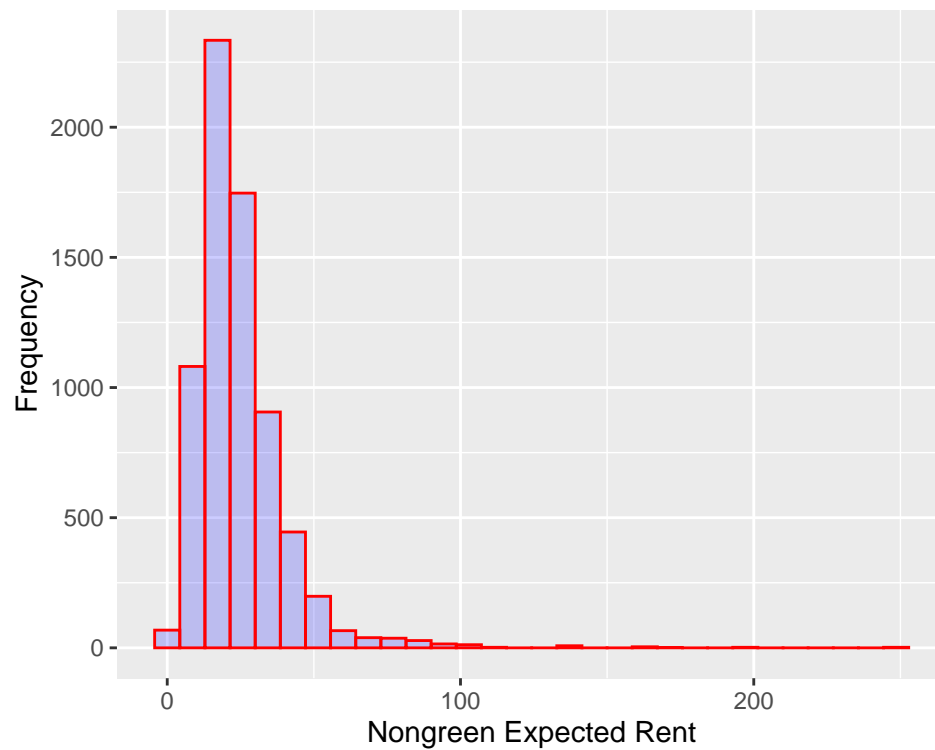
Expected rent in nongreen buildings:

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   1.068  15.306  21.454  24.493  30.015 249.600
```

When comparing expected rent per room, green buildings win by about $3.

We visualize this relationship again below with a boxplot.
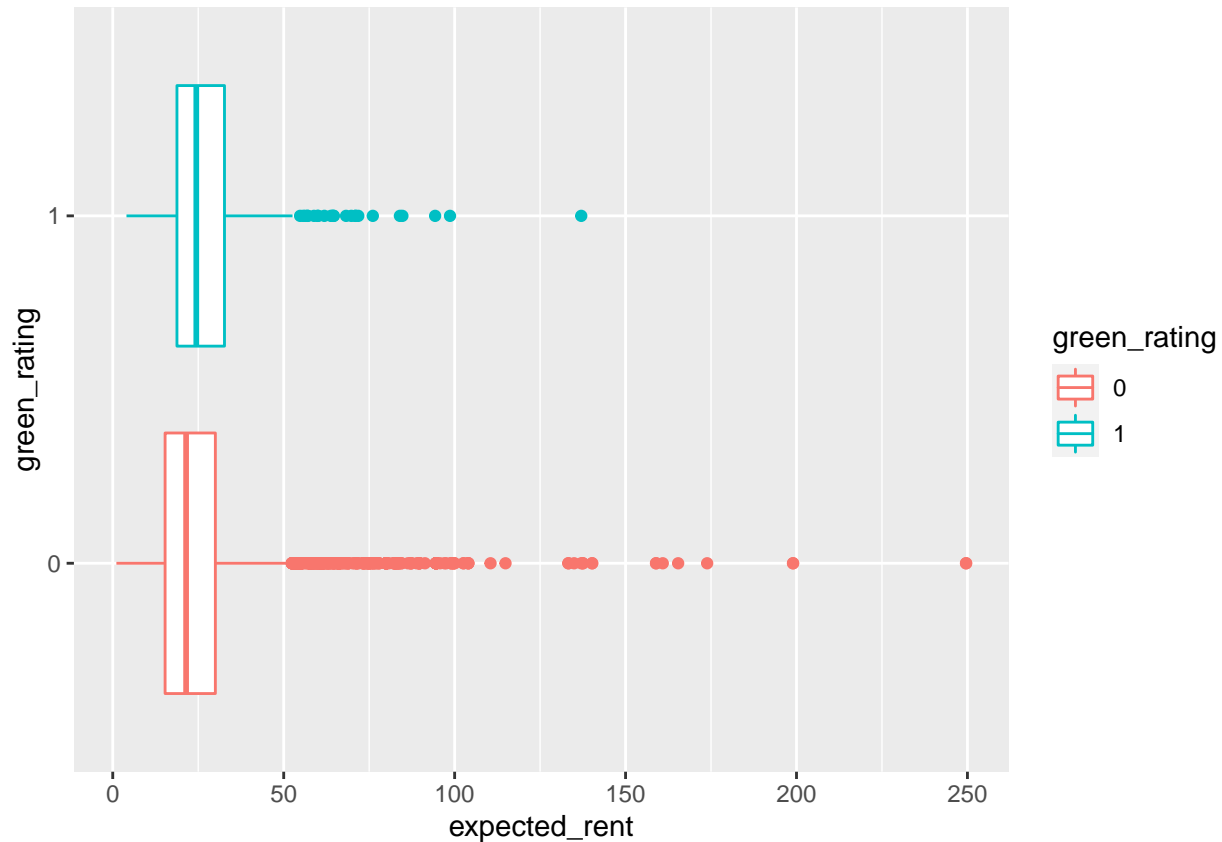
Unlike the stats guru, we are not comfortable estimating the time it would take to make the $5 million dollars back, because we do not know the room sizes, the exact location (where in Austin), the demand for green housing in Austin relative to other cities, or what the heating and cooling days may look like, among many other potential confounders. However, we can confidently say that there are higher rents **and** higher leasing rates in green buildings than in non-green buildings.

Finally, if she is going to build a green building, we want to determine wether class A or class B is more cost-efficient.

We separate our green buildings into green A and green B.

First, we look at the rent of green A versus green B buildings.
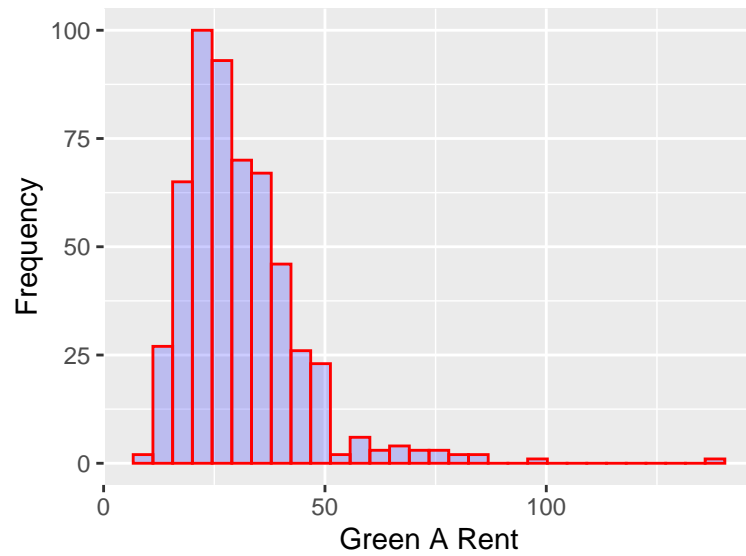
```
##     Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     8.87   22.07   28.44   30.99   36.59  138.07
```
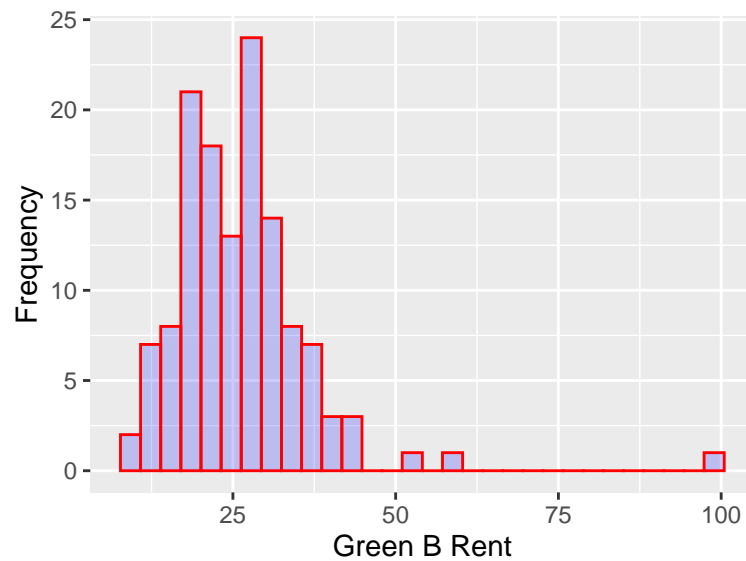


```
##     Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     9.00   19.52   25.20   26.12   30.60   98.65
```

Green A has a higher Rent by about $4. This is expected.
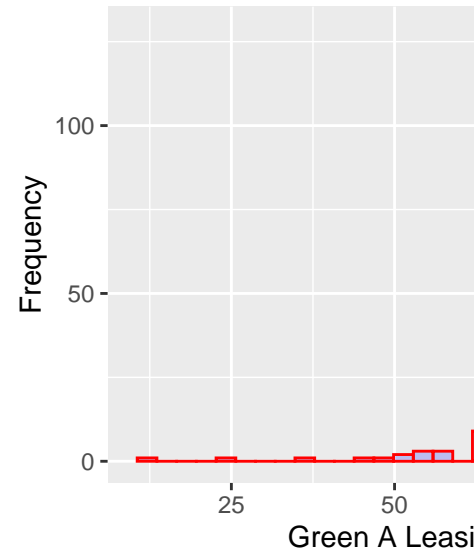
Next, we look at the difference in leasing rate between green A and green B buildings.

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   12.39   86.49   93.63   90.13   97.96  100.00
```
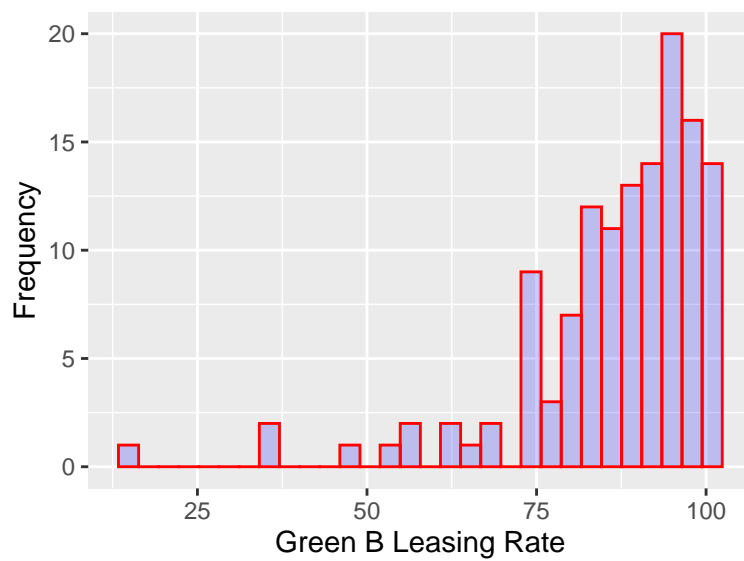


```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   13.94   82.04   89.69   86.50   95.89  100.00
```

Green A is also about 4% more occupied. This was not expected, and leads us to conclude that she should build a nicer green building (type A).

Finally, we compare the expected rent of both building types.
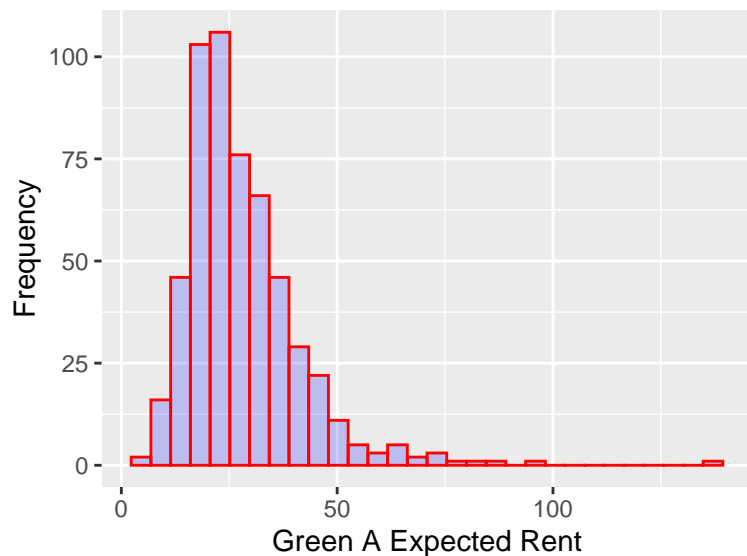
```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   4.536  19.138  25.151  28.112  33.784 137.034
```
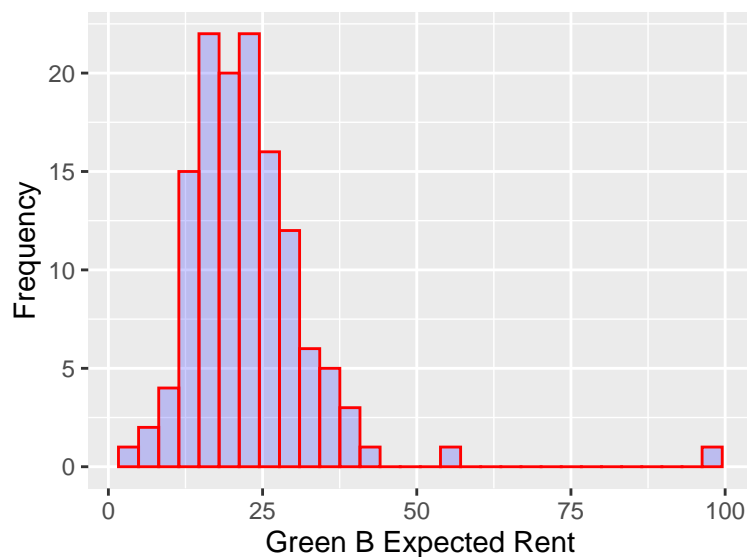


```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   4.015  16.915  21.331  22.559  26.495  98.650
```

As anticipated, the expected rent is higher for green A buildings. However, looking at the leasing_rates is more informative here.

We conclude that a green building, on average, generates more money per-room, due to a mixture of higher rents and higher leasing rates. Additionally, green A buildings are 4% more occupied than green B buildings. More research regarding external factors is necessary in deciding to proceed with the project, but if the choice to proceed is made, she should build a green type A building.

#Visual Story Telling 2: Flights at ABIA

In evaluating the flights into and out of Austin, we first looked at the delays grouped by the day of the week.
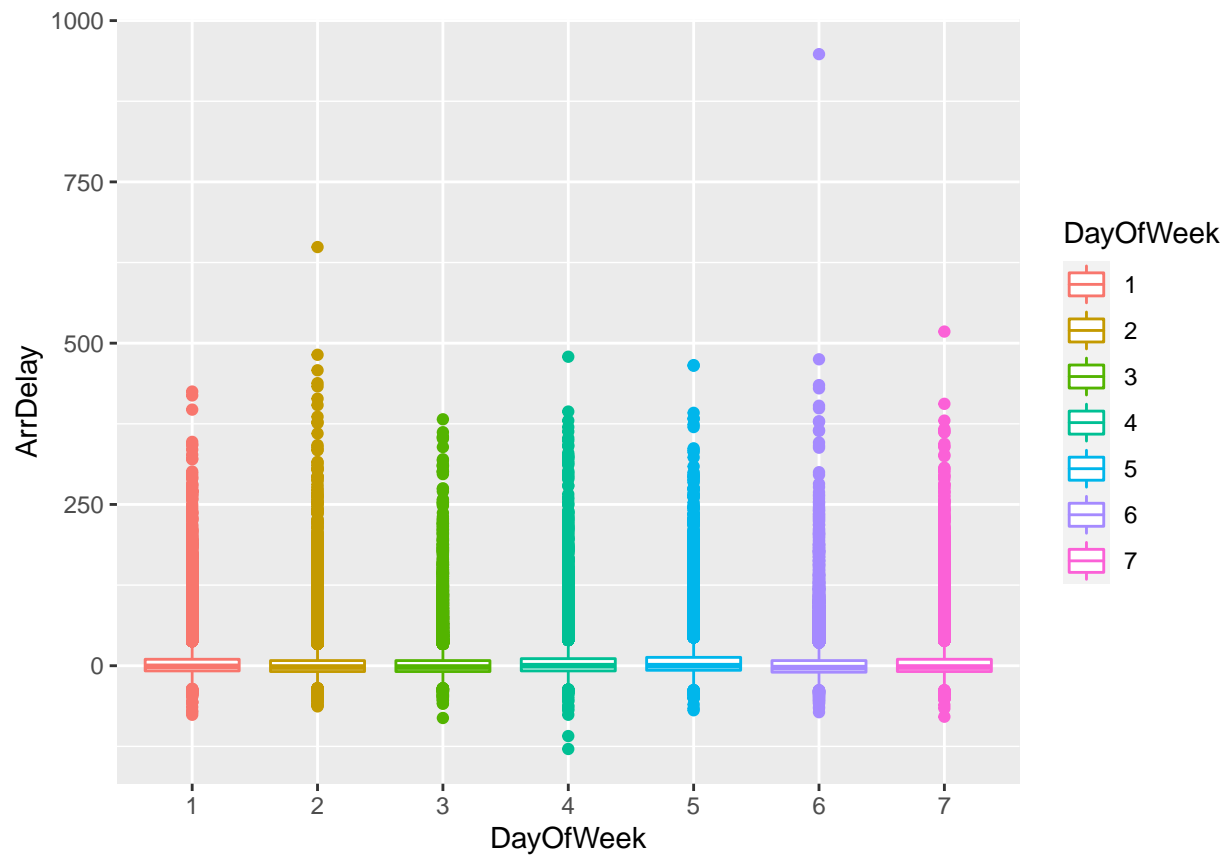
There is no obvious difference in arrival delays per day of the week.

Next, we decided to give this analysis a bit more context by evaluating the number of flights into and out of Austin by airline.
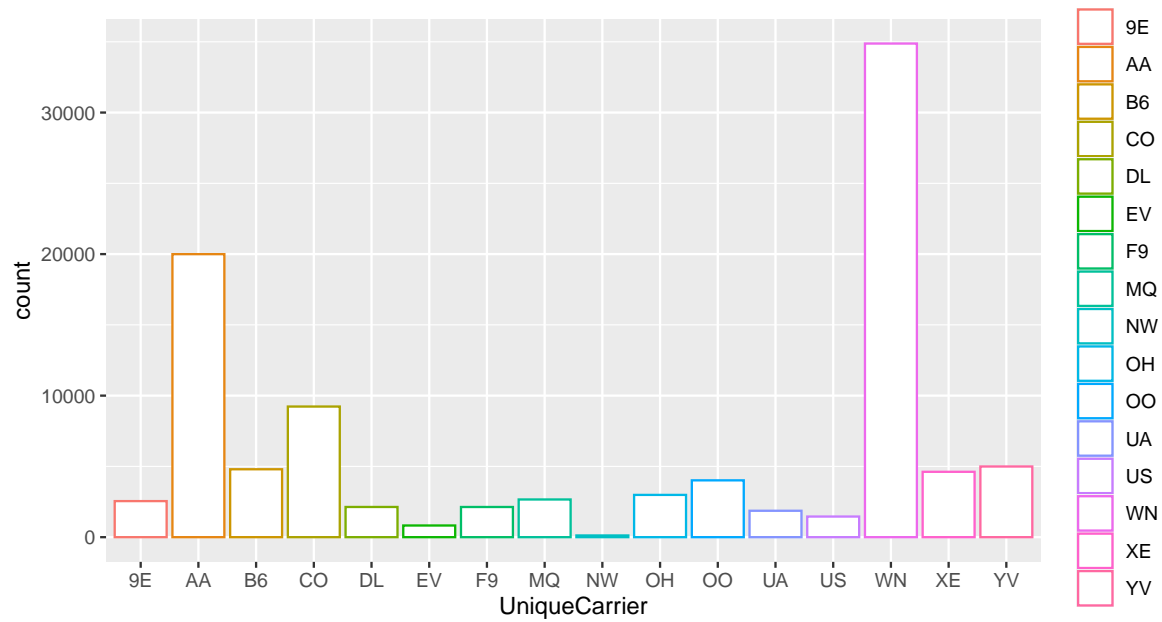
Southwest and American Airlines have the most flights in and out of Austin. More importantly, there is a good bit of variation in flight total by airline.

Next, we looked at the total delay time for each airline, shaded by the cause of the delay.
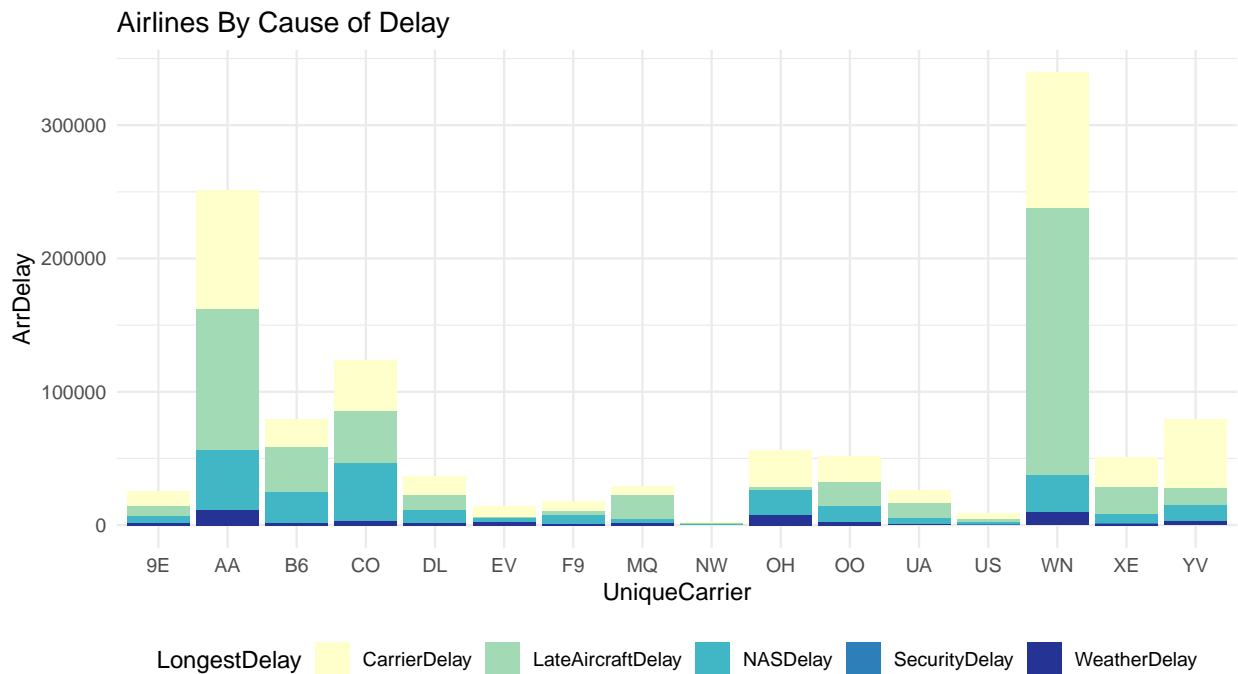
As we noted previously, Southwest and American Airlines make the most flights in and out of ABIA, and thus have the most delay. As we can see, the most frequent cause of delays is 'Late Aircraft Delay' indicating there may be some timeliness issues with the pilots and crews at ABIA.

Finally, we decide to standardize total delay time for number of flights. This allows us to visualize and evaluate airline efficiency without the confounding factor of flight count.

Airlines By Cause of Delay, Standardized for total Flights
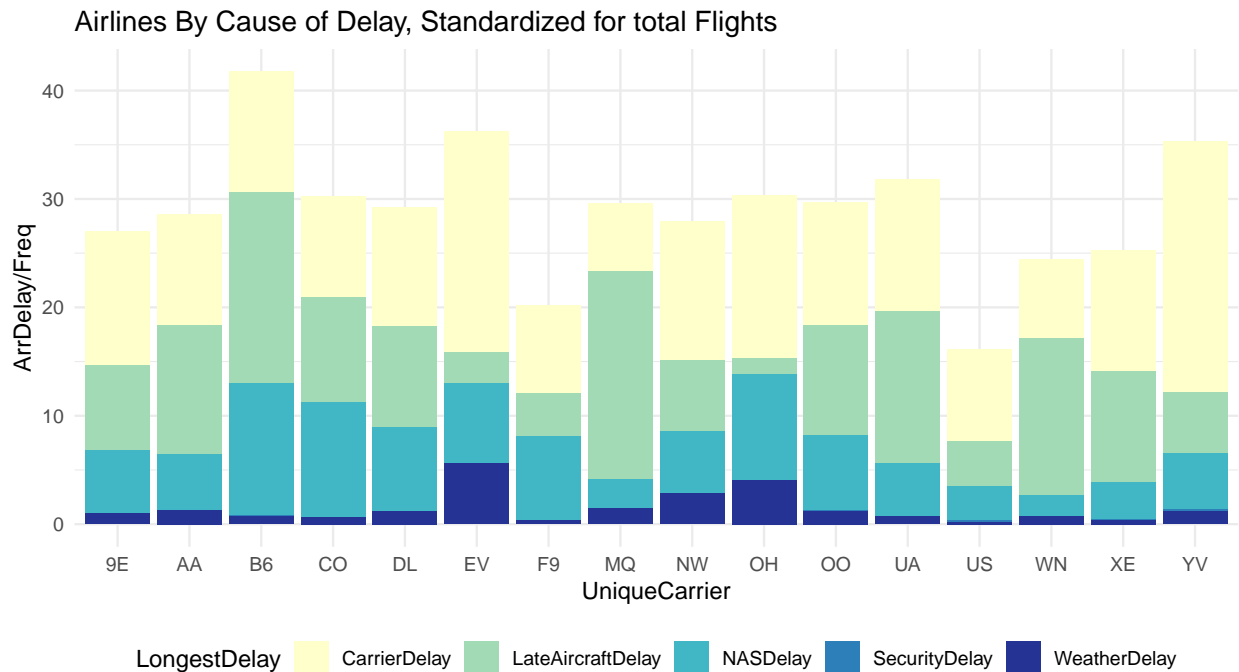
As we can see on this chart, JetBlue (IATA Code: B6) has the longest delays per flight, and Puerto Rico Airline (IATA Code: US) has the least delayed flights on average. ExpressJet (IATA Code: EV) had the most weather delays per flight of any airline followed by PSA (IATA Code: OH). To counter this, these two airlines had some of the lowest 'Late Aircraft Delay' minutes indicating that the airline is successful in employing efficient pilots and crews. Mesa Airlines (IATA Code: YV) has the longest average carrier delay indicating they may not be the best option for those on a tight schedule.

#Problem 3: Portfolio Modeling

In this Monte Carlo Simulation we were tasked with comparing 3 portfolios of ETFs and comparing their performance.

Our team selected to create **Portfolio 1** using 6 of the largest ETFs on the market, focused on Large Cap Growth Stocks. These ETFs typically hold the large tech companies like Apple, Microsoft, and Alphabet, as well as other Blue Chip firms like Berkshire Hathaway, Johnson and Johnson, and JP Morgan Chase. The often track indexes like the S&P 500 or DJI to track the market, however focus on long term growth for their holders.

Portfolio 1 = Large Cap Growth:

  SPY - S&P 500 ETF Trust

  VTI - Vanguard Total Stock Market ETF

  VOO - Vanguard S&P 500 ETF

  QQQ - Invesco QQQ Trust

  DIA - Dow Jones Indus Average ETF

  SCHX - Schwab US Large Cap ETF

Portfolio 2 is focused on Energy ETFs. These funds invest in energy companies, research groups, and commodities to achieve returns on the fluctuating energy market. The last year in particular has been incredibly volatile for energy companies, and our team figured it would be interesting to see the difference between a stable portfolio like Portfolio 1 and a volatile one like Portfolio 2.

Portfolio 2 = Energy (Oil Gas):

VDE - Vanguard Energy

XES - S&P oil and gas

PSCE - Small Cap Energy Fund

PXE - Oil and gas exploration

Portfolio 3 contains 5 Emerging Market Funds, intentionally not focused on a specific region or state. While a vast majority of the companies held in Portfolio 1 are American, our team wanted to investigate how successful nations deemed "emerging markets" have been, particularly with data that includes the Covid-19 market crashes. Some of the countries represented in this portfolio are: China, South Africa, South Korea, Russia, and India.

Portfolio 3 = Emerging Markets:

VWO - Vanguard Emerging Markets

SCHE - Schwab Emerging Markets

GEM - Goldman Sachs Emerging Markets

JEMA - JP Morgan Emerging Markets

SPEM - S&P Emerging Funds


```
## 'getSymbols' currently uses auto.assign=TRUE by default, but will
## use auto.assign=FALSE in 0.5-0. You will still be able to use
## 'loadSymbols' to automatically load data. getOption("getSymbols.env")
## and getOption("getSymbols.auto.assign") will still be checked for
## alternate defaults.
##
## This message is shown once per session and may be disabled by setting
## options("getSymbols.warning4.0"=FALSE). See ?getSymbols for details.


## pausing 1 second between requests for more than 5 symbols
## pausing 1 second between requests for more than 5 symbols
```

Portfolio 1 total expected value
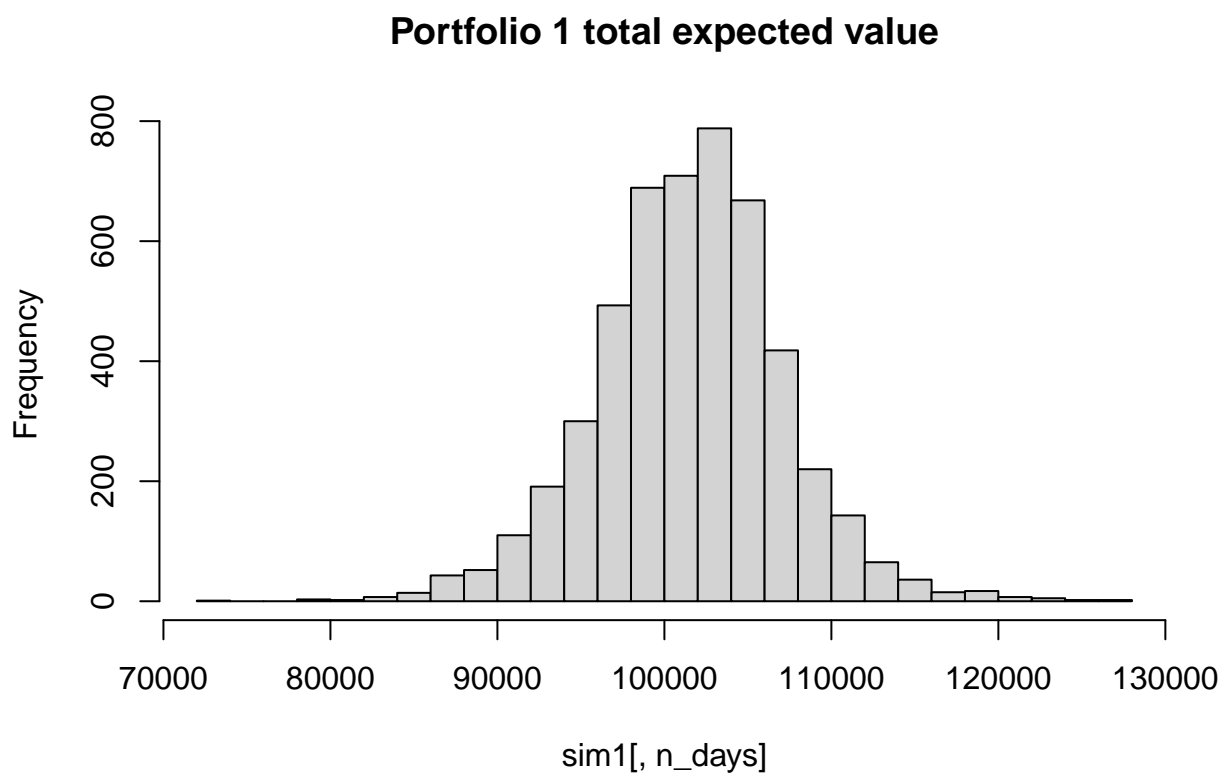
[1] "The expected value is 101537.41289267"

Portfolio 1 total expected gain

sim1[, n_days] − initial_wealth
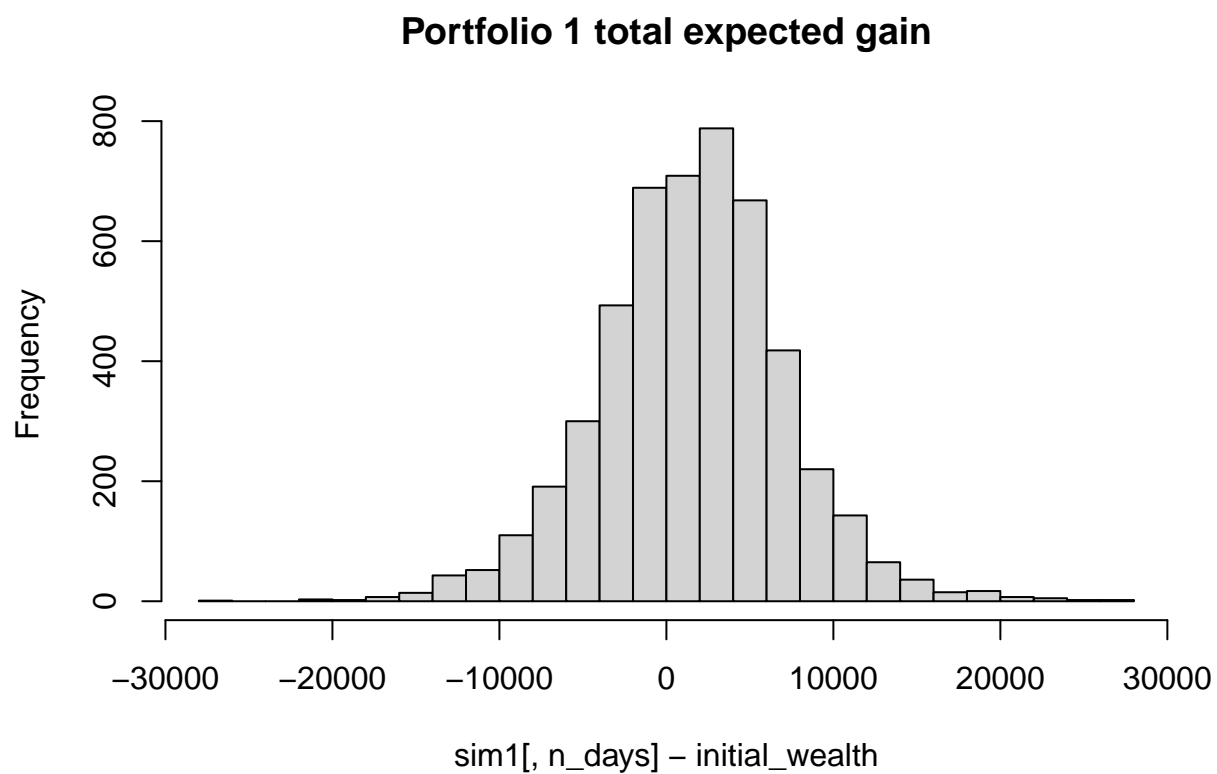
```
## [1] "The expected gain is:  1537.41289267028"
## [1] "The 5% VAR is: $7702.28683920609"
```

Portfolio 2 total expected value
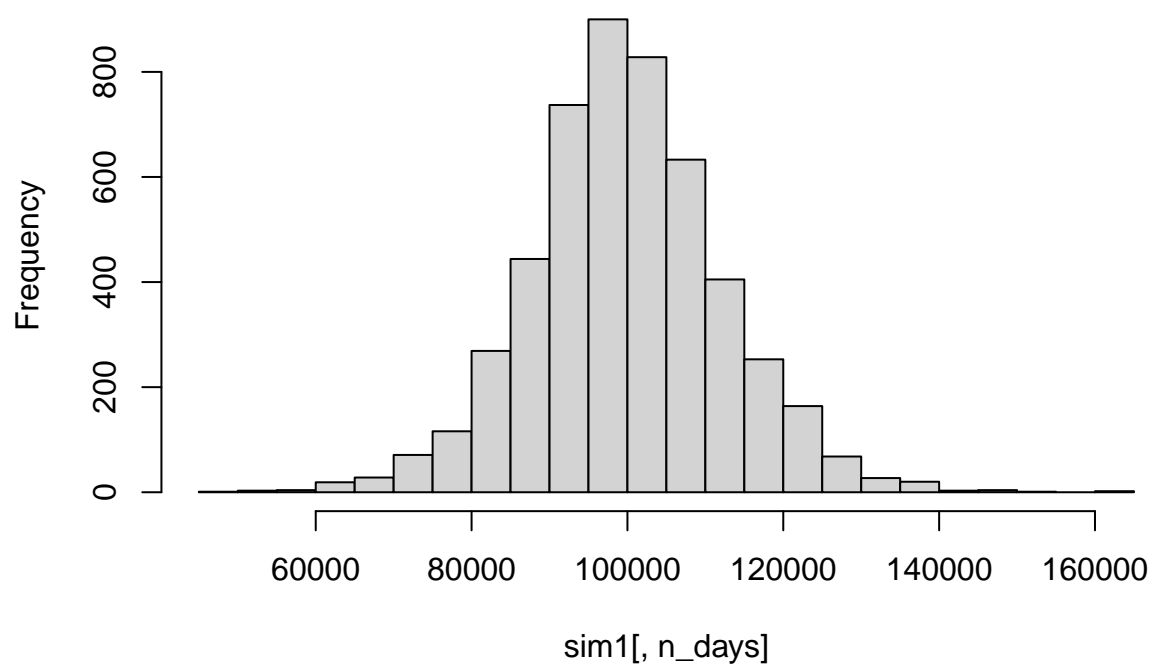

```
## [1] "The expected value is   99894.0964862989"
```

Portfolio 2 total expected gain
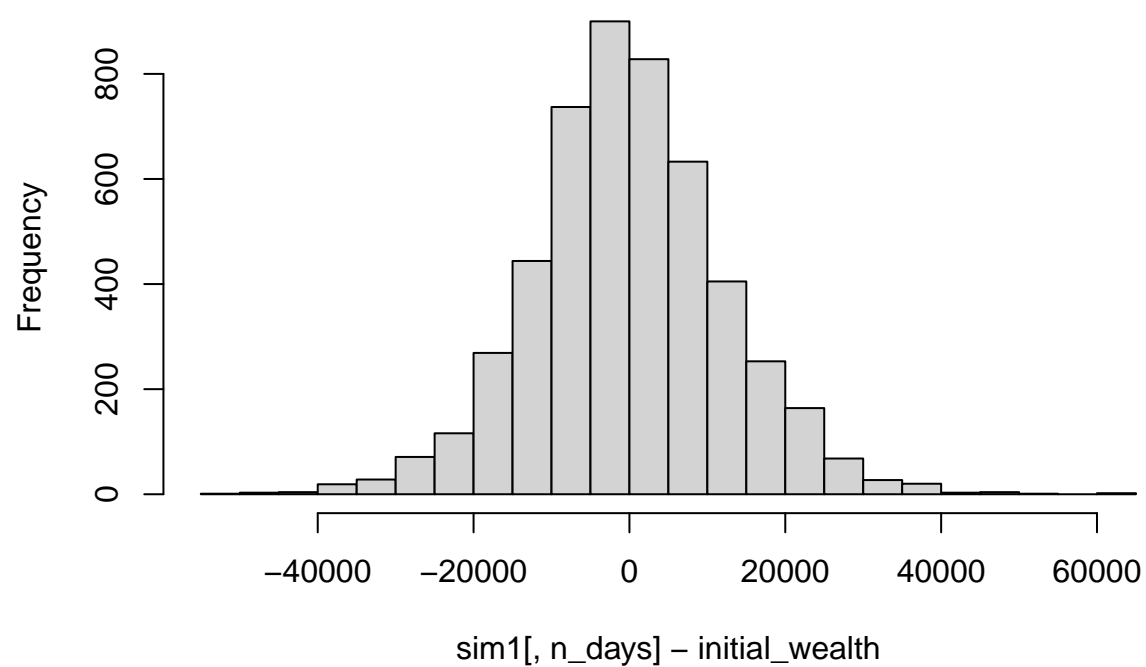
[1] "The expected gain is: -105.903513701113"
[1] "The 5% VAR is: $19890.7440969331"

Portfolio 3 total expected value
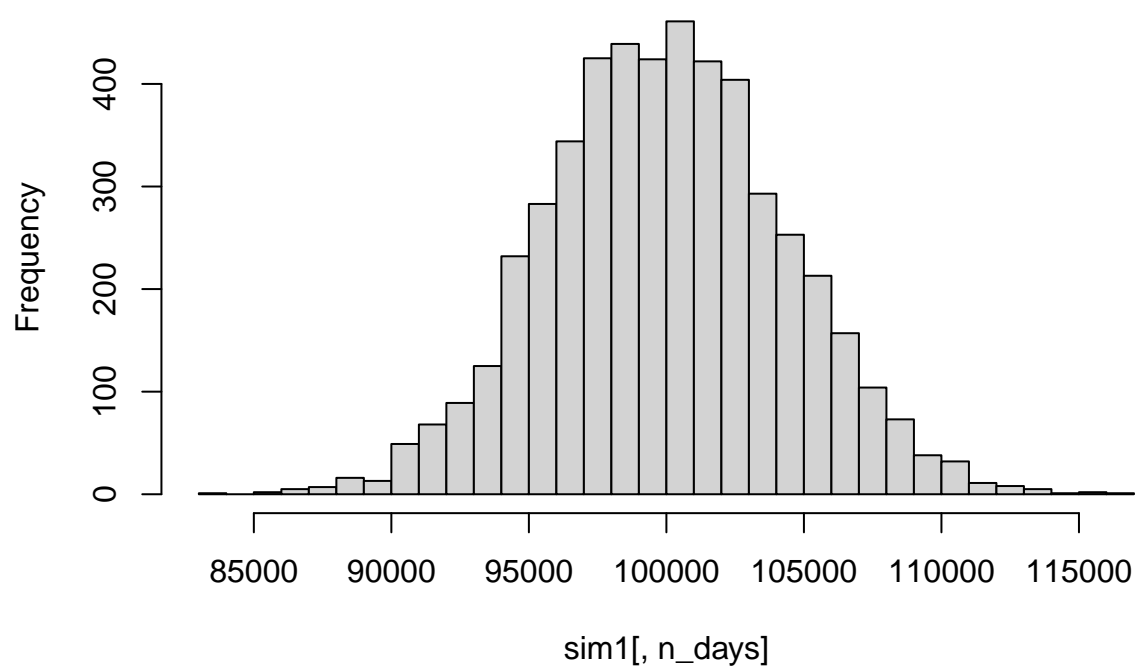
[1] "The expected value is   99989.8518804205"

Portfolio 3 total expected gain
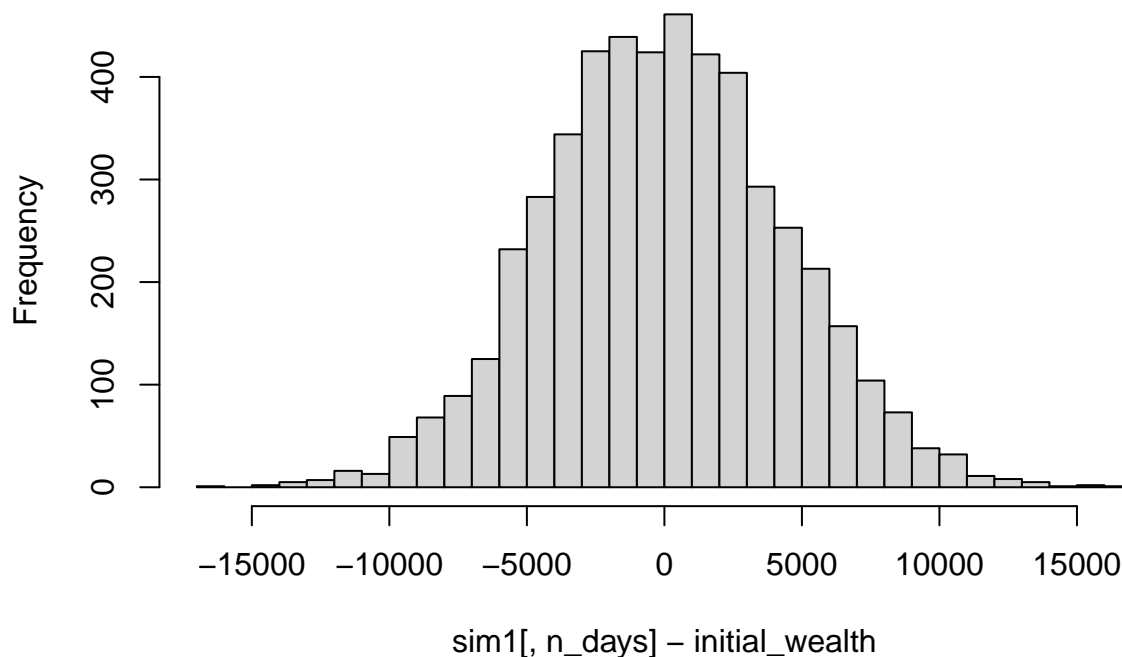

```
## [1] "The expected gain is:  -10.1481195795148"
## [1] "The 5% VAR is: $6982.26369010571"
```

Within the last 5 years, the stock market has faired relatively well. For the first 3.5 years, the market was considered one of the strongest ever and investors were astounded at their returns. Since March of 2019, the Covid-19 pandemic hampered the market for months and caused a crash. Since this period the market has recovered, however this variability in total market performance may yield interesting returns in this simulation.

For Portfolio 1 (Large Cap Growth funds), over a 5000 day simulation, we were able to earn $1577.157. This is approximately a 1.5% return which is modest given the time period. At the 5% risk level, this portfolio's VaR was $7068.17, indicating that in the worst 5% of cases, this portfolio lost around 7% of it's initial value. In the Histograms for Portfolio 1, we can see a data point that achieved over a $30,000 gain which is pretty spectacular for any ETF over 5000 simulations. Overall, Large Cap 'Growth' funds do not appear to have grown that consistently in the last 5 years.

For Portfolio 2 (Energy Based Funds), the model actually predicted a $471 loss. The range of performances by Portfolio 2 is far greater than in Portfolio 1. This is due to the energy market being more volatile and feeling the impacts of market fluctuations more than stable Large Cap Stocks. At the 5% VaR level this portfolio is expected to lose $19427 which is almost 20% of the initial starting value. Some portfolios were able to gain and lose about 60% of the initial value which is incredible.

For Portfolio 3 (Foreign Market Funds), the simulation predicted essentially breaking even ($26 loss). These funds appear to be more stable than the Energy funds as the VaR is only $6900 and no porfolio made or lost more than $15000.

#Problem 4: Market Segmentation

In evaluating market segmentation for NutrientH20 through the tweets in our dataset, we first centered and scaled the data.

Next, we ran a correlation matrix on the dataset to detect patterns, both predicted and unpredicted, among the included variables.
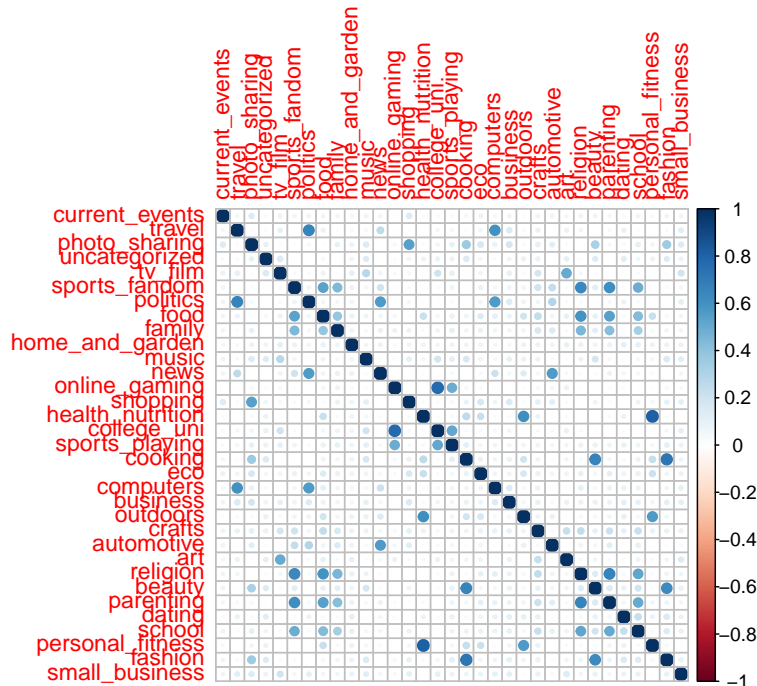
Below are the Top-3 Highest correlated variables:

1.) It looks like **"personal_fitness" and "health_nutrition"** are very highly correlated

2.) It looks like **"college_univ" and "online_gaming"** are very highly correlated

3.) It looks like **"fashion" and "cooking"** are very highly correlated

Some other highly correlated variables include:

('religion' and 'sports_fandom'), ('politics' and 'travel'), and ('cooking' and 'beauty') among others

Next, we ran an elbow plot to determine the most efficient cluster value of K.

```
## Warning: did not converge in 15 iterations
```

```
## Warning: Quick-TRANSfer stage steps exceeded maximum (= 394100)
```

```
##  [1]  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
```

```
## [1] 237851.8 223400.8 211773.3 200976.6 190863.0 183549.6 176821.1 171437.9
## [9] 166694.9 163259.0 160035.4 157771.2 155671.4 154043.7 152368.0 150902.9
## [17] 149653.5 148308.4 147308.7
```
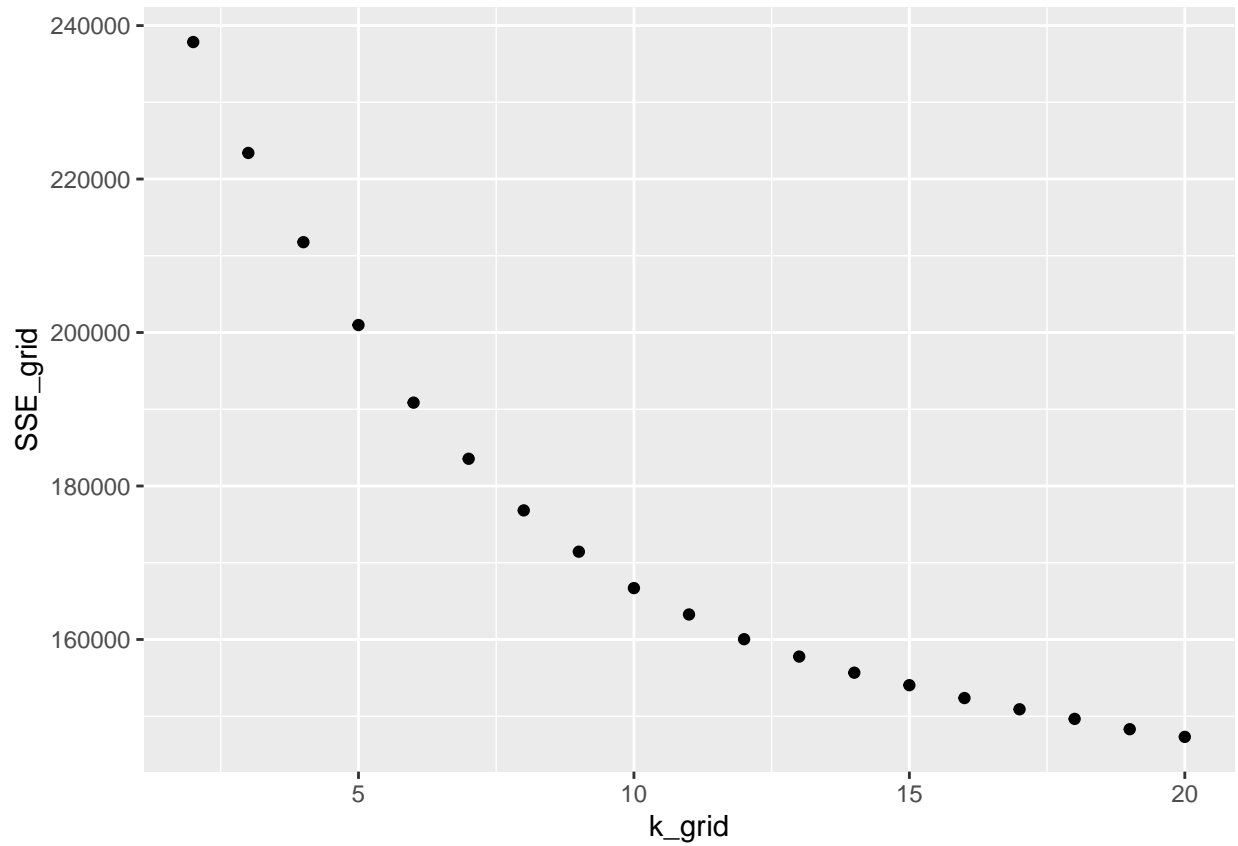

The elbow plot appears to suggest 7 to 9 clusters.

After the elbow plot, we ran a CH index, which has the same purpose as the elbow plot, but provides more context reagrding optimal K.

CH_grid

k_grid
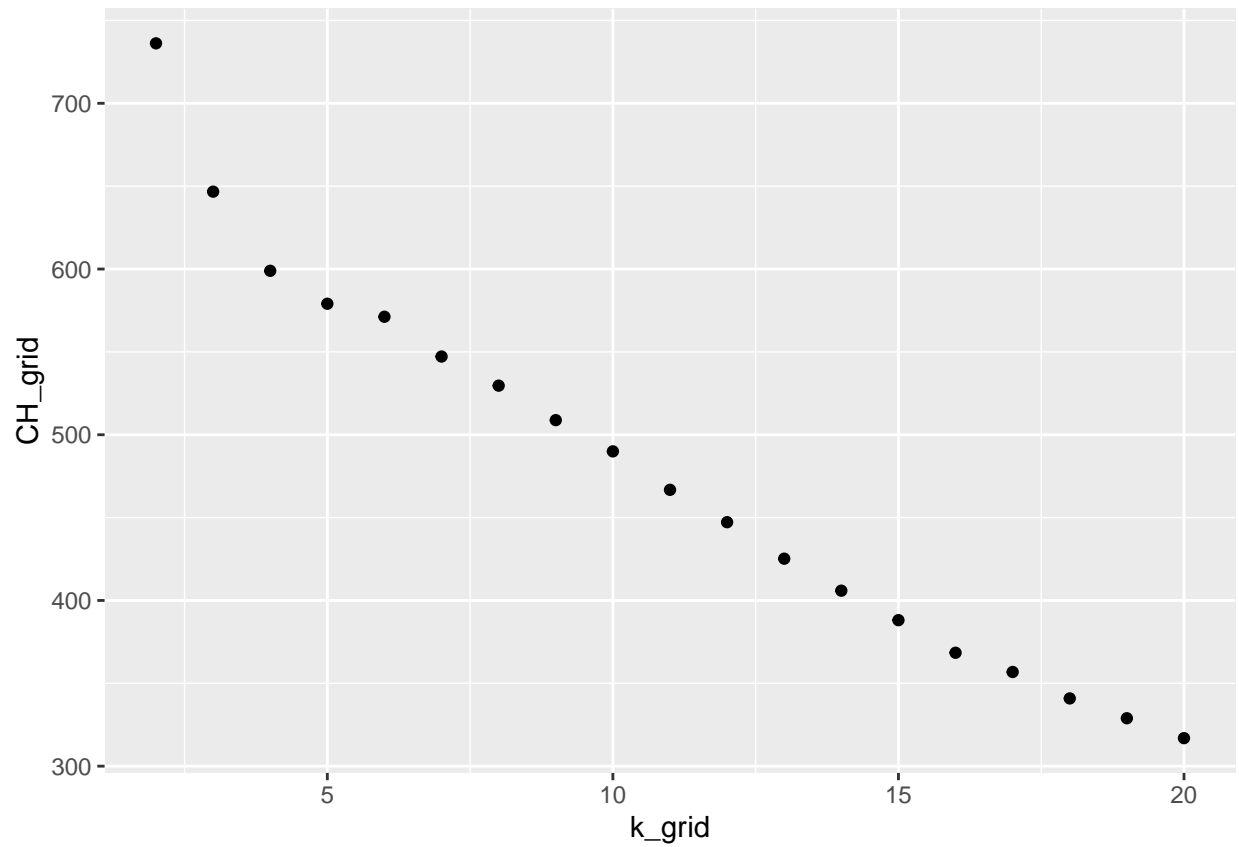
The CH index suggests 5 clusters.

With our elbow plot and CH suggestions in mind, we ran a K-means++ with 5 clusters.

Clusters on raw Data
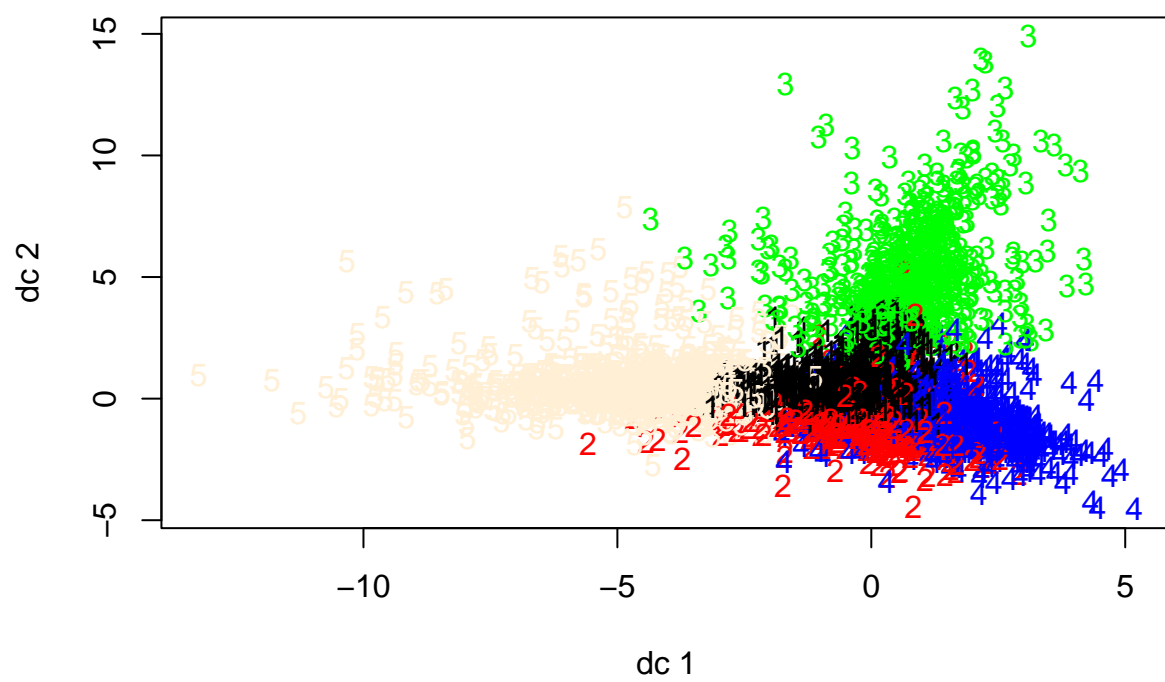
Clusters on Scaled Data
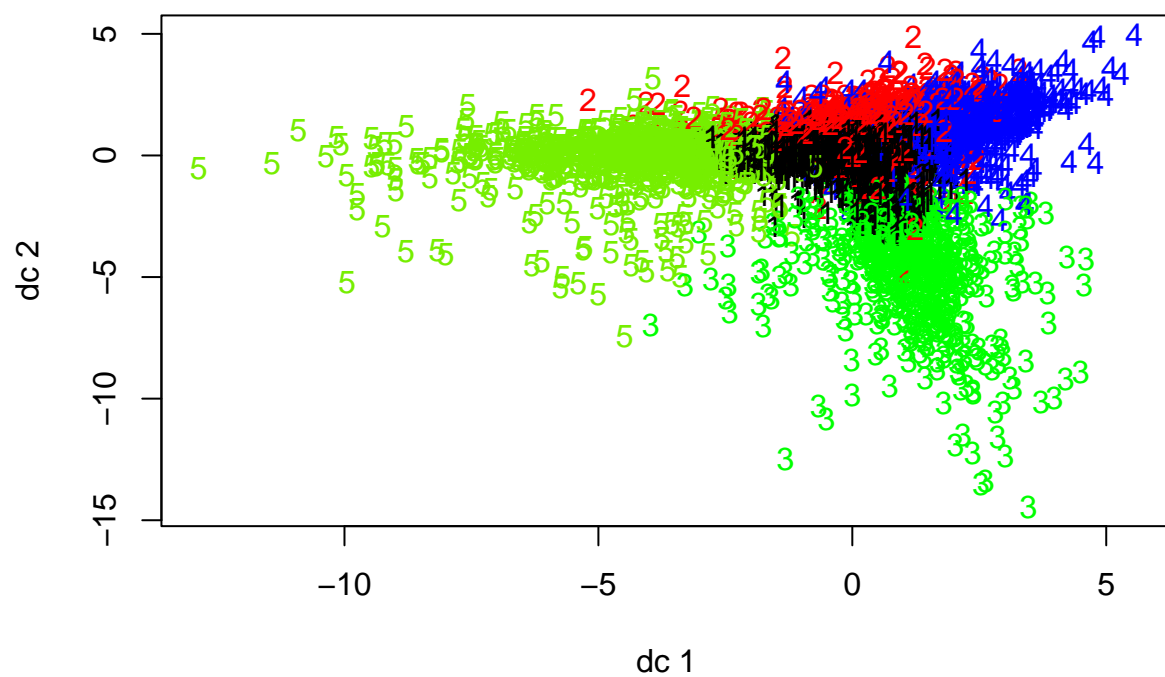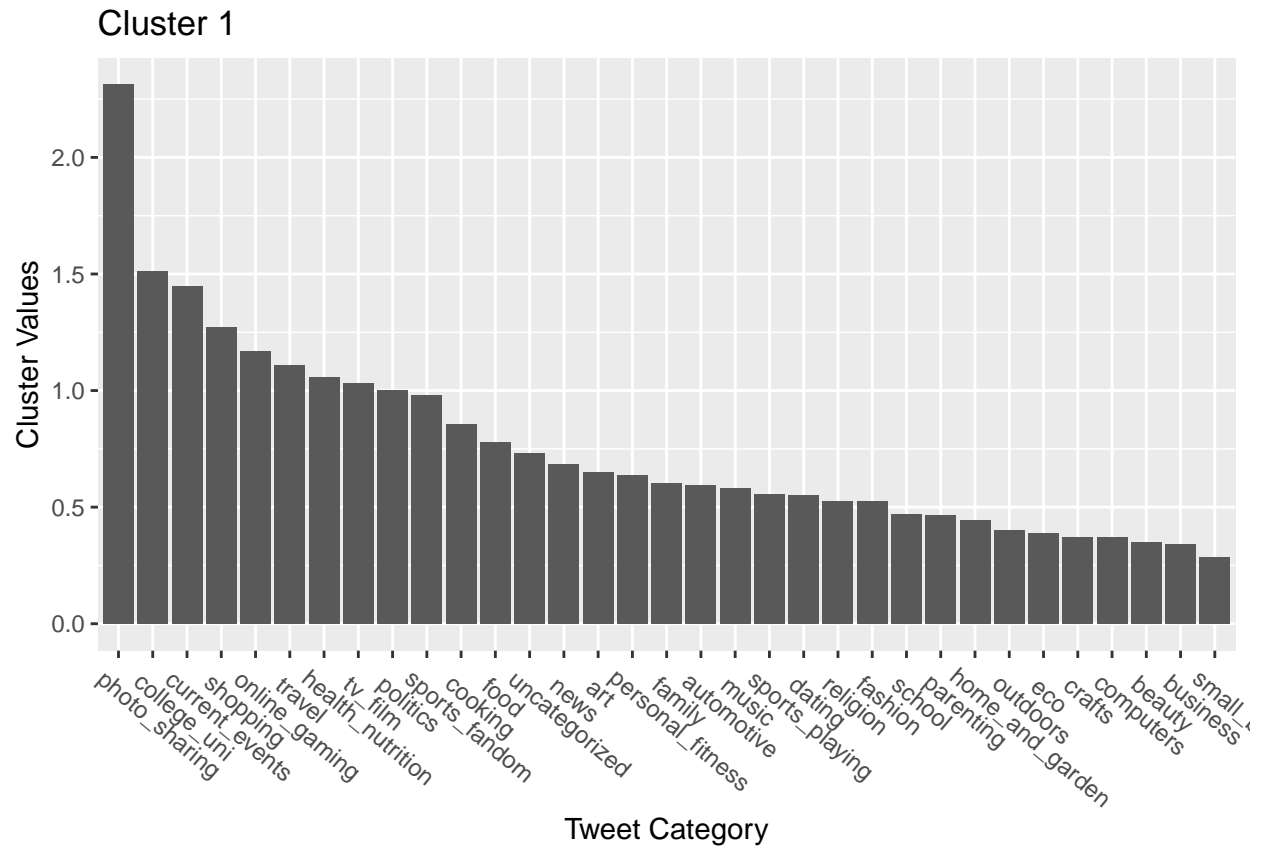
Cluster 1

Cluster 1 —> Top 3 Categories are "photo_sharing", "college_uni", and "current_events"
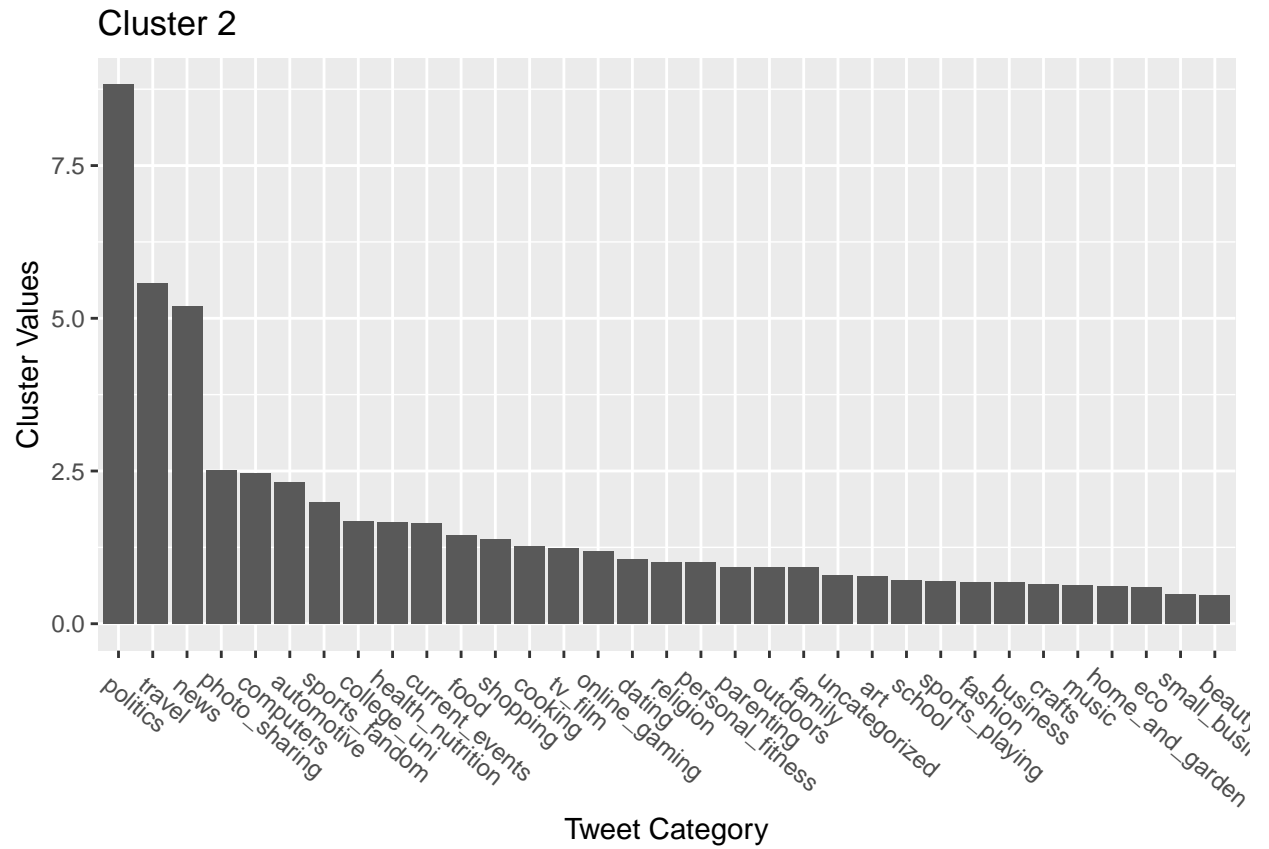
Cluster 2

Cluster 2 —> Top 3 Categories are "politics", "travel", and "news"
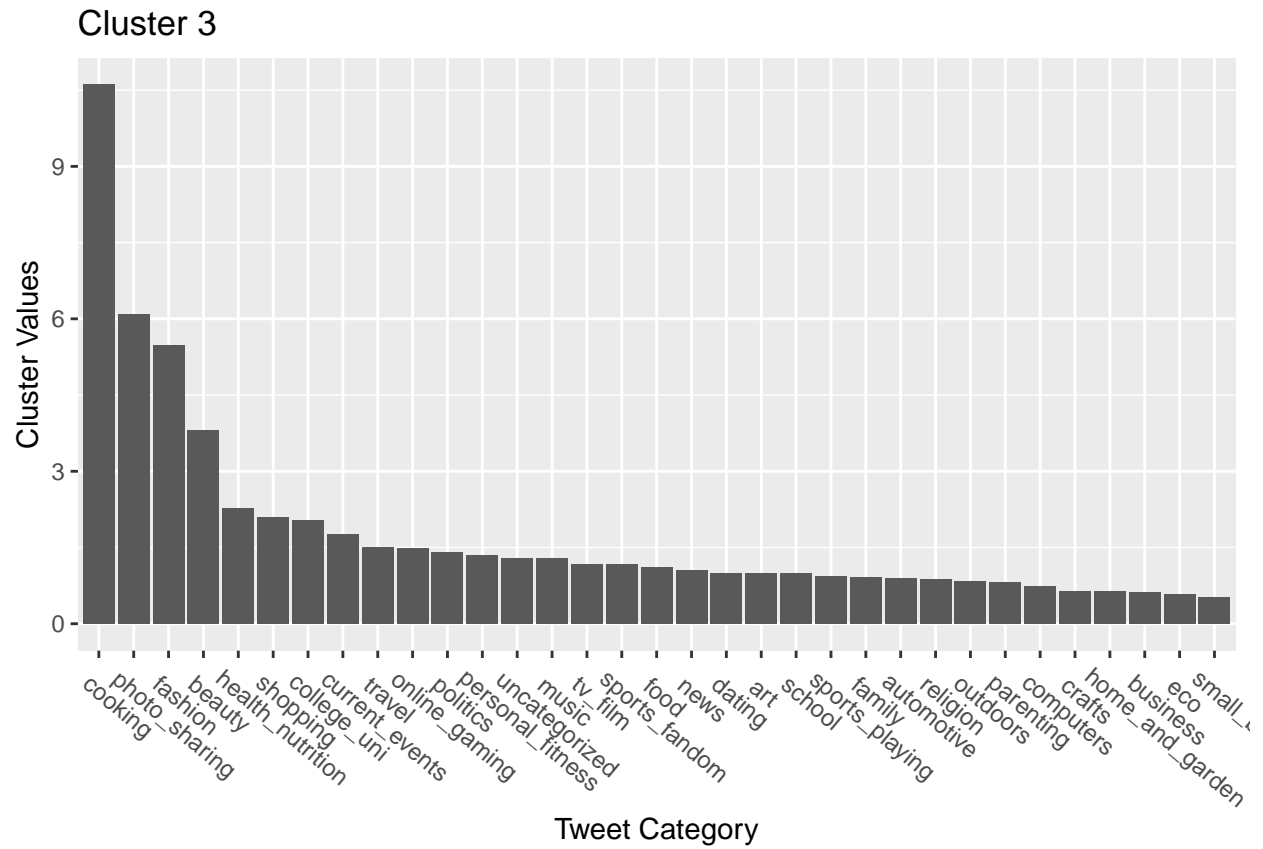
Cluster 3

Cluster 3 —> Top 3 Categories are "cooking", "photo_sharing", "fashion"
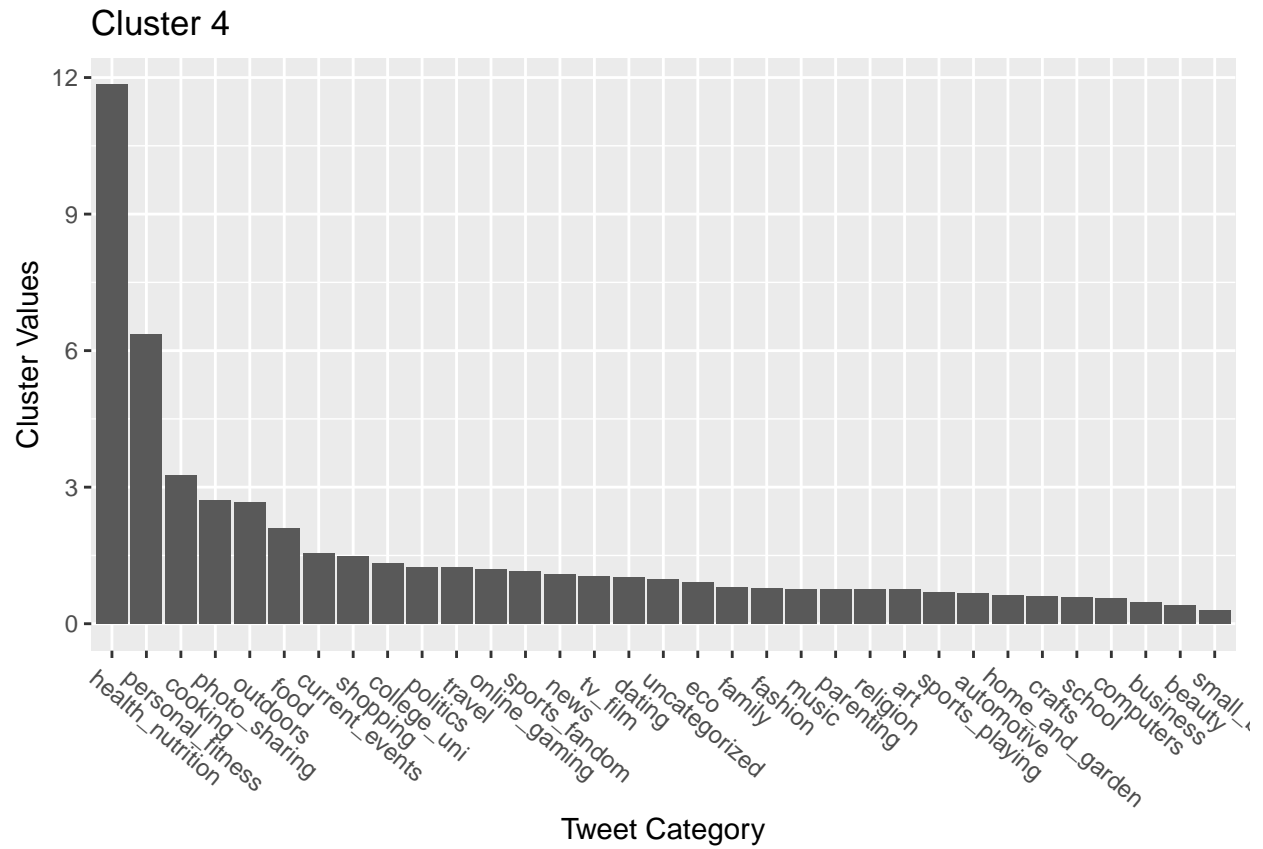
Cluster 4

Cluster 4 —> Top 3 Categories are "health_nutrition", "personal_fitness", "cooking"
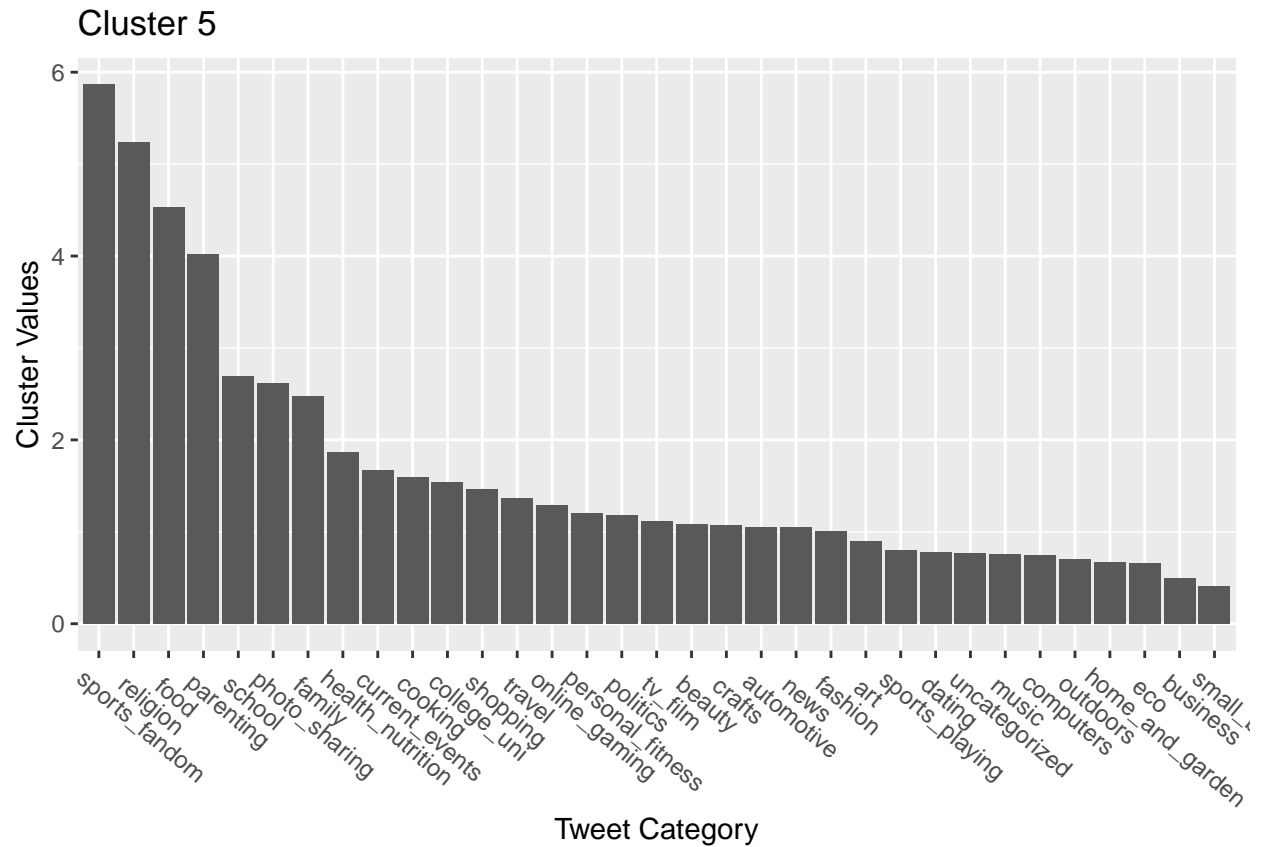
Cluster 5 —> Top 3 Categories are "sports_fandom", "religion", "food"

Just for illustrative purposes, we show a few plots that visualize cluster membership below.
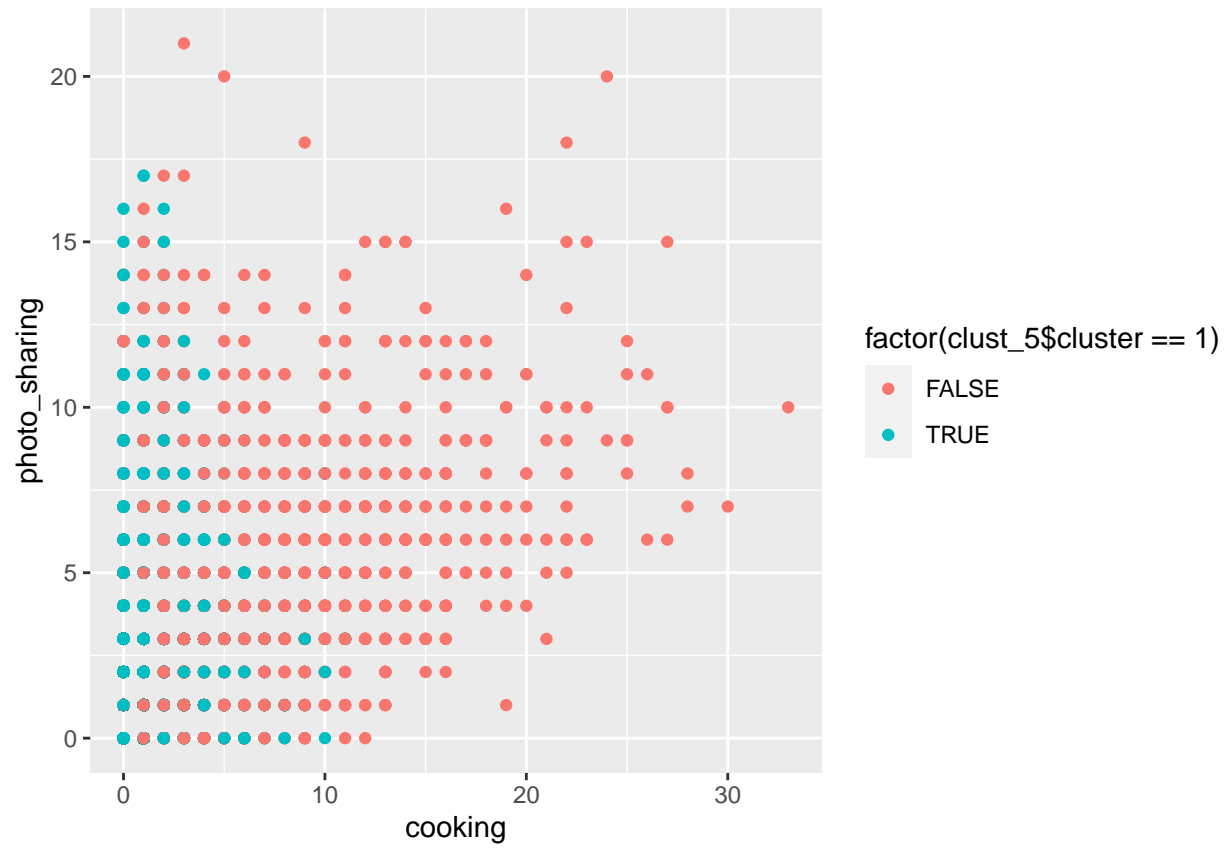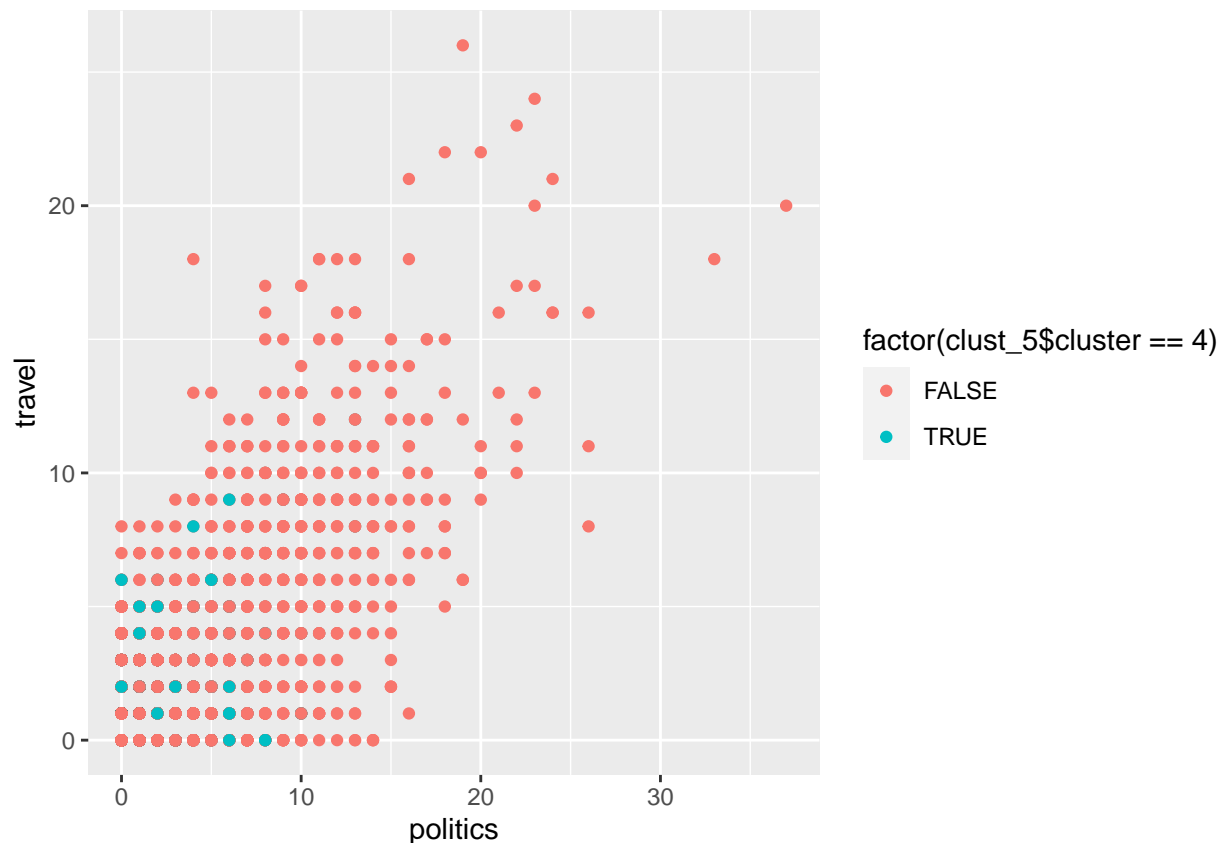
Final Results Based on the results of the K-Means with 5 clusters, we can identify some interesting market segments that appear to stand out in their social media audience. The large consumer brand "NutrientH20" can focus their marketing and advertising on specific cluster groups in order to maximize their outreach. For example, with one of the Clusters, they can target consumers that are interested in "health_nutrition", "personal_fitness" and "cooking" all at the same time. On the other hand, using the results from another Cluster, they can target consumers that are interested in "politics", "travel" and "news" all at the same time.

#Problem 5 Author Attribution

```
## Loading required package: NLP
```

```
##
## Attaching package: 'NLP'
```

```
## The following object is masked from 'package:ggplot2':
##
##     annotate
```

```
##
## Attaching package: 'tm'
```

```
## The following object is masked from 'package:mosaic':
##
##     inspect
```

```
## Warning in tm_map.SimpleCorpus(my_corpus, content_transformer(tolower)):
## transformation drops documents


## Warning in tm_map.SimpleCorpus(my_corpus, removeNumbers): transformation drops
## documents


## Warning in tm_map.SimpleCorpus(my_corpus,
## content_transformer(removePunctuation)): transformation drops documents


## Warning in tm_map.SimpleCorpus(my_corpus, content_transformer(stripWhitespace)):
## transformation drops documents


## Warning in tm_map.SimpleCorpus(my_corpus, content_transformer(removeWords), :
## transformation drops documents


## [1] "DocumentTermMatrix"    "simple_triplet_matrix"


## Warning in tm_map.SimpleCorpus(test_corpus, content_transformer(tolower)):
## transformation drops documents


## Warning in tm_map.SimpleCorpus(test_corpus, content_transformer(removeNumbers)):
## transformation drops documents


## Warning in tm_map.SimpleCorpus(test_corpus,
## content_transformer(removePunctuation)): transformation drops documents


## Warning in tm_map.SimpleCorpus(test_corpus,
## content_transformer(stripWhitespace)): transformation drops documents


## Warning in tm_map.SimpleCorpus(test_corpus, content_transformer(removeWords), :
## transformation drops documents


## [1] "DocumentTermMatrix"    "simple_triplet_matrix"


##
## ### stylo version: 0.7.4 ###
##
## If you plan to cite this software (please do!), use the following reference:
##      Eder, M., Rybicki, J. and Kestemont, M. (2016). Stylometry with R:
##      a package for computational text analysis. R Journal 8(1): 107-121.
##      <https://journal.r-project.org/archive/2016/RJ-2016-007/index.html>
##
## To get full BibTeX entry, type: citation("stylo")
```

For Author Attributions, the modeling package Stylo was used. The task was to predict which author from a set of 50 authors wrote a Reuters article from a set of 2500 articles.

1) The training set was read into a vector with each row being one Article and the value being the text.
2) This vector was then converted to a 'Corpus' Object in R.
3) Tokenization was performed on the Corpus by:

- Converting all characters to lower case
- Removing numbers
- Removing punctuation
- Stripping the white space
- Removing the 'SMART' set of stop words.

4) The tokenized corpus was converted to a Document Term Matrix, with common tokens as columns and each article as a row.
5) Steps 1-4 are repeated for the test set
6) The training and test matrices are the given the original authors as row names (As required by Stylo)
7) Initially, we ran a K-Nearest Neighbor with K = 10. Followed by K = 1 and a Naive Bayes Model.

```
## [1] "K Nearest Neighbors (K=10) Accuracy:"
```

```
## [1] 0.3156
```

```
## [1] "K Nearest Neighbors (K=1) Accuracy:"
```

```
## [1] 0.37
```

```
## [1] "Naive Bayes Accuracy:"
```

```
## [1] 0.0988
```

Out of these three classification models, K-Nearest neighbors with K = 1had the highest accuracy at 36.96%. - Accuracy for K = 10: 32.28% - Accuracy for Naive Bayes: 9.88%

This performance of the K=1 model is likely due to authors maintaining a consistent writing style so the Nearest Neighbor to each test document is an article by the same author.

Problem 6 Association Rule Mining

We set our max length for the left hand side to three because there are only 126 unique items in our data set and we did not want to pick up much noise.

In performing our inspection of association rules, we first looked at support values.

```
##       lhs                      rhs                   support    confidence
## [1]  {}                     => {canned beer}         0.07768175 0.07768175
## [2]  {}                     => {coffee}              0.05805796 0.05805796
## [3]  {}                     => {beef}                0.05246568 0.05246568
## [4]  {}                     => {curd}                0.05327911 0.05327911
## [5]  {}                     => {napkins}             0.05236401 0.05236401
## [6]  {}                     => {pork}                0.05765125 0.05765125
## [7]  {}                     => {frankfurter}         0.05897306 0.05897306
## [8]  {}                     => {bottled beer}        0.08052872 0.08052872
## [9]  {}                     => {brown bread}         0.06487036 0.06487036
## [10] {}                     => {margarine}           0.05856634 0.05856634
## [11] {}                     => {butter}              0.05541434 0.05541434
## [12] {}                     => {newspapers}          0.07981698 0.07981698
## [13] {}                     => {domestic eggs}       0.06344687 0.06344687
## [14] {}                     => {fruit/vegetable juice} 0.07229283 0.07229283
## [15] {}                     => {whipped/sour cream}  0.07168277 0.07168277
## [16] {}                     => {pip fruit}           0.07564820 0.07564820
```

```
## [17] {}                      => {pastry}             0.08896797 0.08896797
## [18] {}                      => {citrus fruit}        0.08276563 0.08276563
## [19] {}                      => {shopping bags}       0.09852567 0.09852567
## [20] {}                      => {sausage}             0.09395018 0.09395018
## [21] {}                      => {bottled water}       0.11052364 0.11052364
## [22] {}                      => {tropical fruit}      0.10493137 0.10493137
## [23] {}                      => {root vegetables}     0.10899847 0.10899847
## [24] {}                      => {soda}                0.17437722 0.17437722
## [25] {}                      => {yogurt}              0.13950178 0.13950178
## [26] {}                      => {rolls/buns}          0.18393493 0.18393493
## [27] {}                      => {other vegetables}    0.19349263 0.19349263
## [28] {}                      => {whole milk}          0.25551601 0.25551601
## [29] {yogurt}                => {whole milk}          0.05602440 0.40160350
## [30] {whole milk}            => {yogurt}              0.05602440 0.21925985
## [31] {rolls/buns}            => {whole milk}          0.05663447 0.30790492
## [32] {whole milk}            => {rolls/buns}          0.05663447 0.22164743
## [33] {other vegetables} => {whole milk}              0.07483477 0.38675775
## [34] {whole milk}            => {other vegetables}    0.07483477 0.29287704
##       coverage  lift      count
## [1]   1.0000000 1.000000   764
## [2]   1.0000000 1.000000   571
## [3]   1.0000000 1.000000   516
## [4]   1.0000000 1.000000   524
## [5]   1.0000000 1.000000   515
## [6]   1.0000000 1.000000   567
## [7]   1.0000000 1.000000   580
## [8]   1.0000000 1.000000   792
## [9]   1.0000000 1.000000   638
## [10]  1.0000000 1.000000   576
## [11]  1.0000000 1.000000   545
## [12]  1.0000000 1.000000   785
## [13]  1.0000000 1.000000   624
## [14]  1.0000000 1.000000   711
## [15]  1.0000000 1.000000   705
## [16]  1.0000000 1.000000   744
## [17]  1.0000000 1.000000   875
## [18]  1.0000000 1.000000   814
## [19]  1.0000000 1.000000   969
## [20]  1.0000000 1.000000   924
## [21]  1.0000000 1.000000  1087
## [22]  1.0000000 1.000000  1032
## [23]  1.0000000 1.000000  1072
## [24]  1.0000000 1.000000  1715
## [25]  1.0000000 1.000000  1372
## [26]  1.0000000 1.000000  1809
## [27]  1.0000000 1.000000  1903
## [28]  1.0000000 1.000000  2513
## [29]  0.1395018 1.571735   551
## [30]  0.2555160 1.571735   551
## [31]  0.1839349 1.205032   557
## [32]  0.2555160 1.205032   557
## [33]  0.1934926 1.513634   736
## [34]  0.2555160 1.513634   736
```

The subsets with the highest support are all single items, which makes sense, as a series of items (how R interprets support) is most often less likely than a single item.

These discoveries all make logical sense.

These high-support single items hit a maximum around .25, and those individual items with the most support are whole milk, other vegetables, rolls/buns, yogurt and soda.

Of the combinations, the support maxes out around .075. This is what we care about. The top combinations are rolls/buns and whole milk, other vegetables and whole milk, and whole milk and yogurt.

Next, we looked at confidence and located those groups with high confidence ratings.

```
##      lhs                             rhs                  support
## [1]  {onions,root vegetables}     => {other vegetables} 0.005693950
## [2]  {curd,tropical fruit}        => {whole milk}       0.006507372
## [3]  {domestic eggs,margarine}    => {whole milk}       0.005185562
## [4]  {butter,domestic eggs}       => {whole milk}       0.005998983
## [5]  {butter,whipped/sour cream}  => {whole milk}       0.006710727
## [6]  {bottled water,butter}       => {whole milk}       0.005388917
## [7]  {butter,tropical fruit}      => {whole milk}       0.006202339
## [8]  {butter,root vegetables}     => {whole milk}       0.008235892
## [9]  {butter,yogurt}              => {whole milk}       0.009354347
## [10] {domestic eggs,pip fruit}    => {whole milk}       0.005388917
## [11] {domestic eggs,tropical fruit} => {whole milk}     0.006914082
## [12] {pip fruit,whipped/sour cream} => {other vegetables} 0.005592272
## [13] {pip fruit,whipped/sour cream} => {whole milk}     0.005998983
##      confidence coverage    lift     count
## [1]  0.6021505  0.009456024 3.112008 56
## [2]  0.6336634  0.010269446 2.479936 64
## [3]  0.6219512  0.008337570 2.434099 51
## [4]  0.6210526  0.009659380 2.430582 59
## [5]  0.6600000  0.010167768 2.583008 66
## [6]  0.6022727  0.008947636 2.357084 53
## [7]  0.6224490  0.009964413 2.436047 61
## [8]  0.6377953  0.012913066 2.496107 81
## [9]  0.6388889  0.014641586 2.500387 92
## [10] 0.6235294  0.008642603 2.440275 53
## [11] 0.6071429  0.011387900 2.376144 68
## [12] 0.6043956  0.009252669 3.123610 55
## [13] 0.6483516  0.009252669 2.537421 59
```

The subsets with the highest confidence are all combinations, and very many of them involve whole milk as the right hand consequent. In fact, all of the consequents are either whole milk or other vegetables. Many of the antecedents include butter or domestic eggs. Confidence maxes out around .65.

Here is a Plot of support and lift, with shading indicating confidence. This helps illustrate the relationships between the three.

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

Scatter plot for 1908 rules
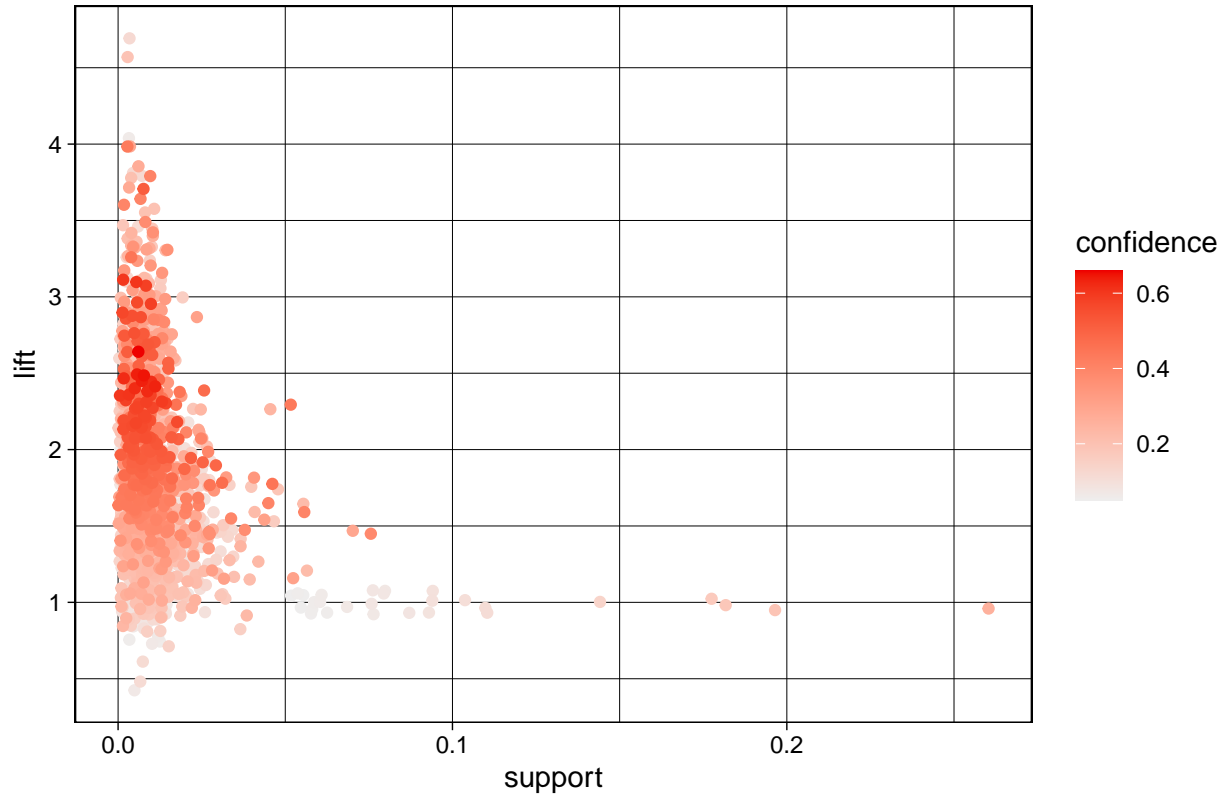
We then created a group of antecedents and consequents that had a lift of one or greater, and a confidence of 0.25 or greater. This means that they are not substitutes, and lhs occurs at least .25 percent of the time given rhs.

This group is called "related." There are 615 pairs in our "related" subset.

```
##         lhs                   rhs                    support confidence    coverage      lift
## [1]    {cake bar}            => {whole milk}          0.005592272  0.4230769 0.013218099 1.655775
## [2]    {dishes}              => {other vegetables}    0.005998983  0.3410405 0.017590239 1.762550
## [3]    {dishes}              => {whole milk}          0.005287239  0.3005780 0.017590239 1.176357
## [4]    {mustard}             => {whole milk}          0.005185562  0.4322034 0.011997966 1.691492
## [5]    {pot plants}          => {whole milk}          0.006914082  0.4000000 0.017285206 1.565460
## [6]    {chewing gum}         => {soda}                0.005388917  0.2560386 0.021047280 1.468303
## [7]    {canned fish}         => {other vegetables}    0.005083884  0.3378378 0.015048297 1.745998
## [8]    {pasta}               => {whole milk}          0.006100661  0.4054054 0.015048297 1.586614
## [9]    {herbs}               => {root vegetables}     0.007015760  0.4312500 0.016268429 3.956477
## [10]   {herbs}               => {other vegetables}    0.007727504  0.4750000 0.016268429 2.454874
## [11]   {herbs}               => {whole milk}          0.007727504  0.4750000 0.016268429 1.858983
## [12]   {processed cheese}    => {soda}                0.005287239  0.3190184 0.016573462 1.829473
## [13]   {processed cheese}    => {other vegetables}    0.005490595  0.3312883 0.016573462 1.712150
## [14]   {processed cheese}    => {whole milk}          0.007015760  0.4233129 0.016573462 1.656698
## [15]   {semi-finished bread} => {other vegetables}    0.005185562  0.2931034 0.017691917 1.514804
## [16]   {semi-finished bread} => {whole milk}          0.007117438  0.4022989 0.017691917 1.574457
## [17]   {beverages}           => {whole milk}          0.006812405  0.2617188 0.026029487 1.024275
## [18]   {detergent}           => {other vegetables}    0.006405694  0.3333333 0.019217082 1.722719
## [19]   {detergent}           => {whole milk}          0.008947636  0.4656085 0.019217082 1.822228
## [20]   {pickled vegetables}  => {other vegetables}    0.006405694  0.3579545 0.017895272 1.849965
```

```
## [21]  {pickled vegetables}     => {whole milk}          0.007117438 0.3977273 0.017895272 1.556565
## [22]  {baking powder}          => {other vegetables}    0.007320793 0.4137931 0.017691917 2.138547
## [23]  {baking powder}          => {whole milk}          0.009252669 0.5229885 0.017691917 2.046793
## [24]  {flour}                  => {other vegetables}    0.006304016 0.3625731 0.017386884 1.873834
## [25]  {flour}                  => {whole milk}          0.008439248 0.4853801 0.017386884 1.899607
## [26]  {soft cheese}            => {yogurt}              0.005998983 0.3511905 0.017081851 2.517462
## [27]  {soft cheese}            => {rolls/buns}          0.005388917 0.3154762 0.017081851 1.715151
## [28]  {soft cheese}            => {other vegetables}    0.007117438 0.4166667 0.017081851 2.153398
## [29]  {soft cheese}            => {whole milk}          0.007524148 0.4404762 0.017081851 1.723869
## [30]  {specialty bar}          => {soda}                0.007219115 0.2639405 0.027351296 1.513618
## [31]  {misc. beverages}        => {soda}                0.007320793 0.2580645 0.028368073 1.479921
## [32]  {grapes}                 => {tropical fruit}      0.006100661 0.2727273 0.022369090 2.599101
## [33]  {grapes}                 => {other vegetables}    0.009049314 0.4045455 0.022369090 2.090754
## [34]  {grapes}                 => {whole milk}          0.007320793 0.3272727 0.022369090 1.280831
## [35]  {cat food}               => {yogurt}              0.006202339 0.2663755 0.023284189 1.909478
## [36]  {cat food}               => {other vegetables}    0.006507372 0.2794760 0.023284189 1.444375
## [37]  {cat food}               => {whole milk}          0.008845958 0.3799127 0.023284189 1.486845
## [38]  {specialty chocolate}    => {whole milk}          0.008032537 0.2642140 0.030401627 1.034041
## [39]  {meat}                   => {rolls/buns}          0.006914082 0.2677165 0.025826131 1.455496
## [40]  {meat}                   => {other vegetables}    0.009964413 0.3858268 0.025826131 1.994013
## [41]  {meat}                   => {whole milk}          0.009964413 0.3858268 0.025826131 1.509991
## [42]  {frozen meals}           => {other vegetables}    0.007524148 0.2652330 0.028368073 1.370765
## [43]  {frozen meals}           => {whole milk}          0.009862735 0.3476703 0.028368073 1.360659
## [44]  {hard cheese}            => {yogurt}              0.006405694 0.2614108 0.024504321 1.873889
## [45]  {hard cheese}            => {other vegetables}    0.009456024 0.3858921 0.024504321 1.994350
## [46]  {hard cheese}            => {whole milk}          0.010066090 0.4107884 0.024504321 1.607682
## [47]  {butter milk}            => {yogurt}              0.008540925 0.3054545 0.027961362 2.189610
## [48]  {butter milk}            => {rolls/buns}          0.007625826 0.2727273 0.027961362 1.482738
## [49]  {butter milk}            => {other vegetables}    0.010371124 0.3709091 0.027961362 1.916916
## [50]  {butter milk}            => {whole milk}          0.011591256 0.4145455 0.027961362 1.622385
## [51]  {candy}                  => {soda}                0.008642603 0.2891156 0.029893238 1.657990
## [52]  {candy}                  => {whole milk}          0.008235892 0.2755102 0.029893238 1.078250
## [53]  {ham}                    => {yogurt}              0.006710727 0.2578125 0.026029487 1.848095
## [54]  {ham}                    => {rolls/buns}          0.006914082 0.2656250 0.026029487 1.444125
## [55]  {ham}                    => {other vegetables}    0.009150991 0.3515625 0.026029487 1.816930
## [56]  {ham}                    => {whole milk}          0.011489578 0.4414062 0.026029487 1.727509
## [57]  {sliced cheese}          => {sausage}             0.007015760 0.2863071 0.024504321 3.047435
## [58]  {sliced cheese}          => {yogurt}              0.008032537 0.3278008 0.024504321 2.349797
## [59]  {sliced cheese}          => {rolls/buns}          0.007625826 0.3112033 0.024504321 1.691921
## [60]  {sliced cheese}          => {other vegetables}    0.009049314 0.3692946 0.024504321 1.908572
## [61]  {sliced cheese}          => {whole milk}          0.010777834 0.4398340 0.024504321 1.721356
## [62]  {oil}                    => {other vegetables}    0.009964413 0.3550725 0.028063040 1.835070
## [63]  {oil}                    => {whole milk}          0.011286223 0.4021739 0.028063040 1.573968
## [64]  {onions}                 => {root vegetables}     0.009456024 0.3049180 0.031011693 2.797452
## [65]  {onions}                 => {other vegetables}    0.014234875 0.4590164 0.031011693 2.372268
## [66]  {onions}                 => {whole milk}          0.012099644 0.3901639 0.031011693 1.526965
## [67]  {berries}                => {whipped/sour cream}  0.009049314 0.2721713 0.033248602 3.796886
## [68]  {berries}                => {yogurt}              0.010574479 0.3180428 0.033248602 2.279848
## [69]  {berries}                => {other vegetables}    0.010269446 0.3088685 0.033248602 1.596280
## [70]  {berries}                => {whole milk}          0.011794611 0.3547401 0.033248602 1.388328
## [71]  {hamburger meat}         => {rolls/buns}          0.008642603 0.2599388 0.033248602 1.413211
## [72]  {hamburger meat}         => {other vegetables}    0.013828165 0.4159021 0.033248602 2.149447
## [73]  {hamburger meat}         => {whole milk}          0.014743264 0.4434251 0.033248602 1.735410
## [74]  {hygiene articles}       => {other vegetables}    0.009557702 0.2901235 0.032943569 1.499403
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```
## [75]  {hygiene articles}          => {whole milk}        0.012811388 0.3888889 0.032943569 1.521975
## [76]  {salty snack}               => {other vegetables}  0.010777834 0.2849462 0.037824098 1.472646
## [77]  {salty snack}               => {whole milk}        0.011184545 0.2956989 0.037824098 1.157262
## [78]  {sugar}                     => {other vegetables}  0.010777834 0.3183183 0.033858668 1.645119
## [79]  {sugar}                     => {whole milk}        0.015048297 0.4444444 0.033858668 1.739400
## [80]  {waffles}                   => {other vegetables}  0.010066090 0.2619048 0.038434164 1.353565
## [81]  {waffles}                   => {whole milk}        0.012709710 0.3306878 0.038434164 1.294196
## [82]  {long life bakery product}  => {other vegetables}  0.010676157 0.2853261 0.037417387 1.474610
## [83]  {long life bakery product}  => {whole milk}        0.013523132 0.3614130 0.037417387 1.414444
## [84]  {dessert}                   => {soda}              0.009862735 0.2657534 0.037112354 1.524015
## [85]  {dessert}                   => {yogurt}            0.009862735 0.2657534 0.037112354 1.905018
## [86]  {dessert}                   => {other vegetables}  0.011591256 0.3123288 0.037112354 1.614164
## [87]  {dessert}                   => {whole milk}        0.013726487 0.3698630 0.037112354 1.447514
## [88]  {cream cheese }             => {yogurt}            0.012404677 0.3128205 0.039654296 2.242412
## [89]  {cream cheese }             => {rolls/buns}        0.009964413 0.2512821 0.039654296 1.366146
## [90]  {cream cheese }             => {other vegetables}  0.013726487 0.3461538 0.039654296 1.788977
## [91]  {cream cheese }             => {whole milk}        0.016471784 0.4153846 0.039654296 1.625670
## [92]  {chicken}                   => {root vegetables}   0.010879512 0.2535545 0.042907982 2.326221
## [93]  {chicken}                   => {other vegetables}  0.017895272 0.4170616 0.042907982 2.155439
## [94]  {chicken}                   => {whole milk}        0.017590239 0.4099526 0.042907982 1.604411
## [95]  {white bread}               => {other vegetables}  0.013726487 0.3260870 0.042094560 1.685268
## [96]  {white bread}               => {whole milk}        0.017081851 0.4057971 0.042094560 1.588147
## [97]  {chocolate}                 => {soda}              0.013523132 0.2725410 0.049618709 1.562939
## [98]  {chocolate}                 => {other vegetables}  0.012709710 0.2561475 0.049618709 1.323810
## [99]  {chocolate}                 => {whole milk}        0.016675140 0.3360656 0.049618709 1.315243
## [100] {coffee}                    => {whole milk}        0.018708693 0.3222417 0.058057956 1.261141
## [101] {frozen vegetables}         => {yogurt}            0.012404677 0.2579281 0.048093543 1.848924
## [102] {frozen vegetables}         => {other vegetables}  0.017793594 0.3699789 0.048093543 1.912108
## [103] {frozen vegetables}         => {whole milk}        0.020437214 0.4249471 0.048093543 1.663094
## [104] {beef}                      => {root vegetables}   0.017386884 0.3313953 0.052465684 3.040367
## [105] {beef}                      => {rolls/buns}        0.013624809 0.2596899 0.052465684 1.411858
## [106] {beef}                      => {other vegetables}  0.019725470 0.3759690 0.052465684 1.943066
## [107] {beef}                      => {whole milk}        0.021250635 0.4050388 0.052465684 1.585180
## [108] {curd}                      => {yogurt}            0.017285206 0.3244275 0.053279105 2.325615
## [109] {curd}                      => {other vegetables}  0.017183528 0.3225191 0.053279105 1.666829
## [110] {curd}                      => {whole milk}        0.026131164 0.4904580 0.053279105 1.919481
## [111] {napkins}                   => {other vegetables}  0.014438231 0.2757282 0.052364006 1.425006
## [112] {napkins}                   => {whole milk}        0.019725470 0.3766990 0.052364006 1.474268
## [113] {pork}                      => {other vegetables}  0.021657346 0.3756614 0.057651246 1.941476
## [114] {pork}                      => {whole milk}        0.022165735 0.3844797 0.057651246 1.504719
## [115] {frankfurter}               => {rolls/buns}        0.019217082 0.3258621 0.058973055 1.771616
## [116] {frankfurter}               => {other vegetables}  0.016471784 0.2793103 0.058973055 1.443519
## [117] {frankfurter}               => {whole milk}        0.020538892 0.3482759 0.058973055 1.363029
## [118] {brown bread}               => {other vegetables}  0.018708693 0.2884013 0.064870361 1.490503
## [119] {brown bread}               => {whole milk}        0.025216065 0.3887147 0.064870361 1.521293
## [120] {margarine}                 => {rolls/buns}        0.014743264 0.2517361 0.058566345 1.368615
## [121] {margarine}                 => {other vegetables}  0.019725470 0.3368056 0.058566345 1.740663
## [122] {margarine}                 => {whole milk}        0.024199288 0.4131944 0.058566345 1.617098
## [123] {butter}                    => {yogurt}            0.014641586 0.2642202 0.055414337 1.894027
## [124] {butter}                    => {other vegetables}  0.020030503 0.3614679 0.055414337 1.868122
## [125] {butter}                    => {whole milk}        0.027554652 0.4972477 0.055414337 1.946053
## [126] {newspapers}                => {whole milk}        0.027351296 0.3426752 0.079816980 1.341110
## [127] {domestic eggs}             => {other vegetables}  0.022267412 0.3509615 0.063446873 1.813824
## [128] {domestic eggs}             => {whole milk}        0.029994916 0.4727564 0.063446873 1.850203
```

```
## [129] {fruit/vegetable juice}  => {soda}               0.018403660  0.2545710 0.072292832 1.459887
## [130] {fruit/vegetable juice}  => {yogurt}             0.018708693  0.2587904 0.072292832 1.855105
## [131] {fruit/vegetable juice}  => {other vegetables}   0.021047280  0.2911392 0.072292832 1.504653
## [132] {fruit/vegetable juice}  => {whole milk}         0.026639553  0.3684951 0.072292832 1.442160
## [133] {whipped/sour cream}     => {yogurt}             0.020742247  0.2893617 0.071682766 2.074251
## [134] {whipped/sour cream}     => {other vegetables}   0.028876462  0.4028369 0.071682766 2.081924
## [135] {whipped/sour cream}     => {whole milk}         0.032231825  0.4496454 0.071682766 1.759754
## [136] {pip fruit}              => {tropical fruit}     0.020437214  0.2701613 0.075648195 2.574648
## [137] {pip fruit}              => {other vegetables}   0.026131164  0.3454301 0.075648195 1.785237
## [138] {pip fruit}              => {whole milk}         0.030096594  0.3978495 0.075648195 1.557043
## [139] {pastry}                 => {other vegetables}   0.022572445  0.2537143 0.088967972 1.311235
## [140] {pastry}                 => {whole milk}         0.033248602  0.3737143 0.088967972 1.462587
## [141] {citrus fruit}           => {yogurt}             0.021657346  0.2616708 0.082765633 1.875752
## [142] {citrus fruit}           => {other vegetables}   0.028876462  0.3488943 0.082765633 1.803140
## [143] {citrus fruit}           => {whole milk}         0.030503305  0.3685504 0.082765633 1.442377
## [144] {sausage}                => {soda}               0.024300966  0.2586580 0.093950178 1.483324
## [145] {sausage}                => {rolls/buns}         0.030604982  0.3257576 0.093950178 1.771048
## [146] {sausage}                => {other vegetables}   0.026944586  0.2867965 0.093950178 1.482209
## [147] {sausage}                => {whole milk}         0.029893238  0.3181818 0.093950178 1.245252
## [148] {bottled water}          => {soda}               0.028978139  0.2621895 0.110523640 1.503577
## [149] {bottled water}          => {whole milk}         0.034367056  0.3109476 0.110523640 1.216940
## [150] {tropical fruit}         => {yogurt}             0.029283172  0.2790698 0.104931368 2.000475
## [151] {tropical fruit}         => {other vegetables}   0.035892222  0.3420543 0.104931368 1.767790
## [152] {tropical fruit}         => {whole milk}         0.042297916  0.4031008 0.104931368 1.577595
## [153] {root vegetables}        => {other vegetables}   0.047381800  0.4347015 0.108998475 2.246605
## [154] {root vegetables}        => {whole milk}         0.048906965  0.4486940 0.108998475 1.756031
## [155] {yogurt}                 => {other vegetables}   0.043416370  0.3112245 0.139501779 1.608457
## [156] {yogurt}                 => {whole milk}         0.056024403  0.4016035 0.139501779 1.571735
## [157] {rolls/buns}             => {whole milk}         0.056634469  0.3079049 0.183934926 1.205032
## [158] {other vegetables}       => {whole milk}         0.074834774  0.3867578 0.193492628 1.513634
## [159] {whole milk}             => {other vegetables}   0.074834774  0.2928770 0.255516014 1.513634
## [160] {oil,
##        other vegetables}       => {whole milk}         0.005083884  0.5102041 0.009964413 1.996760
## [161] {oil,
##        whole milk}             => {other vegetables}   0.005083884  0.4504505 0.011286223 2.327998
## [162] {onions,
##        root vegetables}        => {other vegetables}   0.005693950  0.6021505 0.009456024 3.112008
## [163] {onions,
##        other vegetables}       => {root vegetables}    0.005693950  0.4000000 0.014234875 3.669776
## [164] {onions,
##        other vegetables}       => {whole milk}         0.006609049  0.4642857 0.014234875 1.817051
## [165] {onions,
##        whole milk}             => {other vegetables}   0.006609049  0.5462185 0.012099644 2.822942
## [166] {hamburger meat,
##        other vegetables}       => {whole milk}         0.006304016  0.4558824 0.013828165 1.784164
## [167] {hamburger meat,
##        whole milk}             => {other vegetables}   0.006304016  0.4275862 0.014743264 2.209832
## [168] {hygiene articles,
##        other vegetables}       => {whole milk}         0.005185562  0.5425532 0.009557702 2.123363
## [169] {hygiene articles,
##        whole milk}             => {other vegetables}   0.005185562  0.4047619 0.012811388 2.091872
## [170] {other vegetables,
##        sugar}                  => {whole milk}         0.006304016  0.5849057 0.010777834 2.289115
## [171] {sugar,
```

```
##          whole milk}            => {other vegetables}  0.006304016  0.4189189 0.015048297 2.165038
## [172] {long life bakery product,
##          other vegetables}      => {whole milk}        0.005693950  0.5333333 0.010676157 2.087279
## [173] {long life bakery product,
##          whole milk}            => {other vegetables}  0.005693950  0.4210526 0.013523132 2.176065
## [174] {cream cheese ,
##          yogurt}                => {other vegetables}  0.005287239  0.4262295 0.012404677 2.202820
## [175] {cream cheese ,
##          other vegetables}      => {yogurt}            0.005287239  0.3851852 0.013726487 2.761149
## [176] {cream cheese ,
##          yogurt}                => {whole milk}        0.006609049  0.5327869 0.012404677 2.085141
## [177] {cream cheese ,
##          whole milk}            => {yogurt}            0.006609049  0.4012346 0.016471784 2.876197
## [178] {cream cheese ,
##          other vegetables}      => {whole milk}        0.006710727  0.4888889 0.013726487 1.913340
## [179] {cream cheese ,
##          whole milk}            => {other vegetables}  0.006710727  0.4074074 0.016471784 2.105545
## [180] {chicken,
##          root vegetables}       => {other vegetables}  0.005693950  0.5233645 0.010879512 2.704829
## [181] {chicken,
##          other vegetables}      => {root vegetables}   0.005693950  0.3181818 0.017895272 2.919140
## [182] {chicken,
##          root vegetables}       => {whole milk}        0.005998983  0.5514019 0.010879512 2.157993
## [183] {chicken,
##          whole milk}            => {root vegetables}   0.005998983  0.3410405 0.017590239 3.128855
## [184] {chicken,
##          rolls/buns}            => {whole milk}        0.005287239  0.5473684 0.009659380 2.142208
## [185] {chicken,
##          whole milk}            => {rolls/buns}        0.005287239  0.3005780 0.017590239 1.634154
## [186] {chicken,
##          other vegetables}      => {whole milk}        0.008439248  0.4715909 0.017895272 1.845641
## [187] {chicken,
##          whole milk}            => {other vegetables}  0.008439248  0.4797688 0.017590239 2.479520
## [188] {other vegetables,
##          white bread}           => {whole milk}        0.005897306  0.4296296 0.013726487 1.681420
## [189] {white bread,
##          whole milk}            => {other vegetables}  0.005897306  0.3452381 0.017081851 1.784244
## [190] {chocolate,
##          soda}                  => {whole milk}        0.005083884  0.3759398 0.013523132 1.471297
## [191] {chocolate,
##          whole milk}            => {soda}              0.005083884  0.3048780 0.016675140 1.748382
## [192] {chocolate,
##          other vegetables}      => {whole milk}        0.005490595  0.4320000 0.012709710 1.690696
## [193] {chocolate,
##          whole milk}            => {other vegetables}  0.005490595  0.3292683 0.016675140 1.701710
## [194] {coffee,
##          yogurt}                => {whole milk}        0.005083884  0.5208333 0.009761057 2.038359
## [195] {coffee,
##          whole milk}            => {yogurt}            0.005083884  0.2717391 0.018708693 1.947926
## [196] {coffee,
##          other vegetables}      => {whole milk}        0.006405694  0.4772727 0.013421454 1.867878
## [197] {coffee,
##          whole milk}            => {other vegetables}  0.006405694  0.3423913 0.018708693 1.769532
## [198] {frozen vegetables,
```

```
##         root vegetables}      => {other vegetables} 0.006100661 0.5263158 0.011591256 2.720082
## [199] {frozen vegetables,
##         other vegetables}     => {root vegetables}  0.006100661 0.3428571 0.017793594 3.145522
## [200] {frozen vegetables,
##         root vegetables}      => {whole milk}       0.006202339 0.5350877 0.011591256 2.094146
## [201] {frozen vegetables,
##         whole milk}           => {root vegetables}  0.006202339 0.3034826 0.020437214 2.784283
## [202] {frozen vegetables,
##         yogurt}               => {other vegetables} 0.005287239 0.4262295 0.012404677 2.202820
## [203] {frozen vegetables,
##         other vegetables}     => {yogurt}           0.005287239 0.2971429 0.017793594 2.130029
## [204] {frozen vegetables,
##         yogurt}               => {whole milk}       0.006100661 0.4918033 0.012404677 1.924745
## [205] {frozen vegetables,
##         whole milk}           => {yogurt}           0.006100661 0.2985075 0.020437214 2.139811
## [206] {frozen vegetables,
##         rolls/buns}           => {whole milk}       0.005083884 0.5000000 0.010167768 1.956825
## [207] {frozen vegetables,
##         other vegetables}     => {whole milk}       0.009659380 0.5428571 0.017793594 2.124552
## [208] {frozen vegetables,
##         whole milk}           => {other vegetables} 0.009659380 0.4726368 0.020437214 2.442661
## [209] {beef,
##         root vegetables}      => {other vegetables} 0.007930859 0.4561404 0.017386884 2.357404
## [210] {beef,
##         other vegetables}     => {root vegetables}  0.007930859 0.4020619 0.019725470 3.688692
## [211] {beef,
##         root vegetables}      => {whole milk}       0.008032537 0.4619883 0.017386884 1.808060
## [212] {beef,
##         whole milk}           => {root vegetables}  0.008032537 0.3779904 0.021250635 3.467851
## [213] {beef,
##         yogurt}               => {other vegetables} 0.005185562 0.4434783 0.011692933 2.291965
## [214] {beef,
##         other vegetables}     => {yogurt}           0.005185562 0.2628866 0.019725470 1.884468
## [215] {beef,
##         yogurt}               => {whole milk}       0.006100661 0.5217391 0.011692933 2.041904
## [216] {beef,
##         whole milk}           => {yogurt}           0.006100661 0.2870813 0.021250635 2.057905
## [217] {beef,
##         rolls/buns}           => {other vegetables} 0.005795628 0.4253731 0.013624809 2.198395
## [218] {beef,
##         other vegetables}     => {rolls/buns}       0.005795628 0.2938144 0.019725470 1.597383
## [219] {beef,
##         rolls/buns}           => {whole milk}       0.006812405 0.5000000 0.013624809 1.956825
## [220] {beef,
##         whole milk}           => {rolls/buns}       0.006812405 0.3205742 0.021250635 1.742867
## [221] {beef,
##         other vegetables}     => {whole milk}       0.009252669 0.4690722 0.019725470 1.835784
## [222] {beef,
##         whole milk}           => {other vegetables} 0.009252669 0.4354067 0.021250635 2.250250
## [223] {curd,
##         whipped/sour cream}   => {whole milk}       0.005897306 0.5631068 0.010472801 2.203802
## [224] {curd,
##         tropical fruit}       => {yogurt}           0.005287239 0.5148515 0.010269446 3.690645
## [225] {curd,
```

```
##        yogurt}                     => {tropical fruit}    0.005287239 0.3058824 0.017285206 2.915071
## [226] {curd,
##        tropical fruit}             => {other vegetables}   0.005287239 0.5148515 0.010269446 2.660833
## [227] {curd,
##        other vegetables}           => {tropical fruit}     0.005287239 0.3076923 0.017183528 2.932320
## [228] {curd,
##        tropical fruit}             => {whole milk}         0.006507372 0.6336634 0.010269446 2.479936
## [229] {curd,
##        root vegetables}            => {other vegetables}   0.005490595 0.5046729 0.010879512 2.608228
## [230] {curd,
##        other vegetables}           => {root vegetables}    0.005490595 0.3195266 0.017183528 2.931478
## [231] {curd,
##        root vegetables}            => {whole milk}         0.006202339 0.5700935 0.010879512 2.231146
## [232] {curd,
##        yogurt}                     => {other vegetables}   0.006100661 0.3529412 0.017285206 1.824055
## [233] {curd,
##        other vegetables}           => {yogurt}             0.006100661 0.3550296 0.017183528 2.544982
## [234] {curd,
##        yogurt}                     => {whole milk}         0.010066090 0.5823529 0.017285206 2.279125
## [235] {curd,
##        whole milk}                 => {yogurt}             0.010066090 0.3852140 0.026131164 2.761356
## [236] {curd,
##        rolls/buns}                 => {whole milk}         0.005897306 0.5858586 0.010066090 2.292845
## [237] {curd,
##        other vegetables}           => {whole milk}         0.009862735 0.5739645 0.017183528 2.246296
## [238] {curd,
##        whole milk}                 => {other vegetables}   0.009862735 0.3774319 0.026131164 1.950627
## [239] {napkins,
##        yogurt}                     => {whole milk}         0.006100661 0.4958678 0.012302999 1.940652
## [240] {napkins,
##        whole milk}                 => {yogurt}             0.006100661 0.3092784 0.019725470 2.217021
## [241] {napkins,
##        rolls/buns}                 => {whole milk}         0.005287239 0.4521739 0.011692933 1.769650
## [242] {napkins,
##        whole milk}                 => {rolls/buns}         0.005287239 0.2680412 0.019725470 1.457261
## [243] {napkins,
##        other vegetables}           => {whole milk}         0.006812405 0.4718310 0.014438231 1.846581
## [244] {napkins,
##        whole milk}                 => {other vegetables}   0.006812405 0.3453608 0.019725470 1.784878
## [245] {pork,
##        root vegetables}            => {other vegetables}   0.007015760 0.5149254 0.013624809 2.661214
## [246] {other vegetables,
##        pork}                       => {root vegetables}    0.007015760 0.3239437 0.021657346 2.972002
## [247] {pork,
##        root vegetables}            => {whole milk}         0.006812405 0.5000000 0.013624809 1.956825
## [248] {pork,
##        whole milk}                 => {root vegetables}    0.006812405 0.3073394 0.022165735 2.819667
## [249] {pork,
##        rolls/buns}                 => {other vegetables}   0.005592272 0.4954955 0.011286223 2.560798
## [250] {other vegetables,
##        pork}                       => {rolls/buns}         0.005592272 0.2582160 0.021657346 1.403844
## [251] {pork,
##        rolls/buns}                 => {whole milk}         0.006202339 0.5495495 0.011286223 2.150744
## [252] {pork,
```

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```
##         whole milk}                => {rolls/buns}        0.006202339  0.2798165 0.022165735 1.521280
## [253] {other vegetables,
##         pork}                      => {whole milk}        0.010167768  0.4694836 0.021657346 1.837394
## [254] {pork,
##         whole milk}                => {other vegetables}  0.010167768  0.4587156 0.022165735 2.370714
## [255] {frankfurter,
##         tropical fruit}            => {whole milk}        0.005185562  0.5483871 0.009456024 2.146195
## [256] {frankfurter,
##         whole milk}                => {tropical fruit}    0.005185562  0.2524752 0.020538892 2.406099
## [257] {frankfurter,
##         root vegetables}           => {whole milk}        0.005083884  0.5000000 0.010167768 1.956825
## [258] {frankfurter,
##         yogurt}                    => {whole milk}        0.006202339  0.5545455 0.011184545 2.170296
## [259] {frankfurter,
##         whole milk}                => {yogurt}            0.006202339  0.3019802 0.020538892 2.164705
## [260] {frankfurter,
##         rolls/buns}                => {other vegetables}  0.005592272  0.2910053 0.019217082 1.503961
## [261] {frankfurter,
##         other vegetables}          => {rolls/buns}        0.005592272  0.3395062 0.016471784 1.845795
## [262] {frankfurter,
##         rolls/buns}                => {whole milk}        0.005998983  0.3121693 0.019217082 1.221721
## [263] {frankfurter,
##         whole milk}                => {rolls/buns}        0.005998983  0.2920792 0.020538892 1.587949
## [264] {frankfurter,
##         other vegetables}          => {whole milk}        0.007625826  0.4629630 0.016471784 1.811875
## [265] {frankfurter,
##         whole milk}                => {other vegetables}  0.007625826  0.3712871 0.020538892 1.918870
## [266] {bottled beer,
##         bottled water}             => {soda}              0.005083884  0.3225806 0.015760041 1.849901
## [267] {bottled beer,
##         soda}                      => {bottled water}     0.005083884  0.2994012 0.016980173 2.708934
## [268] {bottled beer,
##         bottled water}             => {whole milk}        0.006100661  0.3870968 0.015760041 1.514961
## [269] {bottled beer,
##         whole milk}                => {bottled water}     0.006100661  0.2985075 0.020437214 2.700847
## [270] {bottled beer,
##         yogurt}                    => {whole milk}        0.005185562  0.5604396 0.009252669 2.193364
## [271] {bottled beer,
##         whole milk}                => {yogurt}            0.005185562  0.2537313 0.020437214 1.818839
## [272] {bottled beer,
##         rolls/buns}                => {whole milk}        0.005388917  0.3955224 0.013624809 1.547936
## [273] {bottled beer,
##         whole milk}                => {rolls/buns}        0.005388917  0.2636816 0.020437214 1.433559
## [274] {bottled beer,
##         other vegetables}          => {whole milk}        0.007625826  0.4716981 0.016166751 1.846061
## [275] {bottled beer,
##         whole milk}                => {other vegetables}  0.007625826  0.3731343 0.020437214 1.928416
## [276] {brown bread,
##         tropical fruit}            => {whole milk}        0.005693950  0.5333333 0.010676157 2.087279
## [277] {brown bread,
##         root vegetables}           => {whole milk}        0.005693950  0.5600000 0.010167768 2.191643
## [278] {brown bread,
##         soda}                      => {whole milk}        0.005083884  0.4032258 0.012608033 1.578084
## [279] {brown bread,
```

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```
##         yogurt}                   => {other vegetables}    0.005185562  0.3566434 0.014539908 1.843188
## [280] {brown bread,
##         other vegetables}         => {yogurt}              0.005185562  0.2771739 0.018708693 1.986884
## [281] {brown bread,
##         yogurt}                   => {whole milk}           0.007117438  0.4895105 0.014539908 1.915772
## [282] {brown bread,
##         whole milk}               => {yogurt}              0.007117438  0.2822581 0.025216065 2.023329
## [283] {brown bread,
##         rolls/buns}               => {whole milk}           0.005287239  0.4193548 0.012608033 1.641208
## [284] {brown bread,
##         other vegetables}         => {whole milk}           0.009354347  0.5000000 0.018708693 1.956825
## [285] {brown bread,
##         whole milk}               => {other vegetables}    0.009354347  0.3709677 0.025216065 1.917219
## [286] {domestic eggs,
##         margarine}                => {whole milk}           0.005185562  0.6219512 0.008337570 2.434099
## [287] {margarine,
##         root vegetables}          => {other vegetables}    0.005897306  0.5321101 0.011082867 2.750028
## [288] {margarine,
##         other vegetables}         => {root vegetables}     0.005897306  0.2989691 0.019725470 2.742874
## [289] {margarine,
##         yogurt}                   => {other vegetables}    0.005693950  0.4000000 0.014234875 2.067262
## [290] {margarine,
##         other vegetables}         => {yogurt}              0.005693950  0.2886598 0.019725470 2.069219
## [291] {margarine,
##         yogurt}                   => {whole milk}           0.007015760  0.4928571 0.014234875 1.928870
## [292] {margarine,
##         whole milk}               => {yogurt}              0.007015760  0.2899160 0.024199288 2.078224
## [293] {margarine,
##         rolls/buns}               => {other vegetables}    0.005185562  0.3517241 0.014743264 1.817765
## [294] {margarine,
##         other vegetables}         => {rolls/buns}           0.005185562  0.2628866 0.019725470 1.429237
## [295] {margarine,
##         rolls/buns}               => {whole milk}           0.007930859  0.5379310 0.014743264 2.105273
## [296] {margarine,
##         whole milk}               => {rolls/buns}           0.007930859  0.3277311 0.024199288 1.781777
## [297] {margarine,
##         other vegetables}         => {whole milk}           0.009252669  0.4690722 0.019725470 1.835784
## [298] {margarine,
##         whole milk}               => {other vegetables}    0.009252669  0.3823529 0.024199288 1.976059
## [299] {butter,
##         domestic eggs}            => {whole milk}           0.005998983  0.6210526 0.009659380 2.430582
## [300] {butter,
##         whipped/sour cream}       => {other vegetables}    0.005795628  0.5700000 0.010167768 2.945849
## [301] {butter,
##         other vegetables}         => {whipped/sour cream} 0.005795628  0.2893401 0.020030503 4.036397
## [302] {butter,
##         whipped/sour cream}       => {whole milk}           0.006710727  0.6600000 0.010167768 2.583008
## [303] {butter,
##         citrus fruit}             => {whole milk}           0.005083884  0.5555556 0.009150991 2.174249
## [304] {bottled water,
##         butter}                   => {whole milk}           0.005388917  0.6022727 0.008947636 2.357084
## [305] {butter,
##         tropical fruit}           => {other vegetables}    0.005490595  0.5510204 0.009964413 2.847759
## [306] {butter,
```

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##          other vegetables}    => {tropical fruit}      0.005490595  0.2741117 0.020030503 2.612295
## [307] {butter,
##          tropical fruit}      => {whole milk}          0.006202339  0.6224490 0.009964413 2.436047
## [308] {butter,
##          root vegetables}     => {other vegetables}    0.006609049  0.5118110 0.012913066 2.645119
## [309] {butter,
##          other vegetables}    => {root vegetables}     0.006609049  0.3299492 0.020030503 3.027100
## [310] {butter,
##          root vegetables}     => {whole milk}          0.008235892  0.6377953 0.012913066 2.496107
## [311] {butter,
##          whole milk}          => {root vegetables}     0.008235892  0.2988930 0.027554652 2.742176
## [312] {butter,
##          yogurt}              => {other vegetables}    0.006405694  0.4375000 0.014641586 2.261068
## [313] {butter,
##          other vegetables}    => {yogurt}              0.006405694  0.3197970 0.020030503 2.292422
## [314] {butter,
##          yogurt}              => {whole milk}          0.009354347  0.6388889 0.014641586 2.500387
## [315] {butter,
##          whole milk}          => {yogurt}              0.009354347  0.3394834 0.027554652 2.433542
## [316] {butter,
##          rolls/buns}          => {other vegetables}    0.005693950  0.4242424 0.013421454 2.192551
## [317] {butter,
##          other vegetables}    => {rolls/buns}          0.005693950  0.2842640 0.020030503 1.545459
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##          rolls/buns}          => {whole milk}          0.006609049  0.4924242 0.013421454 1.927176
## [319] {butter,
##          other vegetables}    => {whole milk}          0.011489578  0.5736041 0.020030503 2.244885
## [320] {butter,
##          whole milk}          => {other vegetables}    0.011489578  0.4169742 0.027554652 2.154987
## [321] {newspapers,
##          tropical fruit}      => {whole milk}          0.005083884  0.4310345 0.011794611 1.686918
## [322] {newspapers,
##          root vegetables}     => {other vegetables}    0.005998983  0.5221239 0.011489578 2.698417
## [323] {newspapers,
##          other vegetables}    => {root vegetables}     0.005998983  0.3105263 0.019318760 2.848905
## [324] {newspapers,
##          root vegetables}     => {whole milk}          0.005795628  0.5044248 0.011489578 1.974142
## [325] {newspapers,
##          yogurt}              => {rolls/buns}          0.005083884  0.3311258 0.015353330 1.800234
## [326] {newspapers,
##          rolls/buns}          => {yogurt}              0.005083884  0.2577320 0.019725470 1.847517
## [327] {newspapers,
##          yogurt}              => {other vegetables}    0.005592272  0.3642384 0.015353330 1.882441
## [328] {newspapers,
##          other vegetables}    => {yogurt}              0.005592272  0.2894737 0.019318760 2.075054
## [329] {newspapers,
##          yogurt}              => {whole milk}          0.006609049  0.4304636 0.015353330 1.684683
## [330] {newspapers,
##          rolls/buns}          => {other vegetables}    0.005490595  0.2783505 0.019725470 1.438559
## [331] {newspapers,
##          other vegetables}    => {rolls/buns}          0.005490595  0.2842105 0.019318760 1.545169
## [332] {newspapers,
##          rolls/buns}          => {whole milk}          0.007625826  0.3865979 0.019725470 1.513009
## [333] {newspapers,
```

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##         whole milk}                 => {rolls/buns}          0.007625826  0.2788104 0.027351296 1.515810
## [334] {newspapers,
##         other vegetables}           => {whole milk}          0.008337570  0.4315789 0.019318760 1.689049
## [335] {newspapers,
##         whole milk}                 => {other vegetables}    0.008337570  0.3048327 0.027351296 1.575423
## [336] {domestic eggs,
##         whipped/sour cream}         => {other vegetables}    0.005083884  0.5102041 0.009964413 2.636814
## [337] {domestic eggs,
##         whipped/sour cream}         => {whole milk}          0.005693950  0.5714286 0.009964413 2.236371
## [338] {domestic eggs,
##         pip fruit}                  => {whole milk}          0.005388917  0.6235294 0.008642603 2.440275
## [339] {citrus fruit,
##         domestic eggs}              => {whole milk}          0.005693950  0.5490196 0.010371124 2.148670
## [340] {domestic eggs,
##         tropical fruit}             => {whole milk}          0.006914082  0.6071429 0.011387900 2.376144
## [341] {domestic eggs,
##         root vegetables}            => {other vegetables}    0.007320793  0.5106383 0.014336553 2.639058
## [342] {domestic eggs,
##         other vegetables}           => {root vegetables}     0.007320793  0.3287671 0.022267412 3.016254
## [343] {domestic eggs,
##         root vegetables}            => {whole milk}          0.008540925  0.5957447 0.014336553 2.331536
## [344] {domestic eggs,
##         whole milk}                 => {root vegetables}     0.008540925  0.2847458 0.029994916 2.612383
## [345] {domestic eggs,
##         soda}                       => {other vegetables}    0.005083884  0.4098361 0.012404677 2.118097
## [346] {domestic eggs,
##         soda}                       => {whole milk}          0.005185562  0.4180328 0.012404677 1.636034
## [347] {domestic eggs,
##         yogurt}                     => {other vegetables}    0.005795628  0.4042553 0.014336553 2.089254
## [348] {domestic eggs,
##         other vegetables}           => {yogurt}              0.005795628  0.2602740 0.022267412 1.865739
## [349] {domestic eggs,
##         yogurt}                     => {whole milk}          0.007727504  0.5390071 0.014336553 2.109485
## [350] {domestic eggs,
##         whole milk}                 => {yogurt}              0.007727504  0.2576271 0.029994916 1.846766
## [351] {domestic eggs,
##         rolls/buns}                 => {other vegetables}    0.005897306  0.3766234 0.015658363 1.946448
## [352] {domestic eggs,
##         other vegetables}           => {rolls/buns}          0.005897306  0.2648402 0.022267412 1.439858
## [353] {domestic eggs,
##         rolls/buns}                 => {whole milk}          0.006609049  0.4220779 0.015658363 1.651865
## [354] {domestic eggs,
##         other vegetables}           => {whole milk}          0.012302999  0.5525114 0.022267412 2.162336
## [355] {domestic eggs,
##         whole milk}                 => {other vegetables}    0.012302999  0.4101695 0.029994916 2.119820
## [356] {bottled water,
##         fruit/vegetable juice}      => {soda}                0.005185562  0.3642857 0.014234875 2.089067
## [357] {fruit/vegetable juice,
##         soda}                       => {bottled water}       0.005185562  0.2817680 0.018403660 2.549391
## [358] {bottled water,
##         fruit/vegetable juice}      => {whole milk}          0.005795628  0.4071429 0.014234875 1.593414
## [359] {fruit/vegetable juice,
##         tropical fruit}             => {other vegetables}    0.006609049  0.4814815 0.013726487 2.488371
## [360] {fruit/vegetable juice,
```

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##        other vegetables}        => {tropical fruit}    0.006609049  0.3140097 0.021047280 2.992524
## [361] {fruit/vegetable juice,
##        tropical fruit}          => {whole milk}         0.005998983  0.4370370 0.013726487 1.710410
## [362] {fruit/vegetable juice,
##        root vegetables}         => {other vegetables}   0.006609049  0.5508475 0.011997966 2.846865
## [363] {fruit/vegetable juice,
##        other vegetables}        => {root vegetables}    0.006609049  0.3140097 0.021047280 2.880863
## [364] {fruit/vegetable juice,
##        root vegetables}         => {whole milk}         0.006507372  0.5423729 0.011997966 2.122657
## [365] {fruit/vegetable juice,
##        soda}                    => {yogurt}             0.005083884  0.2762431 0.018403660 1.980212
## [366] {fruit/vegetable juice,
##        yogurt}                  => {soda}               0.005083884  0.2717391 0.018708693 1.558341
## [367] {fruit/vegetable juice,
##        soda}                    => {whole milk}         0.006100661  0.3314917 0.018403660 1.297342
## [368] {fruit/vegetable juice,
##        yogurt}                  => {other vegetables}   0.008235892  0.4402174 0.018708693 2.275112
## [369] {fruit/vegetable juice,
##        other vegetables}        => {yogurt}             0.008235892  0.3913043 0.021047280 2.805013
## [370] {fruit/vegetable juice,
##        yogurt}                  => {whole milk}         0.009456024  0.5054348 0.018708693 1.978094
## [371] {fruit/vegetable juice,
##        whole milk}              => {yogurt}             0.009456024  0.3549618 0.026639553 2.544497
## [372] {fruit/vegetable juice,
##        rolls/buns}              => {whole milk}         0.005592272  0.3846154 0.014539908 1.505250
## [373] {fruit/vegetable juice,
##        other vegetables}        => {whole milk}         0.010472801  0.4975845 0.021047280 1.947371
## [374] {fruit/vegetable juice,
##        whole milk}              => {other vegetables}   0.010472801  0.3931298 0.026639553 2.031756
## [375] {pip fruit,
##        whipped/sour cream}      => {other vegetables}   0.005592272  0.6043956 0.009252669 3.123610
## [376] {pip fruit,
##        whipped/sour cream}      => {whole milk}         0.005998983  0.6483516 0.009252669 2.537421
## [377] {citrus fruit,
##        whipped/sour cream}      => {other vegetables}   0.005693950  0.5233645 0.010879512 2.704829
## [378] {citrus fruit,
##        whipped/sour cream}      => {whole milk}         0.006304016  0.5794393 0.010879512 2.267722
## [379] {sausage,
##        whipped/sour cream}      => {whole milk}         0.005083884  0.5617978 0.009049314 2.198679
## [380] {tropical fruit,
##        whipped/sour cream}      => {yogurt}             0.006202339  0.4485294 0.013828165 3.215224
## [381] {whipped/sour cream,
##        yogurt}                  => {tropical fruit}     0.006202339  0.2990196 0.020742247 2.849668
## [382] {tropical fruit,
##        whipped/sour cream}      => {other vegetables}   0.007829181  0.5661765 0.013828165 2.926088
## [383] {other vegetables,
##        whipped/sour cream}      => {tropical fruit}     0.007829181  0.2711268 0.028876462 2.583849
## [384] {tropical fruit,
##        whipped/sour cream}      => {whole milk}         0.007930859  0.5735294 0.013828165 2.244593
## [385] {root vegetables,
##        whipped/sour cream}      => {yogurt}             0.006405694  0.3750000 0.017081851 2.688138
## [386] {whipped/sour cream,
##        yogurt}                  => {root vegetables}    0.006405694  0.3088235 0.020742247 2.833283
## [387] {root vegetables,
```

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##         whipped/sour cream}    => {other vegetables}  0.008540925 0.5000000 0.017081851 2.584078
## [388] {other vegetables,
##         whipped/sour cream}    => {root vegetables}    0.008540925 0.2957746 0.028876462 2.713567
## [389] {root vegetables,
##         whipped/sour cream}    => {whole milk}          0.009456024 0.5535714 0.017081851 2.166484
## [390] {whipped/sour cream,
##         whole milk}            => {root vegetables}    0.009456024 0.2933754 0.032231825 2.691555
## [391] {soda,
##         whipped/sour cream}    => {whole milk}          0.005490595 0.4736842 0.011591256 1.853834
## [392] {whipped/sour cream,
##         yogurt}                => {other vegetables}    0.010167768 0.4901961 0.020742247 2.533410
## [393] {other vegetables,
##         whipped/sour cream}    => {yogurt}              0.010167768 0.3521127 0.028876462 2.524073
## [394] {whipped/sour cream,
##         yogurt}                => {whole milk}          0.010879512 0.5245098 0.020742247 2.052747
## [395] {whipped/sour cream,
##         whole milk}            => {yogurt}              0.010879512 0.3375394 0.032231825 2.419607
## [396] {rolls/buns,
##         whipped/sour cream}    => {other vegetables}    0.006710727 0.4583333 0.014641586 2.368738
## [397] {rolls/buns,
##         whipped/sour cream}    => {whole milk}          0.007829181 0.5347222 0.014641586 2.092715
## [398] {other vegetables,
##         whipped/sour cream}    => {whole milk}          0.014641586 0.5070423 0.028876462 1.984385
## [399] {whipped/sour cream,
##         whole milk}            => {other vegetables}    0.014641586 0.4542587 0.032231825 2.347679
## [400] {pastry,
##         pip fruit}             => {whole milk}          0.005083884 0.4761905 0.010676157 1.863642
## [401] {citrus fruit,
##         pip fruit}             => {tropical fruit}      0.005592272 0.4044118 0.013828165 3.854060
## [402] {pip fruit,
##         tropical fruit}        => {citrus fruit}        0.005592272 0.2736318 0.020437214 3.306105
## [403] {citrus fruit,
##         tropical fruit}        => {pip fruit}           0.005592272 0.2806122 0.019928826 3.709437
## [404] {citrus fruit,
##         pip fruit}             => {other vegetables}    0.005897306 0.4264706 0.013828165 2.204066
## [405] {citrus fruit,
##         pip fruit}             => {whole milk}          0.005185562 0.3750000 0.013828165 1.467618
## [406] {pip fruit,
##         sausage}               => {whole milk}          0.005592272 0.5188679 0.010777834 2.030667
## [407] {pip fruit,
##         tropical fruit}        => {root vegetables}     0.005287239 0.2587065 0.020437214 2.373487
## [408] {pip fruit,
##         root vegetables}       => {tropical fruit}      0.005287239 0.3398693 0.015556685 3.238967
## [409] {root vegetables,
##         tropical fruit}        => {pip fruit}           0.005287239 0.2512077 0.021047280 3.320737
## [410] {pip fruit,
##         tropical fruit}        => {yogurt}              0.006405694 0.3134328 0.020437214 2.246802
## [411] {pip fruit,
##         yogurt}                => {tropical fruit}      0.006405694 0.3559322 0.017996950 3.392048
## [412] {pip fruit,
##         tropical fruit}        => {other vegetables}    0.009456024 0.4626866 0.020437214 2.391236
## [413] {other vegetables,
##         pip fruit}             => {tropical fruit}      0.009456024 0.3618677 0.026131164 3.448613
## [414] {other vegetables,
```

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##         tropical fruit}          => {pip fruit}          0.009456024  0.2634561 0.035892222 3.482649
## [415] {pip fruit,
##         tropical fruit}          => {whole milk}         0.008439248  0.4129353 0.020437214 1.616084
## [416] {pip fruit,
##         whole milk}              => {tropical fruit}     0.008439248  0.2804054 0.030096594 2.672274
## [417] {pip fruit,
##         root vegetables}         => {yogurt}             0.005287239  0.3398693 0.015556685 2.436308
## [418] {pip fruit,
##         yogurt}                  => {root vegetables}    0.005287239  0.2937853 0.017996950 2.695316
## [419] {pip fruit,
##         root vegetables}         => {other vegetables}   0.008134215  0.5228758 0.015556685 2.702304
## [420] {other vegetables,
##         pip fruit}               => {root vegetables}    0.008134215  0.3112840 0.026131164 2.855857
## [421] {pip fruit,
##         root vegetables}         => {whole milk}         0.008947636  0.5751634 0.015556685 2.250988
## [422] {pip fruit,
##         whole milk}              => {root vegetables}    0.008947636  0.2972973 0.030096594 2.727536
## [423] {pip fruit,
##         yogurt}                  => {other vegetables}   0.008134215  0.4519774 0.017996950 2.335890
## [424] {other vegetables,
##         pip fruit}               => {yogurt}             0.008134215  0.3112840 0.026131164 2.231398
## [425] {pip fruit,
##         yogurt}                  => {whole milk}         0.009557702  0.5310734 0.017996950 2.078435
## [426] {pip fruit,
##         whole milk}              => {yogurt}             0.009557702  0.3175676 0.030096594 2.276441
## [427] {pip fruit,
##         rolls/buns}              => {other vegetables}   0.005083884  0.3649635 0.013929842 1.886188
## [428] {pip fruit,
##         rolls/buns}              => {whole milk}         0.006202339  0.4452555 0.013929842 1.742574
## [429] {other vegetables,
##         pip fruit}               => {whole milk}         0.013523132  0.5175097 0.026131164 2.025351
## [430] {pip fruit,
##         whole milk}              => {other vegetables}   0.013523132  0.4493243 0.030096594 2.322178
## [431] {pastry,
##         sausage}                 => {whole milk}         0.005693950  0.4552846 0.012506355 1.781824
## [432] {pastry,
##         tropical fruit}          => {other vegetables}   0.005083884  0.3846154 0.013218099 1.987752
## [433] {pastry,
##         tropical fruit}          => {whole milk}         0.006710727  0.5076923 0.013218099 1.986930
## [434] {pastry,
##         root vegetables}         => {other vegetables}   0.005897306  0.5370370 0.010981190 2.775491
## [435] {other vegetables,
##         pastry}                  => {root vegetables}    0.005897306  0.2612613 0.022572445 2.396926
## [436] {pastry,
##         root vegetables}         => {whole milk}         0.005693950  0.5185185 0.010981190 2.029299
## [437] {pastry,
##         soda}                    => {rolls/buns}         0.005388917  0.2560386 0.021047280 1.392007
## [438] {pastry,
##         rolls/buns}              => {soda}               0.005388917  0.2572816 0.020945602 1.475431
## [439] {pastry,
##         soda}                    => {other vegetables}   0.005490595  0.2608696 0.021047280 1.348214
## [440] {pastry,
##         soda}                    => {whole milk}         0.008235892  0.3913043 0.021047280 1.531428
## [441] {pastry,
```

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##         yogurt}                  => {rolls/buns}        0.005795628  0.3275862 0.017691917 1.780990
## [442] {pastry,
##         rolls/buns}              => {yogurt}            0.005795628  0.2766990 0.020945602 1.983480
## [443] {pastry,
##         yogurt}                  => {other vegetables}  0.006609049  0.3735632 0.017691917 1.930633
## [444] {other vegetables,
##         pastry}                  => {yogurt}            0.006609049  0.2927928 0.022572445 2.098846
## [445] {pastry,
##         yogurt}                  => {whole milk}        0.009150991  0.5172414 0.017691917 2.024301
## [446] {pastry,
##         whole milk}              => {yogurt}            0.009150991  0.2752294 0.033248602 1.972945
## [447] {pastry,
##         rolls/buns}              => {other vegetables}  0.006100661  0.2912621 0.020945602 1.505288
## [448] {other vegetables,
##         pastry}                  => {rolls/buns}        0.006100661  0.2702703 0.022572445 1.469380
## [449] {pastry,
##         rolls/buns}              => {whole milk}        0.008540925  0.4077670 0.020945602 1.595857
## [450] {pastry,
##         whole milk}              => {rolls/buns}        0.008540925  0.2568807 0.033248602 1.396585
## [451] {other vegetables,
##         pastry}                  => {whole milk}        0.010574479  0.4684685 0.022572445 1.833421
## [452] {pastry,
##         whole milk}              => {other vegetables}  0.010574479  0.3180428 0.033248602 1.643695
## [453] {bottled water,
##         citrus fruit}            => {other vegetables}  0.005083884  0.3759398 0.013523132 1.942916
## [454] {bottled water,
##         citrus fruit}            => {whole milk}        0.005897306  0.4360902 0.013523132 1.706704
## [455] {citrus fruit,
##         tropical fruit}          => {root vegetables}   0.005693950  0.2857143 0.019928826 2.621269
## [456] {citrus fruit,
##         root vegetables}         => {tropical fruit}    0.005693950  0.3218391 0.017691917 3.067139
## [457] {root vegetables,
##         tropical fruit}          => {citrus fruit}      0.005693950  0.2705314 0.021047280 3.268644
## [458] {citrus fruit,
##         tropical fruit}          => {yogurt}            0.006304016  0.3163265 0.019928826 2.267545
## [459] {citrus fruit,
##         yogurt}                  => {tropical fruit}    0.006304016  0.2910798 0.021657346 2.774002
## [460] {citrus fruit,
##         tropical fruit}          => {other vegetables}  0.009049314  0.4540816 0.019928826 2.346765
## [461] {citrus fruit,
##         other vegetables}        => {tropical fruit}    0.009049314  0.3133803 0.028876462 2.986526
## [462] {other vegetables,
##         tropical fruit}          => {citrus fruit}      0.009049314  0.2521246 0.035892222 3.046248
## [463] {citrus fruit,
##         tropical fruit}          => {whole milk}        0.009049314  0.4540816 0.019928826 1.777116
## [464] {citrus fruit,
##         whole milk}              => {tropical fruit}    0.009049314  0.2966667 0.030503305 2.827245
## [465] {citrus fruit,
##         root vegetables}         => {other vegetables}  0.010371124  0.5862069 0.017691917 3.029608
## [466] {citrus fruit,
##         other vegetables}        => {root vegetables}   0.010371124  0.3591549 0.028876462 3.295045
## [467] {citrus fruit,
##         root vegetables}         => {whole milk}        0.009150991  0.5172414 0.017691917 2.024301
## [468] {citrus fruit,
```

```
##          whole milk}          => {root vegetables}   0.009150991 0.3000000 0.030503305 2.752332
## [469] {citrus fruit,
##          yogurt}              => {rolls/buns}        0.005795628 0.2676056 0.021657346 1.454893
## [470] {citrus fruit,
##          rolls/buns}          => {yogurt}            0.005795628 0.3454545 0.016776817 2.476345
## [471] {citrus fruit,
##          yogurt}              => {other vegetables}  0.007625826 0.3521127 0.021657346 1.819773
## [472] {citrus fruit,
##          other vegetables}    => {yogurt}            0.007625826 0.2640845 0.028876462 1.893055
## [473] {citrus fruit,
##          yogurt}              => {whole milk}        0.010269446 0.4741784 0.021657346 1.855768
## [474] {citrus fruit,
##          whole milk}          => {yogurt}            0.010269446 0.3366667 0.030503305 2.413350
## [475] {citrus fruit,
##          rolls/buns}          => {other vegetables}  0.005998983 0.3575758 0.016776817 1.848007
## [476] {citrus fruit,
##          rolls/buns}          => {whole milk}        0.007219115 0.4303030 0.016776817 1.684055
## [477] {citrus fruit,
##          other vegetables}    => {whole milk}        0.013014743 0.4507042 0.028876462 1.763898
## [478] {citrus fruit,
##          whole milk}          => {other vegetables}  0.013014743 0.4266667 0.030503305 2.205080
## [479] {sausage,
##          shopping bags}       => {soda}              0.005693950 0.3636364 0.015658363 2.085343
## [480] {sausage,
##          shopping bags}       => {rolls/buns}        0.005998983 0.3831169 0.015658363 2.082894
## [481] {rolls/buns,
##          shopping bags}       => {sausage}           0.005998983 0.3072917 0.019522115 3.270794
## [482] {sausage,
##          shopping bags}       => {other vegetables}  0.005388917 0.3441558 0.015658363 1.778651
## [483] {root vegetables,
##          shopping bags}       => {other vegetables}  0.006609049 0.5158730 0.012811388 2.666112
## [484] {other vegetables,
##          shopping bags}       => {root vegetables}   0.006609049 0.2850877 0.023182511 2.615520
## [485] {root vegetables,
##          shopping bags}       => {whole milk}        0.005287239 0.4126984 0.012811388 1.615157
## [486] {shopping bags,
##          soda}                => {rolls/buns}        0.006304016 0.2561983 0.024605999 1.392875
## [487] {rolls/buns,
##          shopping bags}       => {soda}              0.006304016 0.3229167 0.019522115 1.851828
## [488] {shopping bags,
##          soda}                => {whole milk}        0.006812405 0.2768595 0.024605999 1.083531
## [489] {shopping bags,
##          whole milk}          => {soda}              0.006812405 0.2780083 0.024504321 1.594292
## [490] {shopping bags,
##          yogurt}              => {other vegetables}  0.005388917 0.3533333 0.015251652 1.826082
## [491] {shopping bags,
##          yogurt}              => {whole milk}        0.005287239 0.3466667 0.015251652 1.356732
## [492] {rolls/buns,
##          shopping bags}       => {other vegetables}  0.005287239 0.2708333 0.019522115 1.399709
## [493] {rolls/buns,
##          shopping bags}       => {whole milk}        0.005287239 0.2708333 0.019522115 1.059947
## [494] {other vegetables,
##          shopping bags}       => {whole milk}        0.007625826 0.3289474 0.023182511 1.287385
## [495] {shopping bags,
```

```
##          whole milk}                => {other vegetables}  0.007625826  0.3112033  0.024504321  1.608347
## [496] {bottled water,
##          sausage}                   => {other vegetables}  0.005083884  0.4237288  0.011997966  2.189896
## [497] {sausage,
##          tropical fruit}            => {other vegetables}  0.005998983  0.4306569  0.013929842  2.225702
## [498] {sausage,
##          tropical fruit}            => {whole milk}        0.007219115  0.5182482  0.013929842  2.028241
## [499] {root vegetables,
##          sausage}                   => {yogurt}            0.005185562  0.3469388  0.014946619  2.486985
## [500] {sausage,
##          yogurt}                    => {root vegetables}   0.005185562  0.2642487  0.019623793  2.424334
## [501] {root vegetables,
##          sausage}                   => {other vegetables}  0.006812405  0.4557823  0.014946619  2.355554
## [502] {other vegetables,
##          sausage}                   => {root vegetables}   0.006812405  0.2528302  0.026944586  2.319575
## [503] {root vegetables,
##          sausage}                   => {whole milk}        0.007727504  0.5170068  0.014946619  2.023383
## [504] {sausage,
##          whole milk}                => {root vegetables}   0.007727504  0.2585034  0.029893238  2.371624
## [505] {sausage,
##          yogurt}                    => {soda}              0.005592272  0.2849741  0.019623793  1.634239
## [506] {sausage,
##          soda}                      => {rolls/buns}        0.009659380  0.3974895  0.024300966  2.161034
## [507] {rolls/buns,
##          sausage}                   => {soda}              0.009659380  0.3156146  0.030604982  1.809953
## [508] {rolls/buns,
##          soda}                      => {sausage}           0.009659380  0.2519894  0.038332486  2.682160
## [509] {sausage,
##          soda}                      => {other vegetables}  0.007219115  0.2970711  0.024300966  1.535310
## [510] {other vegetables,
##          sausage}                   => {soda}              0.007219115  0.2679245  0.026944586  1.536465
## [511] {sausage,
##          soda}                      => {whole milk}        0.006710727  0.2761506  0.024300966  1.080757
## [512] {sausage,
##          yogurt}                    => {rolls/buns}        0.005998983  0.3056995  0.019623793  1.661998
## [513] {sausage,
##          yogurt}                    => {other vegetables}  0.008134215  0.4145078  0.019623793  2.142241
## [514] {other vegetables,
##          sausage}                   => {yogurt}            0.008134215  0.3018868  0.026944586  2.164035
## [515] {sausage,
##          yogurt}                    => {whole milk}        0.008744281  0.4455959  0.019623793  1.743906
## [516] {sausage,
##          whole milk}                => {yogurt}            0.008744281  0.2925170  0.029893238  2.096869
## [517] {rolls/buns,
##          sausage}                   => {other vegetables}  0.008845958  0.2890365  0.030604982  1.493786
## [518] {other vegetables,
##          sausage}                   => {rolls/buns}        0.008845958  0.3283019  0.026944586  1.784881
## [519] {rolls/buns,
##          sausage}                   => {whole milk}        0.009354347  0.3056478  0.030604982  1.196198
## [520] {sausage,
##          whole milk}                => {rolls/buns}        0.009354347  0.3129252  0.029893238  1.701282
## [521] {other vegetables,
##          sausage}                   => {whole milk}        0.010167768  0.3773585  0.026944586  1.476849
## [522] {sausage,
```

```
##         whole milk}              => {other vegetables}  0.010167768  0.3401361 0.029893238 1.757876
## [523] {bottled water,
##         tropical fruit}          => {soda}              0.005185562  0.2802198 0.018505338 1.606975
## [524] {bottled water,
##         tropical fruit}          => {yogurt}            0.007117438  0.3846154 0.018505338 2.757064
## [525] {bottled water,
##         yogurt}                  => {tropical fruit}    0.007117438  0.3097345 0.022979156 2.951782
## [526] {bottled water,
##         tropical fruit}          => {rolls/buns}        0.005388917  0.2912088 0.018505338 1.583216
## [527] {bottled water,
##         tropical fruit}          => {other vegetables}  0.006202339  0.3351648 0.018505338 1.732184
## [528] {bottled water,
##         tropical fruit}          => {whole milk}        0.008032537  0.4340659 0.018505338 1.698782
## [529] {bottled water,
##         root vegetables}         => {other vegetables}  0.007015760  0.4480519 0.015658363 2.315602
## [530] {bottled water,
##         other vegetables}        => {root vegetables}   0.007015760  0.2827869 0.024809354 2.594411
## [531] {bottled water,
##         root vegetables}         => {whole milk}        0.007320793  0.4675325 0.015658363 1.829758
## [532] {bottled water,
##         soda}                    => {yogurt}            0.007422471  0.2561404 0.028978139 1.836108
## [533] {bottled water,
##         yogurt}                  => {soda}              0.007422471  0.3230088 0.022979156 1.852357
## [534] {soda,
##         yogurt}                  => {bottled water}     0.007422471  0.2713755 0.027351296 2.455361
## [535] {bottled water,
##         rolls/buns}              => {soda}              0.006812405  0.2815126 0.024199288 1.614389
## [536] {bottled water,
##         soda}                    => {whole milk}        0.007524148  0.2596491 0.028978139 1.016176
## [537] {bottled water,
##         yogurt}                  => {rolls/buns}        0.007117438  0.3097345 0.022979156 1.683935
## [538] {bottled water,
##         rolls/buns}              => {yogurt}            0.007117438  0.2941176 0.024199288 2.108343
## [539] {bottled water,
##         yogurt}                  => {other vegetables}  0.008134215  0.3539823 0.022979156 1.829436
## [540] {bottled water,
##         other vegetables}        => {yogurt}            0.008134215  0.3278689 0.024809354 2.350284
## [541] {bottled water,
##         yogurt}                  => {whole milk}        0.009659380  0.4203540 0.022979156 1.645118
## [542] {bottled water,
##         whole milk}              => {yogurt}            0.009659380  0.2810651 0.034367056 2.014778
## [543] {bottled water,
##         rolls/buns}              => {other vegetables}  0.007320793  0.3025210 0.024199288 1.563476
## [544] {bottled water,
##         other vegetables}        => {rolls/buns}        0.007320793  0.2950820 0.024809354 1.604274
## [545] {bottled water,
##         rolls/buns}              => {whole milk}        0.008744281  0.3613445 0.024199288 1.414176
## [546] {bottled water,
##         whole milk}              => {rolls/buns}        0.008744281  0.2544379 0.034367056 1.383304
## [547] {bottled water,
##         other vegetables}        => {whole milk}        0.010777834  0.4344262 0.024809354 1.700192
## [548] {bottled water,
##         whole milk}              => {other vegetables}  0.010777834  0.3136095 0.034367056 1.620783
## [549] {root vegetables,
```

```
##          tropical fruit}         => {yogurt}          0.008134215 0.3864734 0.021047280 2.770384
## [550] {tropical fruit,
##          yogurt}                 => {root vegetables} 0.008134215 0.2777778 0.029283172 2.548456
## [551] {root vegetables,
##          yogurt}                 => {tropical fruit}  0.008134215 0.3149606 0.025826131 3.001587
## [552] {root vegetables,
##          tropical fruit}         => {rolls/buns}      0.005897306 0.2801932 0.021047280 1.523328
## [553] {root vegetables,
##          tropical fruit}         => {other vegetables} 0.012302999 0.5845411 0.021047280 3.020999
## [554] {other vegetables,
##          tropical fruit}         => {root vegetables} 0.012302999 0.3427762 0.035892222 3.144780
## [555] {other vegetables,
##          root vegetables}        => {tropical fruit}  0.012302999 0.2596567 0.047381800 2.474538
## [556] {root vegetables,
##          tropical fruit}         => {whole milk}      0.011997966 0.5700483 0.021047280 2.230969
## [557] {tropical fruit,
##          whole milk}             => {root vegetables} 0.011997966 0.2836538 0.042297916 2.602365
## [558] {soda,
##          tropical fruit}         => {yogurt}          0.006609049 0.3170732 0.020843925 2.272897
## [559] {soda,
##          tropical fruit}         => {rolls/buns}      0.005388917 0.2585366 0.020843925 1.405587
## [560] {soda,
##          tropical fruit}         => {other vegetables} 0.007219115 0.3463415 0.020843925 1.789947
## [561] {soda,
##          tropical fruit}         => {whole milk}      0.007829181 0.3756098 0.020843925 1.470005
## [562] {tropical fruit,
##          yogurt}                 => {rolls/buns}      0.008744281 0.2986111 0.029283172 1.623461
## [563] {rolls/buns,
##          tropical fruit}         => {yogurt}          0.008744281 0.3553719 0.024605999 2.547436
## [564] {rolls/buns,
##          yogurt}                 => {tropical fruit}  0.008744281 0.2544379 0.034367056 2.424803
## [565] {tropical fruit,
##          yogurt}                 => {other vegetables} 0.012302999 0.4201389 0.029283172 2.171343
## [566] {other vegetables,
##          tropical fruit}         => {yogurt}          0.012302999 0.3427762 0.035892222 2.457146
## [567] {other vegetables,
##          yogurt}                 => {tropical fruit}  0.012302999 0.2833724 0.043416370 2.700550
## [568] {tropical fruit,
##          yogurt}                 => {whole milk}      0.015149975 0.5173611 0.029283172 2.024770
## [569] {tropical fruit,
##          whole milk}             => {yogurt}          0.015149975 0.3581731 0.042297916 2.567516
## [570] {whole milk,
##          yogurt}                 => {tropical fruit}  0.015149975 0.2704174 0.056024403 2.577089
## [571] {rolls/buns,
##          tropical fruit}         => {other vegetables} 0.007829181 0.3181818 0.024605999 1.644413
## [572] {rolls/buns,
##          tropical fruit}         => {whole milk}      0.010981190 0.4462810 0.024605999 1.746587
## [573] {tropical fruit,
##          whole milk}             => {rolls/buns}      0.010981190 0.2596154 0.042297916 1.411452
## [574] {other vegetables,
##          tropical fruit}         => {whole milk}      0.017081851 0.4759207 0.035892222 1.862587
## [575] {tropical fruit,
##          whole milk}             => {other vegetables} 0.017081851 0.4038462 0.042297916 2.087140
## [576] {root vegetables,
```

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```
##           soda}                    => {other vegetables}  0.008235892 0.4426230 0.018607016 2.287544
## [577] {other vegetables,
##           soda}                    => {root vegetables}   0.008235892 0.2515528 0.032740214 2.307856
## [578] {root vegetables,
##           soda}                    => {whole milk}        0.008134215 0.4371585 0.018607016 1.710885
## [579] {root vegetables,
##           yogurt}                  => {rolls/buns}        0.007219115 0.2795276 0.025826131 1.519709
## [580] {rolls/buns,
##           root vegetables}         => {yogurt}            0.007219115 0.2970711 0.024300966 2.129515
## [581] {root vegetables,
##           yogurt}                  => {other vegetables}  0.012913066 0.5000000 0.025826131 2.584078
## [582] {other vegetables,
##           root vegetables}         => {yogurt}            0.012913066 0.2725322 0.047381800 1.953611
## [583] {other vegetables,
##           yogurt}                  => {root vegetables}   0.012913066 0.2974239 0.043416370 2.728698
## [584] {root vegetables,
##           yogurt}                  => {whole milk}        0.014539908 0.5629921 0.025826131 2.203354
## [585] {root vegetables,
##           whole milk}              => {yogurt}            0.014539908 0.2972973 0.048906965 2.131136
## [586] {whole milk,
##           yogurt}                  => {root vegetables}   0.014539908 0.2595281 0.056024403 2.381025
## [587] {rolls/buns,
##           root vegetables}         => {other vegetables}  0.012201322 0.5020921 0.024300966 2.594890
## [588] {other vegetables,
##           root vegetables}         => {rolls/buns}        0.012201322 0.2575107 0.047381800 1.400010
## [589] {other vegetables,
##           rolls/buns}              => {root vegetables}   0.012201322 0.2863962 0.042602949 2.627525
## [590] {rolls/buns,
##           root vegetables}         => {whole milk}        0.012709710 0.5230126 0.024300966 2.046888
## [591] {root vegetables,
##           whole milk}              => {rolls/buns}        0.012709710 0.2598753 0.048906965 1.412865
## [592] {other vegetables,
##           root vegetables}         => {whole milk}        0.023182511 0.4892704 0.047381800 1.914833
## [593] {root vegetables,
##           whole milk}              => {other vegetables}  0.023182511 0.4740125 0.048906965 2.449770
## [594] {other vegetables,
##           whole milk}              => {root vegetables}   0.023182511 0.3097826 0.074834774 2.842082
## [595] {soda,
##           yogurt}                  => {rolls/buns}        0.008642603 0.3159851 0.027351296 1.717918
## [596] {rolls/buns,
##           yogurt}                  => {soda}              0.008642603 0.2514793 0.034367056 1.442157
## [597] {soda,
##           yogurt}                  => {other vegetables}  0.008337570 0.3048327 0.027351296 1.575423
## [598] {other vegetables,
##           soda}                    => {yogurt}            0.008337570 0.2546584 0.032740214 1.825485
## [599] {soda,
##           yogurt}                  => {whole milk}        0.010472801 0.3828996 0.027351296 1.498535
## [600] {soda,
##           whole milk}              => {yogurt}            0.010472801 0.2614213 0.040061007 1.873964
## [601] {rolls/buns,
##           soda}                    => {other vegetables}  0.009862735 0.2572944 0.038332486 1.329738
## [602] {other vegetables,
##           soda}                    => {rolls/buns}        0.009862735 0.3012422 0.032740214 1.637765
## [603] {other vegetables,
```

```
##           soda}                    => {whole milk}        0.013929842  0.4254658 0.032740214 1.665124
## [604] {soda,
##        whole milk}                 => {other vegetables}  0.013929842  0.3477157 0.040061007 1.797049
## [605] {rolls/buns,
##        yogurt}                     => {other vegetables}  0.011489578  0.3343195 0.034367056 1.727815
## [606] {other vegetables,
##        yogurt}                     => {rolls/buns}        0.011489578  0.2646370 0.043416370 1.438753
## [607] {other vegetables,
##        rolls/buns}                 => {yogurt}            0.011489578  0.2696897 0.042602949 1.933235
## [608] {rolls/buns,
##        yogurt}                     => {whole milk}        0.015556685  0.4526627 0.034367056 1.771563
## [609] {whole milk,
##        yogurt}                     => {rolls/buns}        0.015556685  0.2776770 0.056024403 1.509648
## [610] {rolls/buns,
##        whole milk}                 => {yogurt}            0.015556685  0.2746858 0.056634469 1.969049
## [611] {other vegetables,
##        yogurt}                     => {whole milk}        0.022267412  0.5128806 0.043416370 2.007235
## [612] {whole milk,
##        yogurt}                     => {other vegetables}  0.022267412  0.3974592 0.056024403 2.054131
## [613] {other vegetables,
##        whole milk}                 => {yogurt}            0.022267412  0.2975543 0.074834774 2.132979
## [614] {other vegetables,
##        rolls/buns}                 => {whole milk}        0.017895272  0.4200477 0.042602949 1.643919
## [615] {rolls/buns,
##        whole milk}                 => {other vegetables}  0.017895272  0.3159785 0.056634469 1.633026
```

Next, we plot our "related" subset out in a way that visualizes associations.

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

Scatter plot for 1908 rules
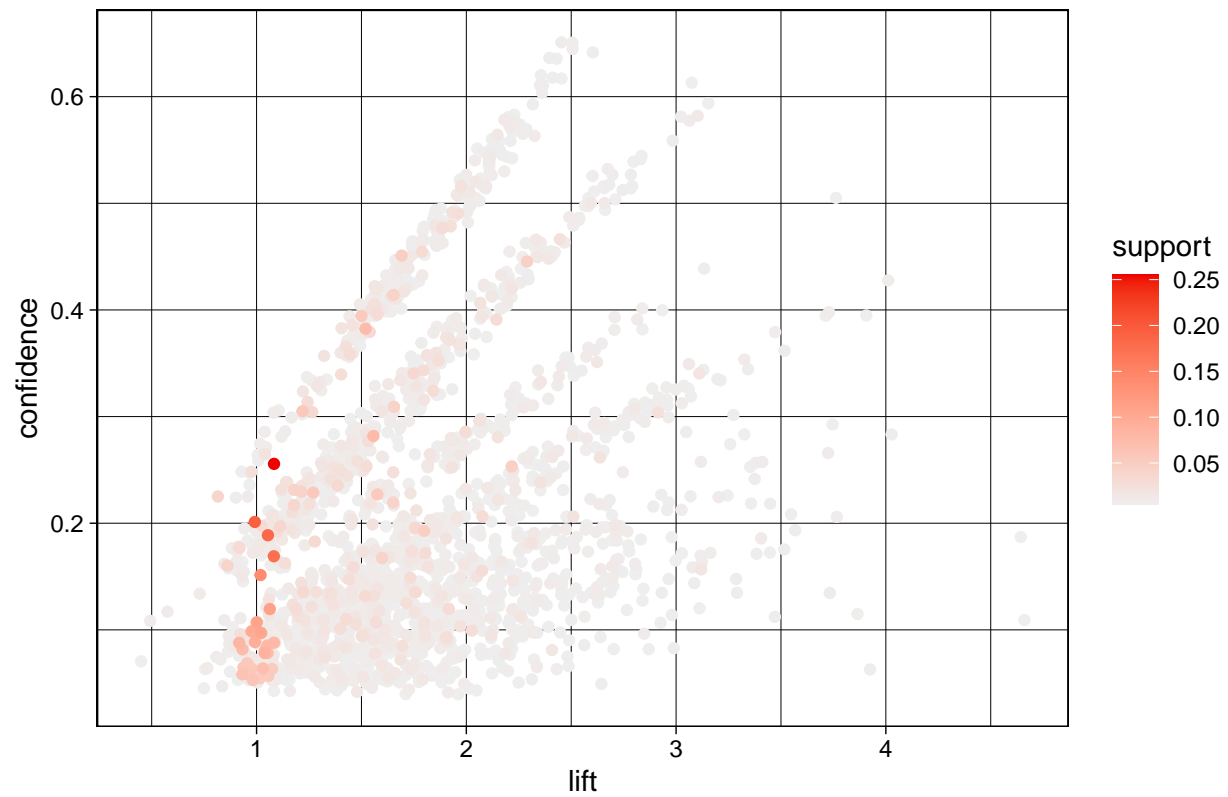
To reduce overplotting, jitter is added! Use jitter = 0 to prevent jitter.

Scatter plot for 1908 rules

```
##      lhs                      rhs                       support confidence   coverage     lift
## [1]  {cake bar}            => {whole milk}          0.005592272  0.4230769 0.013218099 1.655775
## [2]  {dishes}              => {other vegetables}    0.005998983  0.3410405 0.017590239 1.762550
## [3]  {dishes}              => {whole milk}          0.005287239  0.3005780 0.017590239 1.176357
## [4]  {mustard}             => {whole milk}          0.005185562  0.4322034 0.011997966 1.691492
## [5]  {pot plants}          => {whole milk}          0.006914082  0.4000000 0.017285206 1.565460
## [6]  {chewing gum}         => {soda}                0.005388917  0.2560386 0.021047280 1.468303
## [7]  {canned fish}         => {other vegetables}    0.005083884  0.3378378 0.015048297 1.745998
## [8]  {pasta}               => {whole milk}          0.006100661  0.4054054 0.015048297 1.586614
## [9]  {herbs}               => {root vegetables}     0.007015760  0.4312500 0.016268429 3.956477
## [10] {herbs}               => {other vegetables}    0.007727504  0.4750000 0.016268429 2.454874
## [11] {herbs}               => {whole milk}          0.007727504  0.4750000 0.016268429 1.858983
## [12] {processed cheese}    => {soda}                0.005287239  0.3190184 0.016573462 1.829473
## [13] {processed cheese}    => {other vegetables}    0.005490595  0.3312883 0.016573462 1.712150
## [14] {processed cheese}    => {whole milk}          0.007015760  0.4233129 0.016573462 1.656698
## [15] {semi-finished bread} => {other vegetables}    0.005185562  0.2931034 0.017691917 1.514804
## [16] {semi-finished bread} => {whole milk}          0.007117438  0.4022989 0.017691917 1.574457
## [17] {beverages}           => {whole milk}          0.006812405  0.2617188 0.026029487 1.024275
## [18] {detergent}           => {other vegetables}    0.006405694  0.3333333 0.019217082 1.722719
## [19] {detergent}           => {whole milk}          0.008947636  0.4656085 0.019217082 1.822228
## [20] {pickled vegetables}  => {other vegetables}    0.006405694  0.3579545 0.017895272 1.849965
## [21] {pickled vegetables}  => {whole milk}          0.007117438  0.3977273 0.017895272 1.556565
## [22] {baking powder}       => {other vegetables}    0.007320793  0.4137931 0.017691917 2.138547
## [23] {baking powder}       => {whole milk}          0.009252669  0.5229885 0.017691917 2.046793
## [24] {flour}               => {other vegetables}    0.006304016  0.3625731 0.017386884 1.873834
## [25] {flour}               => {whole milk}          0.008439248  0.4853801 0.017386884 1.899607
```

```
## [26]  {soft cheese}          => {yogurt}              0.005998983  0.3511905 0.017081851 2.517462
## [27]  {soft cheese}          => {rolls/buns}          0.005388917  0.3154762 0.017081851 1.715151
## [28]  {soft cheese}          => {other vegetables}    0.007117438  0.4166667 0.017081851 2.153398
## [29]  {soft cheese}          => {whole milk}          0.007524148  0.4404762 0.017081851 1.723869
## [30]  {specialty bar}        => {soda}                0.007219115  0.2639405 0.027351296 1.513618
## [31]  {misc. beverages}      => {soda}                0.007320793  0.2580645 0.028368073 1.479921
## [32]  {grapes}               => {tropical fruit}      0.006100661  0.2727273 0.022369090 2.599101
## [33]  {grapes}               => {other vegetables}    0.009049314  0.4045455 0.022369090 2.090754
## [34]  {grapes}               => {whole milk}          0.007320793  0.3272727 0.022369090 1.280831
## [35]  {cat food}             => {yogurt}              0.006202339  0.2663755 0.023284189 1.909478
## [36]  {cat food}             => {other vegetables}    0.006507372  0.2794760 0.023284189 1.444375
## [37]  {cat food}             => {whole milk}          0.008845958  0.3799127 0.023284189 1.486845
## [38]  {specialty chocolate}  => {whole milk}          0.008032537  0.2642140 0.030401627 1.034041
## [39]  {meat}                 => {rolls/buns}          0.006914082  0.2677165 0.025826131 1.455496
## [40]  {meat}                 => {other vegetables}    0.009964413  0.3858268 0.025826131 1.994013
## [41]  {meat}                 => {whole milk}          0.009964413  0.3858268 0.025826131 1.509991
## [42]  {frozen meals}         => {other vegetables}    0.007524148  0.2652330 0.028368073 1.370765
## [43]  {frozen meals}         => {whole milk}          0.009862735  0.3476703 0.028368073 1.360659
## [44]  {hard cheese}          => {yogurt}              0.006405694  0.2614108 0.024504321 1.873889
## [45]  {hard cheese}          => {other vegetables}    0.009456024  0.3858921 0.024504321 1.994350
## [46]  {hard cheese}          => {whole milk}          0.010066090  0.4107884 0.024504321 1.607682
## [47]  {butter milk}          => {yogurt}              0.008540925  0.3054545 0.027961362 2.189610
## [48]  {butter milk}          => {rolls/buns}          0.007625826  0.2727273 0.027961362 1.482738
## [49]  {butter milk}          => {other vegetables}    0.010371124  0.3709091 0.027961362 1.916916
## [50]  {butter milk}          => {whole milk}          0.011591256  0.4145455 0.027961362 1.622385
## [51]  {candy}                => {soda}                0.008642603  0.2891156 0.029893238 1.657990
## [52]  {candy}                => {whole milk}          0.008235892  0.2755102 0.029893238 1.078250
## [53]  {ham}                  => {yogurt}              0.006710727  0.2578125 0.026029487 1.848095
## [54]  {ham}                  => {rolls/buns}          0.006914082  0.2656250 0.026029487 1.444125
## [55]  {ham}                  => {other vegetables}    0.009150991  0.3515625 0.026029487 1.816930
## [56]  {ham}                  => {whole milk}          0.011489578  0.4414062 0.026029487 1.727509
## [57]  {sliced cheese}        => {sausage}             0.007015760  0.2863071 0.024504321 3.047435
## [58]  {sliced cheese}        => {yogurt}              0.008032537  0.3278008 0.024504321 2.349797
## [59]  {sliced cheese}        => {rolls/buns}          0.007625826  0.3112033 0.024504321 1.691921
## [60]  {sliced cheese}        => {other vegetables}    0.009049314  0.3692946 0.024504321 1.908572
## [61]  {sliced cheese}        => {whole milk}          0.010777834  0.4398340 0.024504321 1.721356
## [62]  {oil}                  => {other vegetables}    0.009964413  0.3550725 0.028063040 1.835070
## [63]  {oil}                  => {whole milk}          0.011286223  0.4021739 0.028063040 1.573968
## [64]  {onions}               => {root vegetables}     0.009456024  0.3049180 0.031011693 2.797452
## [65]  {onions}               => {other vegetables}    0.014234875  0.4590164 0.031011693 2.372268
## [66]  {onions}               => {whole milk}          0.012099644  0.3901639 0.031011693 1.526965
## [67]  {berries}              => {whipped/sour cream}  0.009049314  0.2721713 0.033248602 3.796886
## [68]  {berries}              => {yogurt}              0.010574479  0.3180428 0.033248602 2.279848
## [69]  {berries}              => {other vegetables}    0.010269446  0.3088685 0.033248602 1.596280
## [70]  {berries}              => {whole milk}          0.011794611  0.3547401 0.033248602 1.388328
## [71]  {hamburger meat}       => {rolls/buns}          0.008642603  0.2599388 0.033248602 1.413211
## [72]  {hamburger meat}       => {other vegetables}    0.013828165  0.4159021 0.033248602 2.149447
## [73]  {hamburger meat}       => {whole milk}          0.014743264  0.4434251 0.033248602 1.735410
## [74]  {hygiene articles}     => {other vegetables}    0.009557702  0.2901235 0.032943569 1.499403
## [75]  {hygiene articles}     => {whole milk}          0.012811388  0.3888889 0.032943569 1.521975
## [76]  {salty snack}          => {other vegetables}    0.010777834  0.2849462 0.037824098 1.472646
## [77]  {salty snack}          => {whole milk}          0.011184545  0.2956989 0.037824098 1.157262
## [78]  {sugar}                => {other vegetables}    0.010777834  0.3183183 0.033858668 1.645119
## [79]  {sugar}                => {whole milk}          0.015048297  0.4444444 0.033858668 1.739400
```

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## [80]  {waffles}                 => {other vegetables} 0.010066090 0.2619048 0.038434164 1.353565
## [81]  {waffles}                 => {whole milk}       0.012709710 0.3306878 0.038434164 1.294196
## [82]  {long life bakery product} => {other vegetables} 0.010676157 0.2853261 0.037417387 1.474610
## [83]  {long life bakery product} => {whole milk}       0.013523132 0.3614130 0.037417387 1.414444
## [84]  {dessert}                 => {soda}             0.009862735 0.2657534 0.037112354 1.524015
## [85]  {dessert}                 => {yogurt}           0.009862735 0.2657534 0.037112354 1.905018
## [86]  {dessert}                 => {other vegetables} 0.011591256 0.3123288 0.037112354 1.614164
## [87]  {dessert}                 => {whole milk}       0.013726487 0.3698630 0.037112354 1.447514
## [88]  {cream cheese }           => {yogurt}           0.012404677 0.3128205 0.039654296 2.242412
## [89]  {cream cheese }           => {rolls/buns}       0.009964413 0.2512821 0.039654296 1.366146
## [90]  {cream cheese }           => {other vegetables} 0.013726487 0.3461538 0.039654296 1.788977
## [91]  {cream cheese }           => {whole milk}       0.016471784 0.4153846 0.039654296 1.625670
## [92]  {chicken}                 => {root vegetables}  0.010879512 0.2535545 0.042907982 2.326221
## [93]  {chicken}                 => {other vegetables} 0.017895272 0.4170616 0.042907982 2.155439
## [94]  {chicken}                 => {whole milk}       0.017590239 0.4099526 0.042907982 1.604411
## [95]  {white bread}             => {other vegetables} 0.013726487 0.3260870 0.042094560 1.685268
## [96]  {white bread}             => {whole milk}       0.017081851 0.4057971 0.042094560 1.588147
## [97]  {chocolate}               => {soda}             0.013523132 0.2725410 0.049618709 1.562939
## [98]  {chocolate}               => {other vegetables} 0.012709710 0.2561475 0.049618709 1.323810
## [99]  {chocolate}               => {whole milk}       0.016675140 0.3360656 0.049618709 1.315243
## [100] {coffee}                  => {whole milk}       0.018708693 0.3222417 0.058057956 1.261141
## [101] {frozen vegetables}       => {yogurt}           0.012404677 0.2579281 0.048093543 1.848924
## [102] {frozen vegetables}       => {other vegetables} 0.017793594 0.3699789 0.048093543 1.912108
## [103] {frozen vegetables}       => {whole milk}       0.020437214 0.4249471 0.048093543 1.663094
## [104] {beef}                    => {root vegetables}  0.017386884 0.3313953 0.052465684 3.040367
## [105] {beef}                    => {rolls/buns}       0.013624809 0.2596899 0.052465684 1.411858
## [106] {beef}                    => {other vegetables} 0.019725470 0.3759690 0.052465684 1.943066
## [107] {beef}                    => {whole milk}       0.021250635 0.4050388 0.052465684 1.585180
## [108] {curd}                    => {yogurt}           0.017285206 0.3244275 0.053279105 2.325615
## [109] {curd}                    => {other vegetables} 0.017183528 0.3225191 0.053279105 1.666829
## [110] {curd}                    => {whole milk}       0.026131164 0.4904580 0.053279105 1.919481
## [111] {napkins}                 => {other vegetables} 0.014438231 0.2757282 0.052364006 1.425006
## [112] {napkins}                 => {whole milk}       0.019725470 0.3766990 0.052364006 1.474268
## [113] {pork}                    => {other vegetables} 0.021657346 0.3756614 0.057651246 1.941476
## [114] {pork}                    => {whole milk}       0.022165735 0.3844797 0.057651246 1.504719
## [115] {frankfurter}             => {rolls/buns}       0.019217082 0.3258621 0.058973055 1.771616
## [116] {frankfurter}             => {other vegetables} 0.016471784 0.2793103 0.058973055 1.443519
## [117] {frankfurter}             => {whole milk}       0.020538892 0.3482759 0.058973055 1.363029
## [118] {brown bread}             => {other vegetables} 0.018708693 0.2884013 0.064870361 1.490503
## [119] {brown bread}             => {whole milk}       0.025216065 0.3887147 0.064870361 1.521293
## [120] {margarine}               => {rolls/buns}       0.014743264 0.2517361 0.058566345 1.368615
## [121] {margarine}               => {other vegetables} 0.019725470 0.3368056 0.058566345 1.740663
## [122] {margarine}               => {whole milk}       0.024199288 0.4131944 0.058566345 1.617098
## [123] {butter}                  => {yogurt}           0.014641586 0.2642202 0.055414337 1.894027
## [124] {butter}                  => {other vegetables} 0.020030503 0.3614679 0.055414337 1.868122
## [125] {butter}                  => {whole milk}       0.027554652 0.4972477 0.055414337 1.946053
## [126] {newspapers}              => {whole milk}       0.027351296 0.3426752 0.079816980 1.341110
## [127] {domestic eggs}           => {other vegetables} 0.022267412 0.3509615 0.063446873 1.813824
## [128] {domestic eggs}           => {whole milk}       0.029994916 0.4727564 0.063446873 1.850203
## [129] {fruit/vegetable juice}   => {soda}             0.018403660 0.2545710 0.072292832 1.459887
## [130] {fruit/vegetable juice}   => {yogurt}           0.018708693 0.2587904 0.072292832 1.855105
## [131] {fruit/vegetable juice}   => {other vegetables} 0.021047280 0.2911392 0.072292832 1.504653
## [132] {fruit/vegetable juice}   => {whole milk}       0.026639553 0.3684951 0.072292832 1.442160
## [133] {whipped/sour cream}      => {yogurt}           0.020742247 0.2893617 0.071682766 2.074251
```

```
## [134] {whipped/sour cream}        => {other vegetables}  0.028876462  0.4028369 0.071682766 2.081924
## [135] {whipped/sour cream}        => {whole milk}        0.032231825  0.4496454 0.071682766 1.759754
## [136] {pip fruit}                 => {tropical fruit}    0.020437214  0.2701613 0.075648195 2.574648
## [137] {pip fruit}                 => {other vegetables}  0.026131164  0.3454301 0.075648195 1.785237
## [138] {pip fruit}                 => {whole milk}        0.030096594  0.3978495 0.075648195 1.557043
## [139] {pastry}                    => {other vegetables}  0.022572445  0.2537143 0.088967972 1.311235
## [140] {pastry}                    => {whole milk}        0.033248602  0.3737143 0.088967972 1.462587
## [141] {citrus fruit}              => {yogurt}            0.021657346  0.2616708 0.082765633 1.875752
## [142] {citrus fruit}              => {other vegetables}  0.028876462  0.3488943 0.082765633 1.803140
## [143] {citrus fruit}              => {whole milk}        0.030503305  0.3685504 0.082765633 1.442377
## [144] {sausage}                   => {soda}              0.024300966  0.2586580 0.093950178 1.483324
## [145] {sausage}                   => {rolls/buns}        0.030604982  0.3257576 0.093950178 1.771048
## [146] {sausage}                   => {other vegetables}  0.026944586  0.2867965 0.093950178 1.482209
## [147] {sausage}                   => {whole milk}        0.029893238  0.3181818 0.093950178 1.245252
## [148] {bottled water}             => {soda}              0.028978139  0.2621895 0.110523640 1.503577
## [149] {bottled water}             => {whole milk}        0.034367056  0.3109476 0.110523640 1.216940
## [150] {tropical fruit}            => {yogurt}            0.029283172  0.2790698 0.104931368 2.000475
## [151] {tropical fruit}            => {other vegetables}  0.035892222  0.3420543 0.104931368 1.767790
## [152] {tropical fruit}            => {whole milk}        0.042297916  0.4031008 0.104931368 1.577595
## [153] {root vegetables}           => {other vegetables}  0.047381800  0.4347015 0.108998475 2.246605
## [154] {root vegetables}           => {whole milk}        0.048906965  0.4486940 0.108998475 1.756031
## [155] {yogurt}                    => {other vegetables}  0.043416370  0.3112245 0.139501779 1.608457
## [156] {yogurt}                    => {whole milk}        0.056024403  0.4016035 0.139501779 1.571735
## [157] {rolls/buns}                => {whole milk}        0.056634469  0.3079049 0.183934926 1.205032
## [158] {other vegetables}          => {whole milk}        0.074834774  0.3867578 0.193492628 1.513634
## [159] {whole milk}                => {other vegetables}  0.074834774  0.2928770 0.255516014 1.513634
## [160] {oil,
##        other vegetables}          => {whole milk}        0.005083884  0.5102041 0.009964413 1.996760
## [161] {oil,
##        whole milk}                => {other vegetables}  0.005083884  0.4504505 0.011286223 2.327998
## [162] {onions,
##        root vegetables}           => {other vegetables}  0.005693950  0.6021505 0.009456024 3.112008
## [163] {onions,
##        other vegetables}          => {root vegetables}   0.005693950  0.4000000 0.014234875 3.669776
## [164] {onions,
##        other vegetables}          => {whole milk}        0.006609049  0.4642857 0.014234875 1.817051
## [165] {onions,
##        whole milk}                => {other vegetables}  0.006609049  0.5462185 0.012099644 2.822942
## [166] {hamburger meat,
##        other vegetables}          => {whole milk}        0.006304016  0.4558824 0.013828165 1.784164
## [167] {hamburger meat,
##        whole milk}                => {other vegetables}  0.006304016  0.4275862 0.014743264 2.209832
## [168] {hygiene articles,
##        other vegetables}          => {whole milk}        0.005185562  0.5425532 0.009557702 2.123363
## [169] {hygiene articles,
##        whole milk}                => {other vegetables}  0.005185562  0.4047619 0.012811388 2.091872
## [170] {other vegetables,
##        sugar}                     => {whole milk}        0.006304016  0.5849057 0.010777834 2.289115
## [171] {sugar,
##        whole milk}                => {other vegetables}  0.006304016  0.4189189 0.015048297 2.165038
## [172] {long life bakery product,
##        other vegetables}          => {whole milk}        0.005693950  0.5333333 0.010676157 2.087279
## [173] {long life bakery product,
##        whole milk}                => {other vegetables}  0.005693950  0.4210526 0.013523132 2.176065
```

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## [174] {cream cheese ,
##        yogurt}                => {other vegetables}  0.005287239  0.4262295 0.012404677 2.202820
## [175] {cream cheese ,
##        other vegetables}      => {yogurt}            0.005287239  0.3851852 0.013726487 2.761149
## [176] {cream cheese ,
##        yogurt}                => {whole milk}        0.006609049  0.5327869 0.012404677 2.085141
## [177] {cream cheese ,
##        whole milk}            => {yogurt}            0.006609049  0.4012346 0.016471784 2.876197
## [178] {cream cheese ,
##        other vegetables}      => {whole milk}        0.006710727  0.4888889 0.013726487 1.913340
## [179] {cream cheese ,
##        whole milk}            => {other vegetables}  0.006710727  0.4074074 0.016471784 2.105545
## [180] {chicken,
##        root vegetables}       => {other vegetables}  0.005693950  0.5233645 0.010879512 2.704829
## [181] {chicken,
##        other vegetables}      => {root vegetables}   0.005693950  0.3181818 0.017895272 2.919140
## [182] {chicken,
##        root vegetables}       => {whole milk}        0.005998983  0.5514019 0.010879512 2.157993
## [183] {chicken,
##        whole milk}            => {root vegetables}   0.005998983  0.3410405 0.017590239 3.128855
## [184] {chicken,
##        rolls/buns}            => {whole milk}        0.005287239  0.5473684 0.009659380 2.142208
## [185] {chicken,
##        whole milk}            => {rolls/buns}        0.005287239  0.3005780 0.017590239 1.634154
## [186] {chicken,
##        other vegetables}      => {whole milk}        0.008439248  0.4715909 0.017895272 1.845641
## [187] {chicken,
##        whole milk}            => {other vegetables}  0.008439248  0.4797688 0.017590239 2.479520
## [188] {other vegetables,
##        white bread}           => {whole milk}        0.005897306  0.4296296 0.013726487 1.681420
## [189] {white bread,
##        whole milk}            => {other vegetables}  0.005897306  0.3452381 0.017081851 1.784244
## [190] {chocolate,
##        soda}                  => {whole milk}        0.005083884  0.3759398 0.013523132 1.471297
## [191] {chocolate,
##        whole milk}            => {soda}              0.005083884  0.3048780 0.016675140 1.748382
## [192] {chocolate,
##        other vegetables}      => {whole milk}        0.005490595  0.4320000 0.012709710 1.690696
## [193] {chocolate,
##        whole milk}            => {other vegetables}  0.005490595  0.3292683 0.016675140 1.701710
## [194] {coffee,
##        yogurt}                => {whole milk}        0.005083884  0.5208333 0.009761057 2.038359
## [195] {coffee,
##        whole milk}            => {yogurt}            0.005083884  0.2717391 0.018708693 1.947926
## [196] {coffee,
##        other vegetables}      => {whole milk}        0.006405694  0.4772727 0.013421454 1.867878
## [197] {coffee,
##        whole milk}            => {other vegetables}  0.006405694  0.3423913 0.018708693 1.769532
## [198] {frozen vegetables,
##        root vegetables}       => {other vegetables}  0.006100661  0.5263158 0.011591256 2.720082
## [199] {frozen vegetables,
##        other vegetables}      => {root vegetables}   0.006100661  0.3428571 0.017793594 3.145522
## [200] {frozen vegetables,
##        root vegetables}       => {whole milk}        0.006202339  0.5350877 0.011591256 2.094146
```

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```
## [201] {frozen vegetables,
##        whole milk}            => {root vegetables}    0.006202339  0.3034826  0.020437214 2.784283
## [202] {frozen vegetables,
##        yogurt}                => {other vegetables}   0.005287239  0.4262295  0.012404677 2.202820
## [203] {frozen vegetables,
##        other vegetables}      => {yogurt}             0.005287239  0.2971429  0.017793594 2.130029
## [204] {frozen vegetables,
##        yogurt}                => {whole milk}         0.006100661  0.4918033  0.012404677 1.924745
## [205] {frozen vegetables,
##        whole milk}            => {yogurt}             0.006100661  0.2985075  0.020437214 2.139811
## [206] {frozen vegetables,
##        rolls/buns}            => {whole milk}         0.005083884  0.5000000  0.010167768 1.956825
## [207] {frozen vegetables,
##        other vegetables}      => {whole milk}         0.009659380  0.5428571  0.017793594 2.124552
## [208] {frozen vegetables,
##        whole milk}            => {other vegetables}   0.009659380  0.4726368  0.020437214 2.442661
## [209] {beef,
##        root vegetables}       => {other vegetables}   0.007930859  0.4561404  0.017386884 2.357404
## [210] {beef,
##        other vegetables}      => {root vegetables}    0.007930859  0.4020619  0.019725470 3.688692
## [211] {beef,
##        root vegetables}       => {whole milk}         0.008032537  0.4619883  0.017386884 1.808060
## [212] {beef,
##        whole milk}            => {root vegetables}    0.008032537  0.3779904  0.021250635 3.467851
## [213] {beef,
##        yogurt}                => {other vegetables}   0.005185562  0.4434783  0.011692933 2.291965
## [214] {beef,
##        other vegetables}      => {yogurt}             0.005185562  0.2628866  0.019725470 1.884468
## [215] {beef,
##        yogurt}                => {whole milk}         0.006100661  0.5217391  0.011692933 2.041904
## [216] {beef,
##        whole milk}            => {yogurt}             0.006100661  0.2870813  0.021250635 2.057905
## [217] {beef,
##        rolls/buns}            => {other vegetables}   0.005795628  0.4253731  0.013624809 2.198395
## [218] {beef,
##        other vegetables}      => {rolls/buns}         0.005795628  0.2938144  0.019725470 1.597383
## [219] {beef,
##        rolls/buns}            => {whole milk}         0.006812405  0.5000000  0.013624809 1.956825
## [220] {beef,
##        whole milk}            => {rolls/buns}         0.006812405  0.3205742  0.021250635 1.742867
## [221] {beef,
##        other vegetables}      => {whole milk}         0.009252669  0.4690722  0.019725470 1.835784
## [222] {beef,
##        whole milk}            => {other vegetables}   0.009252669  0.4354067  0.021250635 2.250250
## [223] {curd,
##        whipped/sour cream}    => {whole milk}         0.005897306  0.5631068  0.010472801 2.203802
## [224] {curd,
##        tropical fruit}        => {yogurt}             0.005287239  0.5148515  0.010269446 3.690645
## [225] {curd,
##        yogurt}                => {tropical fruit}     0.005287239  0.3058824  0.017285206 2.915071
## [226] {curd,
##        tropical fruit}        => {other vegetables}   0.005287239  0.5148515  0.010269446 2.660833
## [227] {curd,
##        other vegetables}      => {tropical fruit}     0.005287239  0.3076923  0.017183528 2.932320
```

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```
## [228] {curd,
##        tropical fruit}        => {whole milk}        0.006507372  0.6336634 0.010269446 2.479936
## [229] {curd,
##        root vegetables}       => {other vegetables}  0.005490595  0.5046729 0.010879512 2.608228
## [230] {curd,
##        other vegetables}      => {root vegetables}   0.005490595  0.3195266 0.017183528 2.931478
## [231] {curd,
##        root vegetables}       => {whole milk}        0.006202339  0.5700935 0.010879512 2.231146
## [232] {curd,
##        yogurt}                => {other vegetables}  0.006100661  0.3529412 0.017285206 1.824055
## [233] {curd,
##        other vegetables}      => {yogurt}            0.006100661  0.3550296 0.017183528 2.544982
## [234] {curd,
##        yogurt}                => {whole milk}        0.010066090  0.5823529 0.017285206 2.279125
## [235] {curd,
##        whole milk}            => {yogurt}            0.010066090  0.3852140 0.026131164 2.761356
## [236] {curd,
##        rolls/buns}            => {whole milk}        0.005897306  0.5858586 0.010066090 2.292845
## [237] {curd,
##        other vegetables}      => {whole milk}        0.009862735  0.5739645 0.017183528 2.246296
## [238] {curd,
##        whole milk}            => {other vegetables}  0.009862735  0.3774319 0.026131164 1.950627
## [239] {napkins,
##        yogurt}                => {whole milk}        0.006100661  0.4958678 0.012302999 1.940652
## [240] {napkins,
##        whole milk}            => {yogurt}            0.006100661  0.3092784 0.019725470 2.217021
## [241] {napkins,
##        rolls/buns}            => {whole milk}        0.005287239  0.4521739 0.011692933 1.769650
## [242] {napkins,
##        whole milk}            => {rolls/buns}        0.005287239  0.2680412 0.019725470 1.457261
## [243] {napkins,
##        other vegetables}      => {whole milk}        0.006812405  0.4718310 0.014438231 1.846581
## [244] {napkins,
##        whole milk}            => {other vegetables}  0.006812405  0.3453608 0.019725470 1.784878
## [245] {pork,
##        root vegetables}       => {other vegetables}  0.007015760  0.5149254 0.013624809 2.661214
## [246] {other vegetables,
##        pork}                  => {root vegetables}   0.007015760  0.3239437 0.021657346 2.972002
## [247] {pork,
##        root vegetables}       => {whole milk}        0.006812405  0.5000000 0.013624809 1.956825
## [248] {pork,
##        whole milk}            => {root vegetables}   0.006812405  0.3073394 0.022165735 2.819667
## [249] {pork,
##        rolls/buns}            => {other vegetables}  0.005592272  0.4954955 0.011286223 2.560798
## [250] {other vegetables,
##        pork}                  => {rolls/buns}        0.005592272  0.2582160 0.021657346 1.403844
## [251] {pork,
##        rolls/buns}            => {whole milk}        0.006202339  0.5495495 0.011286223 2.150744
## [252] {pork,
##        whole milk}            => {rolls/buns}        0.006202339  0.2798165 0.022165735 1.521280
## [253] {other vegetables,
##        pork}                  => {whole milk}        0.010167768  0.4694836 0.021657346 1.837394
## [254] {pork,
##        whole milk}            => {other vegetables}  0.010167768  0.4587156 0.022165735 2.370714
```

```
## [255] {frankfurter,
##        tropical fruit}      => {whole milk}       0.005185562 0.5483871 0.009456024 2.146195
## [256] {frankfurter,
##        whole milk}          => {tropical fruit}   0.005185562 0.2524752 0.020538892 2.406099
## [257] {frankfurter,
##        root vegetables}     => {whole milk}       0.005083884 0.5000000 0.010167768 1.956825
## [258] {frankfurter,
##        yogurt}              => {whole milk}       0.006202339 0.5545455 0.011184545 2.170296
## [259] {frankfurter,
##        whole milk}          => {yogurt}           0.006202339 0.3019802 0.020538892 2.164705
## [260] {frankfurter,
##        rolls/buns}          => {other vegetables} 0.005592272 0.2910053 0.019217082 1.503961
## [261] {frankfurter,
##        other vegetables}    => {rolls/buns}       0.005592272 0.3395062 0.016471784 1.845795
## [262] {frankfurter,
##        rolls/buns}          => {whole milk}       0.005998983 0.3121693 0.019217082 1.221721
## [263] {frankfurter,
##        whole milk}          => {rolls/buns}       0.005998983 0.2920792 0.020538892 1.587949
## [264] {frankfurter,
##        other vegetables}    => {whole milk}       0.007625826 0.4629630 0.016471784 1.811875
## [265] {frankfurter,
##        whole milk}          => {other vegetables} 0.007625826 0.3712871 0.020538892 1.918870
## [266] {bottled beer,
##        bottled water}       => {soda}             0.005083884 0.3225806 0.015760041 1.849901
## [267] {bottled beer,
##        soda}                => {bottled water}    0.005083884 0.2994012 0.016980173 2.708934
## [268] {bottled beer,
##        bottled water}       => {whole milk}       0.006100661 0.3870968 0.015760041 1.514961
## [269] {bottled beer,
##        whole milk}          => {bottled water}    0.006100661 0.2985075 0.020437214 2.700847
## [270] {bottled beer,
##        yogurt}              => {whole milk}       0.005185562 0.5604396 0.009252669 2.193364
## [271] {bottled beer,
##        whole milk}          => {yogurt}           0.005185562 0.2537313 0.020437214 1.818839
## [272] {bottled beer,
##        rolls/buns}          => {whole milk}       0.005388917 0.3955224 0.013624809 1.547936
## [273] {bottled beer,
##        whole milk}          => {rolls/buns}       0.005388917 0.2636816 0.020437214 1.433559
## [274] {bottled beer,
##        other vegetables}    => {whole milk}       0.007625826 0.4716981 0.016166751 1.846061
## [275] {bottled beer,
##        whole milk}          => {other vegetables} 0.007625826 0.3731343 0.020437214 1.928416
## [276] {brown bread,
##        tropical fruit}      => {whole milk}       0.005693950 0.5333333 0.010676157 2.087279
## [277] {brown bread,
##        root vegetables}     => {whole milk}       0.005693950 0.5600000 0.010167768 2.191643
## [278] {brown bread,
##        soda}                => {whole milk}       0.005083884 0.4032258 0.012608033 1.578084
## [279] {brown bread,
##        yogurt}              => {other vegetables} 0.005185562 0.3566434 0.014539908 1.843188
## [280] {brown bread,
##        other vegetables}    => {yogurt}           0.005185562 0.2771739 0.018708693 1.986884
## [281] {brown bread,
##        yogurt}              => {whole milk}       0.007117438 0.4895105 0.014539908 1.915772
```

```
## [282] {brown bread,
##        whole milk}           => {yogurt}             0.007117438  0.2822581 0.025216065 2.023329
## [283] {brown bread,
##        rolls/buns}           => {whole milk}         0.005287239  0.4193548 0.012608033 1.641208
## [284] {brown bread,
##        other vegetables}     => {whole milk}         0.009354347  0.5000000 0.018708693 1.956825
## [285] {brown bread,
##        whole milk}           => {other vegetables}   0.009354347  0.3709677 0.025216065 1.917219
## [286] {domestic eggs,
##        margarine}            => {whole milk}         0.005185562  0.6219512 0.008337570 2.434099
## [287] {margarine,
##        root vegetables}      => {other vegetables}   0.005897306  0.5321101 0.011082867 2.750028
## [288] {margarine,
##        other vegetables}     => {root vegetables}    0.005897306  0.2989691 0.019725470 2.742874
## [289] {margarine,
##        yogurt}               => {other vegetables}   0.005693950  0.4000000 0.014234875 2.067262
## [290] {margarine,
##        other vegetables}     => {yogurt}             0.005693950  0.2886598 0.019725470 2.069219
## [291] {margarine,
##        yogurt}               => {whole milk}         0.007015760  0.4928571 0.014234875 1.928870
## [292] {margarine,
##        whole milk}           => {yogurt}             0.007015760  0.2899160 0.024199288 2.078224
## [293] {margarine,
##        rolls/buns}           => {other vegetables}   0.005185562  0.3517241 0.014743264 1.817765
## [294] {margarine,
##        other vegetables}     => {rolls/buns}         0.005185562  0.2628866 0.019725470 1.429237
## [295] {margarine,
##        rolls/buns}           => {whole milk}         0.007930859  0.5379310 0.014743264 2.105273
## [296] {margarine,
##        whole milk}           => {rolls/buns}         0.007930859  0.3277311 0.024199288 1.781777
## [297] {margarine,
##        other vegetables}     => {whole milk}         0.009252669  0.4690722 0.019725470 1.835784
## [298] {margarine,
##        whole milk}           => {other vegetables}   0.009252669  0.3823529 0.024199288 1.976059
## [299] {butter,
##        domestic eggs}        => {whole milk}         0.005998983  0.6210526 0.009659380 2.430582
## [300] {butter,
##        whipped/sour cream}   => {other vegetables}   0.005795628  0.5700000 0.010167768 2.945849
## [301] {butter,
##        other vegetables}     => {whipped/sour cream} 0.005795628  0.2893401 0.020030503 4.036397
## [302] {butter,
##        whipped/sour cream}   => {whole milk}         0.006710727  0.6600000 0.010167768 2.583008
## [303] {butter,
##        citrus fruit}         => {whole milk}         0.005083884  0.5555556 0.009150991 2.174249
## [304] {bottled water,
##        butter}               => {whole milk}         0.005388917  0.6022727 0.008947636 2.357084
## [305] {butter,
##        tropical fruit}       => {other vegetables}   0.005490595  0.5510204 0.009964413 2.847759
## [306] {butter,
##        other vegetables}     => {tropical fruit}     0.005490595  0.2741117 0.020030503 2.612295
## [307] {butter,
##        tropical fruit}       => {whole milk}         0.006202339  0.6224490 0.009964413 2.436047
## [308] {butter,
##        root vegetables}      => {other vegetables}   0.006609049  0.5118110 0.012913066 2.645119
```

```
## [309] {butter,
##       other vegetables}        => {root vegetables}    0.006609049   0.3299492  0.020030503  3.027100
## [310] {butter,
##       root vegetables}         => {whole milk}          0.008235892   0.6377953  0.012913066  2.496107
## [311] {butter,
##       whole milk}              => {root vegetables}     0.008235892   0.2988930  0.027554652  2.742176
## [312] {butter,
##       yogurt}                  => {other vegetables}    0.006405694   0.4375000  0.014641586  2.261068
## [313] {butter,
##       other vegetables}        => {yogurt}              0.006405694   0.3197970  0.020030503  2.292422
## [314] {butter,
##       yogurt}                  => {whole milk}          0.009354347   0.6388889  0.014641586  2.500387
## [315] {butter,
##       whole milk}              => {yogurt}              0.009354347   0.3394834  0.027554652  2.433542
## [316] {butter,
##       rolls/buns}              => {other vegetables}    0.005693950   0.4242424  0.013421454  2.192551
## [317] {butter,
##       other vegetables}        => {rolls/buns}          0.005693950   0.2842640  0.020030503  1.545459
## [318] {butter,
##       rolls/buns}              => {whole milk}          0.006609049   0.4924242  0.013421454  1.927176
## [319] {butter,
##       other vegetables}        => {whole milk}          0.011489578   0.5736041  0.020030503  2.244885
## [320] {butter,
##       whole milk}              => {other vegetables}    0.011489578   0.4169742  0.027554652  2.154987
## [321] {newspapers,
##       tropical fruit}          => {whole milk}          0.005083884   0.4310345  0.011794611  1.686918
## [322] {newspapers,
##       root vegetables}         => {other vegetables}    0.005998983   0.5221239  0.011489578  2.698417
## [323] {newspapers,
##       other vegetables}        => {root vegetables}     0.005998983   0.3105263  0.019318760  2.848905
## [324] {newspapers,
##       root vegetables}         => {whole milk}          0.005795628   0.5044248  0.011489578  1.974142
## [325] {newspapers,
##       yogurt}                  => {rolls/buns}          0.005083884   0.3311258  0.015353330  1.800234
## [326] {newspapers,
##       rolls/buns}              => {yogurt}              0.005083884   0.2577320  0.019725470  1.847517
## [327] {newspapers,
##       yogurt}                  => {other vegetables}    0.005592272   0.3642384  0.015353330  1.882441
## [328] {newspapers,
##       other vegetables}        => {yogurt}              0.005592272   0.2894737  0.019318760  2.075054
## [329] {newspapers,
##       yogurt}                  => {whole milk}          0.006609049   0.4304636  0.015353330  1.684683
## [330] {newspapers,
##       rolls/buns}              => {other vegetables}    0.005490595   0.2783505  0.019725470  1.438559
## [331] {newspapers,
##       other vegetables}        => {rolls/buns}          0.005490595   0.2842105  0.019318760  1.545169
## [332] {newspapers,
##       rolls/buns}              => {whole milk}          0.007625826   0.3865979  0.019725470  1.513009
## [333] {newspapers,
##       whole milk}              => {rolls/buns}          0.007625826   0.2788104  0.027351296  1.515810
## [334] {newspapers,
##       other vegetables}        => {whole milk}          0.008337570   0.4315789  0.019318760  1.689049
## [335] {newspapers,
##       whole milk}              => {other vegetables}    0.008337570   0.3048327  0.027351296  1.575423
```

```
## [336] {domestic eggs,
##        whipped/sour cream}   => {other vegetables}  0.005083884  0.5102041 0.009964413 2.636814
## [337] {domestic eggs,
##        whipped/sour cream}   => {whole milk}         0.005693950  0.5714286 0.009964413 2.236371
## [338] {domestic eggs,
##        pip fruit}            => {whole milk}         0.005388917  0.6235294 0.008642603 2.440275
## [339] {citrus fruit,
##        domestic eggs}        => {whole milk}         0.005693950  0.5490196 0.010371124 2.148670
## [340] {domestic eggs,
##        tropical fruit}       => {whole milk}         0.006914082  0.6071429 0.011387900 2.376144
## [341] {domestic eggs,
##        root vegetables}      => {other vegetables}  0.007320793  0.5106383 0.014336553 2.639058
## [342] {domestic eggs,
##        other vegetables}     => {root vegetables}   0.007320793  0.3287671 0.022267412 3.016254
## [343] {domestic eggs,
##        root vegetables}      => {whole milk}         0.008540925  0.5957447 0.014336553 2.331536
## [344] {domestic eggs,
##        whole milk}           => {root vegetables}   0.008540925  0.2847458 0.029994916 2.612383
## [345] {domestic eggs,
##        soda}                 => {other vegetables}  0.005083884  0.4098361 0.012404677 2.118097
## [346] {domestic eggs,
##        soda}                 => {whole milk}         0.005185562  0.4180328 0.012404677 1.636034
## [347] {domestic eggs,
##        yogurt}               => {other vegetables}  0.005795628  0.4042553 0.014336553 2.089254
## [348] {domestic eggs,
##        other vegetables}     => {yogurt}            0.005795628  0.2602740 0.022267412 1.865739
## [349] {domestic eggs,
##        yogurt}               => {whole milk}         0.007727504  0.5390071 0.014336553 2.109485
## [350] {domestic eggs,
##        whole milk}           => {yogurt}            0.007727504  0.2576271 0.029994916 1.846766
## [351] {domestic eggs,
##        rolls/buns}           => {other vegetables}  0.005897306  0.3766234 0.015658363 1.946448
## [352] {domestic eggs,
##        other vegetables}     => {rolls/buns}        0.005897306  0.2648402 0.022267412 1.439858
## [353] {domestic eggs,
##        rolls/buns}           => {whole milk}         0.006609049  0.4220779 0.015658363 1.651865
## [354] {domestic eggs,
##        other vegetables}     => {whole milk}         0.012302999  0.5525114 0.022267412 2.162336
## [355] {domestic eggs,
##        whole milk}           => {other vegetables}  0.012302999  0.4101695 0.029994916 2.119820
## [356] {bottled water,
##        fruit/vegetable juice} => {soda}             0.005185562  0.3642857 0.014234875 2.089067
## [357] {fruit/vegetable juice,
##        soda}                 => {bottled water}     0.005185562  0.2817680 0.018403660 2.549391
## [358] {bottled water,
##        fruit/vegetable juice} => {whole milk}        0.005795628  0.4071429 0.014234875 1.593414
## [359] {fruit/vegetable juice,
##        tropical fruit}       => {other vegetables}  0.006609049  0.4814815 0.013726487 2.488371
## [360] {fruit/vegetable juice,
##        other vegetables}     => {tropical fruit}    0.006609049  0.3140097 0.021047280 2.992524
## [361] {fruit/vegetable juice,
##        tropical fruit}       => {whole milk}         0.005998983  0.4370370 0.013726487 1.710410
## [362] {fruit/vegetable juice,
##        root vegetables}      => {other vegetables}  0.006609049  0.5508475 0.011997966 2.846865
```

```
## [363] {fruit/vegetable juice,
##         other vegetables}        => {root vegetables}    0.006609049  0.3140097 0.021047280 2.880863
## [364] {fruit/vegetable juice,
##         root vegetables}         => {whole milk}         0.006507372  0.5423729 0.011997966 2.122657
## [365] {fruit/vegetable juice,
##         soda}                    => {yogurt}             0.005083884  0.2762431 0.018403660 1.980212
## [366] {fruit/vegetable juice,
##         yogurt}                  => {soda}               0.005083884  0.2717391 0.018708693 1.558341
## [367] {fruit/vegetable juice,
##         soda}                    => {whole milk}         0.006100661  0.3314917 0.018403660 1.297342
## [368] {fruit/vegetable juice,
##         yogurt}                  => {other vegetables}   0.008235892  0.4402174 0.018708693 2.275112
## [369] {fruit/vegetable juice,
##         other vegetables}        => {yogurt}             0.008235892  0.3913043 0.021047280 2.805013
## [370] {fruit/vegetable juice,
##         yogurt}                  => {whole milk}         0.009456024  0.5054348 0.018708693 1.978094
## [371] {fruit/vegetable juice,
##         whole milk}              => {yogurt}             0.009456024  0.3549618 0.026639553 2.544497
## [372] {fruit/vegetable juice,
##         rolls/buns}              => {whole milk}         0.005592272  0.3846154 0.014539908 1.505250
## [373] {fruit/vegetable juice,
##         other vegetables}        => {whole milk}         0.010472801  0.4975845 0.021047280 1.947371
## [374] {fruit/vegetable juice,
##         whole milk}              => {other vegetables}   0.010472801  0.3931298 0.026639553 2.031756
## [375] {pip fruit,
##         whipped/sour cream}      => {other vegetables}   0.005592272  0.6043956 0.009252669 3.123610
## [376] {pip fruit,
##         whipped/sour cream}      => {whole milk}         0.005998983  0.6483516 0.009252669 2.537421
## [377] {citrus fruit,
##         whipped/sour cream}      => {other vegetables}   0.005693950  0.5233645 0.010879512 2.704829
## [378] {citrus fruit,
##         whipped/sour cream}      => {whole milk}         0.006304016  0.5794393 0.010879512 2.267722
## [379] {sausage,
##         whipped/sour cream}      => {whole milk}         0.005083884  0.5617978 0.009049314 2.198679
## [380] {tropical fruit,
##         whipped/sour cream}      => {yogurt}             0.006202339  0.4485294 0.013828165 3.215224
## [381] {whipped/sour cream,
##         yogurt}                  => {tropical fruit}     0.006202339  0.2990196 0.020742247 2.849668
## [382] {tropical fruit,
##         whipped/sour cream}      => {other vegetables}   0.007829181  0.5661765 0.013828165 2.926088
## [383] {other vegetables,
##         whipped/sour cream}      => {tropical fruit}     0.007829181  0.2711268 0.028876462 2.583849
## [384] {tropical fruit,
##         whipped/sour cream}      => {whole milk}         0.007930859  0.5735294 0.013828165 2.244593
## [385] {root vegetables,
##         whipped/sour cream}      => {yogurt}             0.006405694  0.3750000 0.017081851 2.688138
## [386] {whipped/sour cream,
##         yogurt}                  => {root vegetables}    0.006405694  0.3088235 0.020742247 2.833283
## [387] {root vegetables,
##         whipped/sour cream}      => {other vegetables}   0.008540925  0.5000000 0.017081851 2.584078
## [388] {other vegetables,
##         whipped/sour cream}      => {root vegetables}    0.008540925  0.2957746 0.028876462 2.713567
## [389] {root vegetables,
##         whipped/sour cream}      => {whole milk}         0.009456024  0.5535714 0.017081851 2.166484
```

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## [390] {whipped/sour cream,
##        whole milk}              => {root vegetables}   0.009456024 0.2933754 0.032231825 2.691555
## [391] {soda,
##        whipped/sour cream}      => {whole milk}         0.005490595 0.4736842 0.011591256 1.853834
## [392] {whipped/sour cream,
##        yogurt}                  => {other vegetables}   0.010167768 0.4901961 0.020742247 2.533410
## [393] {other vegetables,
##        whipped/sour cream}      => {yogurt}             0.010167768 0.3521127 0.028876462 2.524073
## [394] {whipped/sour cream,
##        yogurt}                  => {whole milk}         0.010879512 0.5245098 0.020742247 2.052747
## [395] {whipped/sour cream,
##        whole milk}              => {yogurt}             0.010879512 0.3375394 0.032231825 2.419607
## [396] {rolls/buns,
##        whipped/sour cream}      => {other vegetables}   0.006710727 0.4583333 0.014641586 2.368738
## [397] {rolls/buns,
##        whipped/sour cream}      => {whole milk}         0.007829181 0.5347222 0.014641586 2.092715
## [398] {other vegetables,
##        whipped/sour cream}      => {whole milk}         0.014641586 0.5070423 0.028876462 1.984385
## [399] {whipped/sour cream,
##        whole milk}              => {other vegetables}   0.014641586 0.4542587 0.032231825 2.347679
## [400] {pastry,
##        pip fruit}               => {whole milk}         0.005083884 0.4761905 0.010676157 1.863642
## [401] {citrus fruit,
##        pip fruit}               => {tropical fruit}     0.005592272 0.4044118 0.013828165 3.854060
## [402] {pip fruit,
##        tropical fruit}          => {citrus fruit}       0.005592272 0.2736318 0.020437214 3.306105
## [403] {citrus fruit,
##        tropical fruit}          => {pip fruit}          0.005592272 0.2806122 0.019928826 3.709437
## [404] {citrus fruit,
##        pip fruit}               => {other vegetables}   0.005897306 0.4264706 0.013828165 2.204066
## [405] {citrus fruit,
##        pip fruit}               => {whole milk}         0.005185562 0.3750000 0.013828165 1.467618
## [406] {pip fruit,
##        sausage}                 => {whole milk}         0.005592272 0.5188679 0.010777834 2.030667
## [407] {pip fruit,
##        tropical fruit}          => {root vegetables}    0.005287239 0.2587065 0.020437214 2.373487
## [408] {pip fruit,
##        root vegetables}         => {tropical fruit}     0.005287239 0.3398693 0.015556685 3.238967
## [409] {root vegetables,
##        tropical fruit}          => {pip fruit}          0.005287239 0.2512077 0.021047280 3.320737
## [410] {pip fruit,
##        tropical fruit}          => {yogurt}             0.006405694 0.3134328 0.020437214 2.246802
## [411] {pip fruit,
##        yogurt}                  => {tropical fruit}     0.006405694 0.3559322 0.017996950 3.392048
## [412] {pip fruit,
##        tropical fruit}          => {other vegetables}   0.009456024 0.4626866 0.020437214 2.391236
## [413] {other vegetables,
##        pip fruit}               => {tropical fruit}     0.009456024 0.3618677 0.026131164 3.448613
## [414] {other vegetables,
##        tropical fruit}          => {pip fruit}          0.009456024 0.2634561 0.035892222 3.482649
## [415] {pip fruit,
##        tropical fruit}          => {whole milk}         0.008439248 0.4129353 0.020437214 1.616084
## [416] {pip fruit,
##        whole milk}              => {tropical fruit}     0.008439248 0.2804054 0.030096594 2.672274
```

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## [417] {pip fruit,
##        root vegetables}         => {yogurt}            0.005287239 0.3398693 0.015556685 2.436308
## [418] {pip fruit,
##        yogurt}                  => {root vegetables}   0.005287239 0.2937853 0.017996950 2.695316
## [419] {pip fruit,
##        root vegetables}         => {other vegetables}  0.008134215 0.5228758 0.015556685 2.702304
## [420] {other vegetables,
##        pip fruit}               => {root vegetables}   0.008134215 0.3112840 0.026131164 2.855857
## [421] {pip fruit,
##        root vegetables}         => {whole milk}        0.008947636 0.5751634 0.015556685 2.250988
## [422] {pip fruit,
##        whole milk}              => {root vegetables}   0.008947636 0.2972973 0.030096594 2.727536
## [423] {pip fruit,
##        yogurt}                  => {other vegetables}  0.008134215 0.4519774 0.017996950 2.335890
## [424] {other vegetables,
##        pip fruit}               => {yogurt}            0.008134215 0.3112840 0.026131164 2.231398
## [425] {pip fruit,
##        yogurt}                  => {whole milk}        0.009557702 0.5310734 0.017996950 2.078435
## [426] {pip fruit,
##        whole milk}              => {yogurt}            0.009557702 0.3175676 0.030096594 2.276441
## [427] {pip fruit,
##        rolls/buns}              => {other vegetables}  0.005083884 0.3649635 0.013929842 1.886188
## [428] {pip fruit,
##        rolls/buns}              => {whole milk}        0.006202339 0.4452555 0.013929842 1.742574
## [429] {other vegetables,
##        pip fruit}               => {whole milk}        0.013523132 0.5175097 0.026131164 2.025351
## [430] {pip fruit,
##        whole milk}              => {other vegetables}  0.013523132 0.4493243 0.030096594 2.322178
## [431] {pastry,
##        sausage}                 => {whole milk}        0.005693950 0.4552846 0.012506355 1.781824
## [432] {pastry,
##        tropical fruit}          => {other vegetables}  0.005083884 0.3846154 0.013218099 1.987752
## [433] {pastry,
##        tropical fruit}          => {whole milk}        0.006710727 0.5076923 0.013218099 1.986930
## [434] {pastry,
##        root vegetables}         => {other vegetables}  0.005897306 0.5370370 0.010981190 2.775491
## [435] {other vegetables,
##        pastry}                  => {root vegetables}   0.005897306 0.2612613 0.022572445 2.396926
## [436] {pastry,
##        root vegetables}         => {whole milk}        0.005693950 0.5185185 0.010981190 2.029299
## [437] {pastry,
##        soda}                    => {rolls/buns}        0.005388917 0.2560386 0.021047280 1.392007
## [438] {pastry,
##        rolls/buns}              => {soda}              0.005388917 0.2572816 0.020945602 1.475431
## [439] {pastry,
##        soda}                    => {other vegetables}  0.005490595 0.2608696 0.021047280 1.348214
## [440] {pastry,
##        soda}                    => {whole milk}        0.008235892 0.3913043 0.021047280 1.531428
## [441] {pastry,
##        yogurt}                  => {rolls/buns}        0.005795628 0.3275862 0.017691917 1.780990
## [442] {pastry,
##        rolls/buns}              => {yogurt}            0.005795628 0.2766990 0.020945602 1.983480
## [443] {pastry,
##        yogurt}                  => {other vegetables}  0.006609049 0.3735632 0.017691917 1.930633
```

```
## [444] {other vegetables,
##        pastry}                  => {yogurt}            0.006609049 0.2927928 0.022572445 2.098846
## [445] {pastry,
##        yogurt}                  => {whole milk}        0.009150991 0.5172414 0.017691917 2.024301
## [446] {pastry,
##        whole milk}              => {yogurt}            0.009150991 0.2752294 0.033248602 1.972945
## [447] {pastry,
##        rolls/buns}              => {other vegetables}  0.006100661 0.2912621 0.020945602 1.505288
## [448] {other vegetables,
##        pastry}                  => {rolls/buns}        0.006100661 0.2702703 0.022572445 1.469380
## [449] {pastry,
##        rolls/buns}              => {whole milk}        0.008540925 0.4077670 0.020945602 1.595857
## [450] {pastry,
##        whole milk}              => {rolls/buns}        0.008540925 0.2568807 0.033248602 1.396585
## [451] {other vegetables,
##        pastry}                  => {whole milk}        0.010574479 0.4684685 0.022572445 1.833421
## [452] {pastry,
##        whole milk}              => {other vegetables}  0.010574479 0.3180428 0.033248602 1.643695
## [453] {bottled water,
##        citrus fruit}            => {other vegetables}  0.005083884 0.3759398 0.013523132 1.942916
## [454] {bottled water,
##        citrus fruit}            => {whole milk}        0.005897306 0.4360902 0.013523132 1.706704
## [455] {citrus fruit,
##        tropical fruit}          => {root vegetables}   0.005693950 0.2857143 0.019928826 2.621269
## [456] {citrus fruit,
##        root vegetables}         => {tropical fruit}    0.005693950 0.3218391 0.017691917 3.067139
## [457] {root vegetables,
##        tropical fruit}          => {citrus fruit}      0.005693950 0.2705314 0.021047280 3.268644
## [458] {citrus fruit,
##        tropical fruit}          => {yogurt}            0.006304016 0.3163265 0.019928826 2.267545
## [459] {citrus fruit,
##        yogurt}                  => {tropical fruit}    0.006304016 0.2910798 0.021657346 2.774002
## [460] {citrus fruit,
##        tropical fruit}          => {other vegetables}  0.009049314 0.4540816 0.019928826 2.346765
## [461] {citrus fruit,
##        other vegetables}        => {tropical fruit}    0.009049314 0.3133803 0.028876462 2.986526
## [462] {other vegetables,
##        tropical fruit}          => {citrus fruit}      0.009049314 0.2521246 0.035892222 3.046248
## [463] {citrus fruit,
##        tropical fruit}          => {whole milk}        0.009049314 0.4540816 0.019928826 1.777116
## [464] {citrus fruit,
##        whole milk}              => {tropical fruit}    0.009049314 0.2966667 0.030503305 2.827245
## [465] {citrus fruit,
##        root vegetables}         => {other vegetables}  0.010371124 0.5862069 0.017691917 3.029608
## [466] {citrus fruit,
##        other vegetables}        => {root vegetables}   0.010371124 0.3591549 0.028876462 3.295045
## [467] {citrus fruit,
##        root vegetables}         => {whole milk}        0.009150991 0.5172414 0.017691917 2.024301
## [468] {citrus fruit,
##        whole milk}              => {root vegetables}   0.009150991 0.3000000 0.030503305 2.752332
## [469] {citrus fruit,
##        yogurt}                  => {rolls/buns}        0.005795628 0.2676056 0.021657346 1.454893
## [470] {citrus fruit,
##        rolls/buns}              => {yogurt}            0.005795628 0.3454545 0.016776817 2.476345
```

```
## [471] {citrus fruit,
##         yogurt}              => {other vegetables} 0.007625826  0.3521127 0.021657346 1.819773
## [472] {citrus fruit,
##         other vegetables}    => {yogurt}           0.007625826  0.2640845 0.028876462 1.893055
## [473] {citrus fruit,
##         yogurt}              => {whole milk}        0.010269446  0.4741784 0.021657346 1.855768
## [474] {citrus fruit,
##         whole milk}          => {yogurt}           0.010269446  0.3366667 0.030503305 2.413350
## [475] {citrus fruit,
##         rolls/buns}          => {other vegetables} 0.005998983  0.3575758 0.016776817 1.848007
## [476] {citrus fruit,
##         rolls/buns}          => {whole milk}        0.007219115  0.4303030 0.016776817 1.684055
## [477] {citrus fruit,
##         other vegetables}    => {whole milk}        0.013014743  0.4507042 0.028876462 1.763898
## [478] {citrus fruit,
##         whole milk}          => {other vegetables} 0.013014743  0.4266667 0.030503305 2.205080
## [479] {sausage,
##         shopping bags}       => {soda}             0.005693950  0.3636364 0.015658363 2.085343
## [480] {sausage,
##         shopping bags}       => {rolls/buns}        0.005998983  0.3831169 0.015658363 2.082894
## [481] {rolls/buns,
##         shopping bags}       => {sausage}          0.005998983  0.3072917 0.019522115 3.270794
## [482] {sausage,
##         shopping bags}       => {other vegetables} 0.005388917  0.3441558 0.015658363 1.778651
## [483] {root vegetables,
##         shopping bags}       => {other vegetables} 0.006609049  0.5158730 0.012811388 2.666112
## [484] {other vegetables,
##         shopping bags}       => {root vegetables}  0.006609049  0.2850877 0.023182511 2.615520
## [485] {root vegetables,
##         shopping bags}       => {whole milk}        0.005287239  0.4126984 0.012811388 1.615157
## [486] {shopping bags,
##         soda}                => {rolls/buns}        0.006304016  0.2561983 0.024605999 1.392875
## [487] {rolls/buns,
##         shopping bags}       => {soda}             0.006304016  0.3229167 0.019522115 1.851828
## [488] {shopping bags,
##         soda}                => {whole milk}        0.006812405  0.2768595 0.024605999 1.083531
## [489] {shopping bags,
##         whole milk}          => {soda}             0.006812405  0.2780083 0.024504321 1.594292
## [490] {shopping bags,
##         yogurt}              => {other vegetables} 0.005388917  0.3533333 0.015251652 1.826082
## [491] {shopping bags,
##         yogurt}              => {whole milk}        0.005287239  0.3466667 0.015251652 1.356732
## [492] {rolls/buns,
##         shopping bags}       => {other vegetables} 0.005287239  0.2708333 0.019522115 1.399709
## [493] {rolls/buns,
##         shopping bags}       => {whole milk}        0.005287239  0.2708333 0.019522115 1.059947
## [494] {other vegetables,
##         shopping bags}       => {whole milk}        0.007625826  0.3289474 0.023182511 1.287385
## [495] {shopping bags,
##         whole milk}          => {other vegetables} 0.007625826  0.3112033 0.024504321 1.608347
## [496] {bottled water,
##         sausage}             => {other vegetables} 0.005083884  0.4237288 0.011997966 2.189896
## [497] {sausage,
##         tropical fruit}      => {other vegetables} 0.005998983  0.4306569 0.013929842 2.225702
```
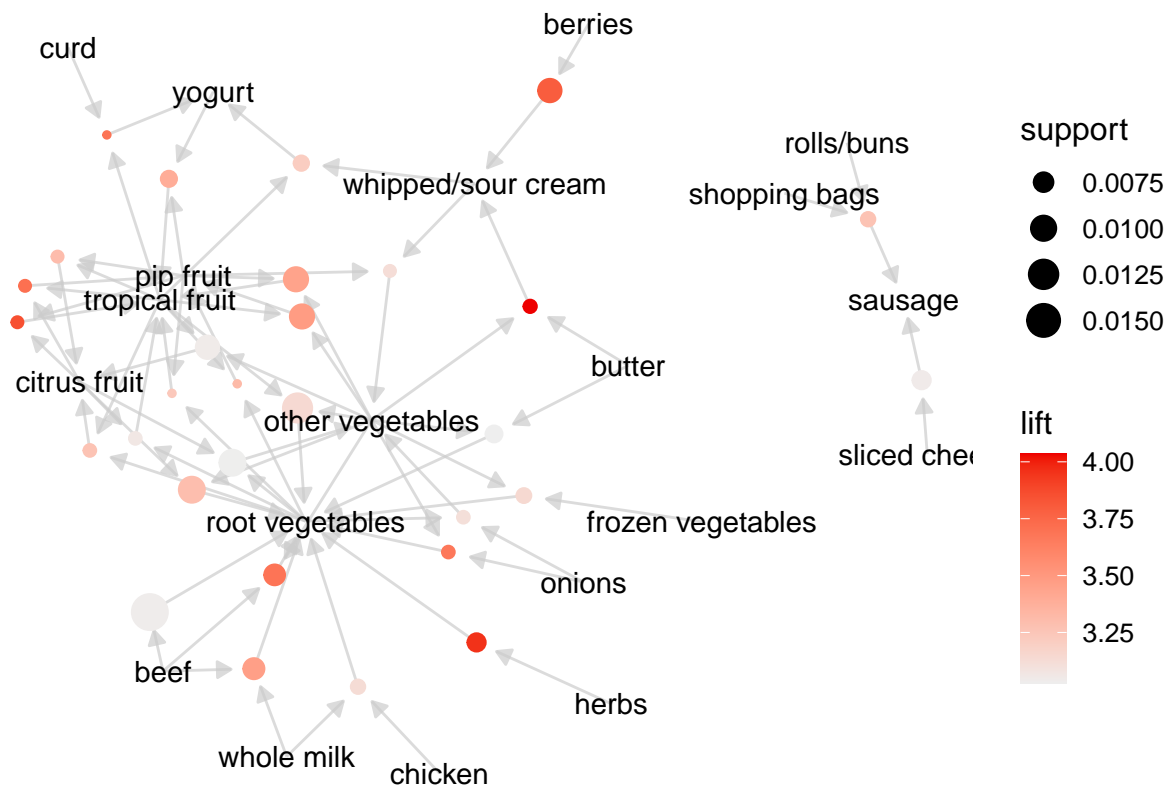
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## [498] {sausage,
##        tropical fruit}        => {whole milk}       0.007219115 0.5182482 0.013929842 2.028241
## [499] {root vegetables,
##        sausage}               => {yogurt}           0.005185562 0.3469388 0.014946619 2.486985
## [500] {sausage,
##        yogurt}                => {root vegetables}  0.005185562 0.2642487 0.019623793 2.424334
## [501] {root vegetables,
##        sausage}               => {other vegetables} 0.006812405 0.4557823 0.014946619 2.355554
## [502] {other vegetables,
##        sausage}               => {root vegetables}  0.006812405 0.2528302 0.026944586 2.319575
## [503] {root vegetables,
##        sausage}               => {whole milk}       0.007727504 0.5170068 0.014946619 2.023383
## [504] {sausage,
##        whole milk}            => {root vegetables}  0.007727504 0.2585034 0.029893238 2.371624
## [505] {sausage,
##        yogurt}                => {soda}             0.005592272 0.2849741 0.019623793 1.634239
## [506] {sausage,
##        soda}                  => {rolls/buns}       0.009659380 0.3974895 0.024300966 2.161034
## [507] {rolls/buns,
##        sausage}               => {soda}             0.009659380 0.3156146 0.030604982 1.809953
## [508] {rolls/buns,
##        soda}                  => {sausage}          0.009659380 0.2519894 0.038332486 2.682160
## [509] {sausage,
##        soda}                  => {other vegetables} 0.007219115 0.2970711 0.024300966 1.535310
## [510] {other vegetables,
##        sausage}               => {soda}             0.007219115 0.2679245 0.026944586 1.536465
## [511] {sausage,
##        soda}                  => {whole milk}       0.006710727 0.2761506 0.024300966 1.080757
## [512] {sausage,
##        yogurt}                => {rolls/buns}       0.005998983 0.3056995 0.019623793 1.661998
## [513] {sausage,
##        yogurt}                => {other vegetables} 0.008134215 0.4145078 0.019623793 2.142241
## [514] {other vegetables,
##        sausage}               => {yogurt}           0.008134215 0.3018868 0.026944586 2.164035
## [515] {sausage,
##        yogurt}                => {whole milk}       0.008744281 0.4455959 0.019623793 1.743906
## [516] {sausage,
##        whole milk}            => {yogurt}           0.008744281 0.2925170 0.029893238 2.096869
## [517] {rolls/buns,
##        sausage}               => {other vegetables} 0.008845958 0.2890365 0.030604982 1.493786
## [518] {other vegetables,
##        sausage}               => {rolls/buns}       0.008845958 0.3283019 0.026944586 1.784881
## [519] {rolls/buns,
##        sausage}               => {whole milk}       0.009354347 0.3056478 0.030604982 1.196198
## [520] {sausage,
##        whole milk}            => {rolls/buns}       0.009354347 0.3129252 0.029893238 1.701282
## [521] {other vegetables,
##        sausage}               => {whole milk}       0.010167768 0.3773585 0.026944586 1.476849
## [522] {sausage,
##        whole milk}            => {other vegetables} 0.010167768 0.3401361 0.029893238 1.757876
## [523] {bottled water,
##        tropical fruit}        => {soda}             0.005185562 0.2802198 0.018505338 1.606975
## [524] {bottled water,
##        tropical fruit}        => {yogurt}           0.007117438 0.3846154 0.018505338 2.757064
```

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```
## [525] {bottled water,
##        yogurt}               => {tropical fruit}      0.007117438  0.3097345 0.022979156 2.951782
## [526] {bottled water,
##        tropical fruit}       => {rolls/buns}           0.005388917  0.2912088 0.018505338 1.583216
## [527] {bottled water,
##        tropical fruit}       => {other vegetables}     0.006202339  0.3351648 0.018505338 1.732184
## [528] {bottled water,
##        tropical fruit}       => {whole milk}           0.008032537  0.4340659 0.018505338 1.698782
## [529] {bottled water,
##        root vegetables}      => {other vegetables}     0.007015760  0.4480519 0.015658363 2.315602
## [530] {bottled water,
##        other vegetables}     => {root vegetables}      0.007015760  0.2827869 0.024809354 2.594411
## [531] {bottled water,
##        root vegetables}      => {whole milk}           0.007320793  0.4675325 0.015658363 1.829758
## [532] {bottled water,
##        soda}                 => {yogurt}               0.007422471  0.2561404 0.028978139 1.836108
## [533] {bottled water,
##        yogurt}               => {soda}                 0.007422471  0.3230088 0.022979156 1.852357
## [534] {soda,
##        yogurt}               => {bottled water}        0.007422471  0.2713755 0.027351296 2.455361
## [535] {bottled water,
##        rolls/buns}           => {soda}                 0.006812405  0.2815126 0.024199288 1.614389
## [536] {bottled water,
##        soda}                 => {whole milk}           0.007524148  0.2596491 0.028978139 1.016176
## [537] {bottled water,
##        yogurt}               => {rolls/buns}           0.007117438  0.3097345 0.022979156 1.683935
## [538] {bottled water,
##        rolls/buns}           => {yogurt}               0.007117438  0.2941176 0.024199288 2.108343
## [539] {bottled water,
##        yogurt}               => {other vegetables}     0.008134215  0.3539823 0.022979156 1.829436
## [540] {bottled water,
##        other vegetables}     => {yogurt}               0.008134215  0.3278689 0.024809354 2.350284
## [541] {bottled water,
##        yogurt}               => {whole milk}           0.009659380  0.4203540 0.022979156 1.645118
## [542] {bottled water,
##        whole milk}           => {yogurt}               0.009659380  0.2810651 0.034367056 2.014778
## [543] {bottled water,
##        rolls/buns}           => {other vegetables}     0.007320793  0.3025210 0.024199288 1.563476
## [544] {bottled water,
##        other vegetables}     => {rolls/buns}           0.007320793  0.2950820 0.024809354 1.604274
## [545] {bottled water,
##        rolls/buns}           => {whole milk}           0.008744281  0.3613445 0.024199288 1.414176
## [546] {bottled water,
##        whole milk}           => {rolls/buns}           0.008744281  0.2544379 0.034367056 1.383304
## [547] {bottled water,
##        other vegetables}     => {whole milk}           0.010777834  0.4344262 0.024809354 1.700192
## [548] {bottled water,
##        whole milk}           => {other vegetables}     0.010777834  0.3136095 0.034367056 1.620783
## [549] {root vegetables,
##        tropical fruit}       => {yogurt}               0.008134215  0.3864734 0.021047280 2.770384
## [550] {tropical fruit,
##        yogurt}               => {root vegetables}      0.008134215  0.2777778 0.029283172 2.548456
## [551] {root vegetables,
##        yogurt}               => {tropical fruit}       0.008134215  0.3149606 0.025826131 3.001587
```

```
## [552] {root vegetables,
##        tropical fruit}           => {rolls/buns}        0.005897306  0.2801932 0.021047280 1.523328
## [553] {root vegetables,
##        tropical fruit}           => {other vegetables}  0.012302999  0.5845411 0.021047280 3.020999
## [554] {other vegetables,
##        tropical fruit}           => {root vegetables}   0.012302999  0.3427762 0.035892222 3.144780
## [555] {other vegetables,
##        root vegetables}          => {tropical fruit}    0.012302999  0.2596567 0.047381800 2.474538
## [556] {root vegetables,
##        tropical fruit}           => {whole milk}        0.011997966  0.5700483 0.021047280 2.230969
## [557] {tropical fruit,
##        whole milk}               => {root vegetables}   0.011997966  0.2836538 0.042297916 2.602365
## [558] {soda,
##        tropical fruit}           => {yogurt}            0.006609049  0.3170732 0.020843925 2.272897
## [559] {soda,
##        tropical fruit}           => {rolls/buns}        0.005388917  0.2585366 0.020843925 1.405587
## [560] {soda,
##        tropical fruit}           => {other vegetables}  0.007219115  0.3463415 0.020843925 1.789947
## [561] {soda,
##        tropical fruit}           => {whole milk}        0.007829181  0.3756098 0.020843925 1.470005
## [562] {tropical fruit,
##        yogurt}                   => {rolls/buns}        0.008744281  0.2986111 0.029283172 1.623461
## [563] {rolls/buns,
##        tropical fruit}           => {yogurt}            0.008744281  0.3553719 0.024605999 2.547436
## [564] {rolls/buns,
##        yogurt}                   => {tropical fruit}    0.008744281  0.2544379 0.034367056 2.424803
## [565] {tropical fruit,
##        yogurt}                   => {other vegetables}  0.012302999  0.4201389 0.029283172 2.171343
## [566] {other vegetables,
##        tropical fruit}           => {yogurt}            0.012302999  0.3427762 0.035892222 2.457146
## [567] {other vegetables,
##        yogurt}                   => {tropical fruit}    0.012302999  0.2833724 0.043416370 2.700550
## [568] {tropical fruit,
##        yogurt}                   => {whole milk}        0.015149975  0.5173611 0.029283172 2.024770
## [569] {tropical fruit,
##        whole milk}               => {yogurt}            0.015149975  0.3581731 0.042297916 2.567516
## [570] {whole milk,
##        yogurt}                   => {tropical fruit}    0.015149975  0.2704174 0.056024403 2.577089
## [571] {rolls/buns,
##        tropical fruit}           => {other vegetables}  0.007829181  0.3181818 0.024605999 1.644413
## [572] {rolls/buns,
##        tropical fruit}           => {whole milk}        0.010981190  0.4462810 0.024605999 1.746587
## [573] {tropical fruit,
##        whole milk}               => {rolls/buns}        0.010981190  0.2596154 0.042297916 1.411452
## [574] {other vegetables,
##        tropical fruit}           => {whole milk}        0.017081851  0.4759207 0.035892222 1.862587
## [575] {tropical fruit,
##        whole milk}               => {other vegetables}  0.017081851  0.4038462 0.042297916 2.087140
## [576] {root vegetables,
##        soda}                     => {other vegetables}  0.008235892  0.4426230 0.018607016 2.287544
## [577] {other vegetables,
##        soda}                     => {root vegetables}   0.008235892  0.2515528 0.032740214 2.307856
## [578] {root vegetables,
##        soda}                     => {whole milk}        0.008134215  0.4371585 0.018607016 1.710885
```

```
## [579] {root vegetables,
##        yogurt}              => {rolls/buns}         0.007219115  0.2795276 0.025826131 1.519709
## [580] {rolls/buns,
##        root vegetables}     => {yogurt}             0.007219115  0.2970711 0.024300966 2.129515
## [581] {root vegetables,
##        yogurt}              => {other vegetables}   0.012913066  0.5000000 0.025826131 2.584078
## [582] {other vegetables,
##        root vegetables}     => {yogurt}             0.012913066  0.2725322 0.047381800 1.953611
## [583] {other vegetables,
##        yogurt}              => {root vegetables}    0.012913066  0.2974239 0.043416370 2.728698
## [584] {root vegetables,
##        yogurt}              => {whole milk}         0.014539908  0.5629921 0.025826131 2.203354
## [585] {root vegetables,
##        whole milk}          => {yogurt}             0.014539908  0.2972973 0.048906965 2.131136
## [586] {whole milk,
##        yogurt}              => {root vegetables}    0.014539908  0.2595281 0.056024403 2.381025
## [587] {rolls/buns,
##        root vegetables}     => {other vegetables}   0.012201322  0.5020921 0.024300966 2.594890
## [588] {other vegetables,
##        root vegetables}     => {rolls/buns}         0.012201322  0.2575107 0.047381800 1.400010
## [589] {other vegetables,
##        rolls/buns}          => {root vegetables}    0.012201322  0.2863962 0.042602949 2.627525
## [590] {rolls/buns,
##        root vegetables}     => {whole milk}         0.012709710  0.5230126 0.024300966 2.046888
## [591] {root vegetables,
##        whole milk}          => {rolls/buns}         0.012709710  0.2598753 0.048906965 1.412865
## [592] {other vegetables,
##        root vegetables}     => {whole milk}         0.023182511  0.4892704 0.047381800 1.914833
## [593] {root vegetables,
##        whole milk}          => {other vegetables}   0.023182511  0.4740125 0.048906965 2.449770
## [594] {other vegetables,
##        whole milk}          => {root vegetables}    0.023182511  0.3097826 0.074834774 2.842082
## [595] {soda,
##        yogurt}              => {rolls/buns}         0.008642603  0.3159851 0.027351296 1.717918
## [596] {rolls/buns,
##        yogurt}              => {soda}               0.008642603  0.2514793 0.034367056 1.442157
## [597] {soda,
##        yogurt}              => {other vegetables}   0.008337570  0.3048327 0.027351296 1.575423
## [598] {other vegetables,
##        soda}                => {yogurt}             0.008337570  0.2546584 0.032740214 1.825485
## [599] {soda,
##        yogurt}              => {whole milk}         0.010472801  0.3828996 0.027351296 1.498535
## [600] {soda,
##        whole milk}          => {yogurt}             0.010472801  0.2614213 0.040061007 1.873964
## [601] {rolls/buns,
##        soda}                => {other vegetables}   0.009862735  0.2572944 0.038332486 1.329738
## [602] {other vegetables,
##        soda}                => {rolls/buns}         0.009862735  0.3012422 0.032740214 1.637765
## [603] {other vegetables,
##        soda}                => {whole milk}         0.013929842  0.4254658 0.032740214 1.665124
## [604] {soda,
##        whole milk}          => {other vegetables}   0.013929842  0.3477157 0.040061007 1.797049
## [605] {rolls/buns,
##        yogurt}              => {other vegetables}   0.011489578  0.3343195 0.034367056 1.727815
```

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```
## [606] {other vegetables,
##        yogurt}                => {rolls/buns}        0.011489578  0.2646370  0.043416370  1.438753
## [607] {other vegetables,
##        rolls/buns}            => {yogurt}            0.011489578  0.2696897  0.042602949  1.933235
## [608] {rolls/buns,
##        yogurt}                => {whole milk}        0.015556685  0.4526627  0.034367056  1.771563
## [609] {whole milk,
##        yogurt}                => {rolls/buns}        0.015556685  0.2776770  0.056024403  1.509648
## [610] {rolls/buns,
##        whole milk}            => {yogurt}            0.015556685  0.2746858  0.056634469  1.969049
## [611] {other vegetables,
##        yogurt}                => {whole milk}        0.022267412  0.5128806  0.043416370  2.007235
## [612] {whole milk,
##        yogurt}                => {other vegetables}  0.022267412  0.3974592  0.056024403  2.054131
## [613] {other vegetables,
##        whole milk}            => {yogurt}            0.022267412  0.2975543  0.074834774  2.132979
## [614] {other vegetables,
##        rolls/buns}            => {whole milk}        0.017895272  0.4200477  0.042602949  1.643919
## [615] {rolls/buns,
##        whole milk}            => {other vegetables}  0.017895272  0.3159785  0.056634469  1.633026
```


To evaluate substitute groups, we created a subset where lift is less than .75

```
substitutes = subset(groceryrules, subset=lift < .75)
inspect(substitutes)
```

```
##       lhs                  rhs                    support    confidence coverage
## [1] {canned beer}    => {yogurt}           0.005388917 0.06937173 0.07768175
## [2] {canned beer}    => {other vegetables} 0.009049314 0.11649215 0.07768175
## [3] {canned beer}    => {whole milk}       0.008845958 0.11387435 0.07768175
## [4] {bottled beer}   => {shopping bags}    0.005592272 0.06944444 0.08052872
## [5] {shopping bags}  => {bottled beer}     0.005592272 0.05675955 0.09852567
##       lift       count
## [1] 0.4972820 53
## [2] 0.6020495 89
## [3] 0.4456642 87
## [4] 0.7048360 55
## [5] 0.7048360 55
```

This subset shows that beer and yogurt, beer and vegetables, beer and whole milk, and bottled beer and shopping bags are all substitutes. People who buy yogurt and vegetables are less likely to buy beer than those who do not. This may be because "beer runs" and actual grocery shopping fall into two different behavioral categories.
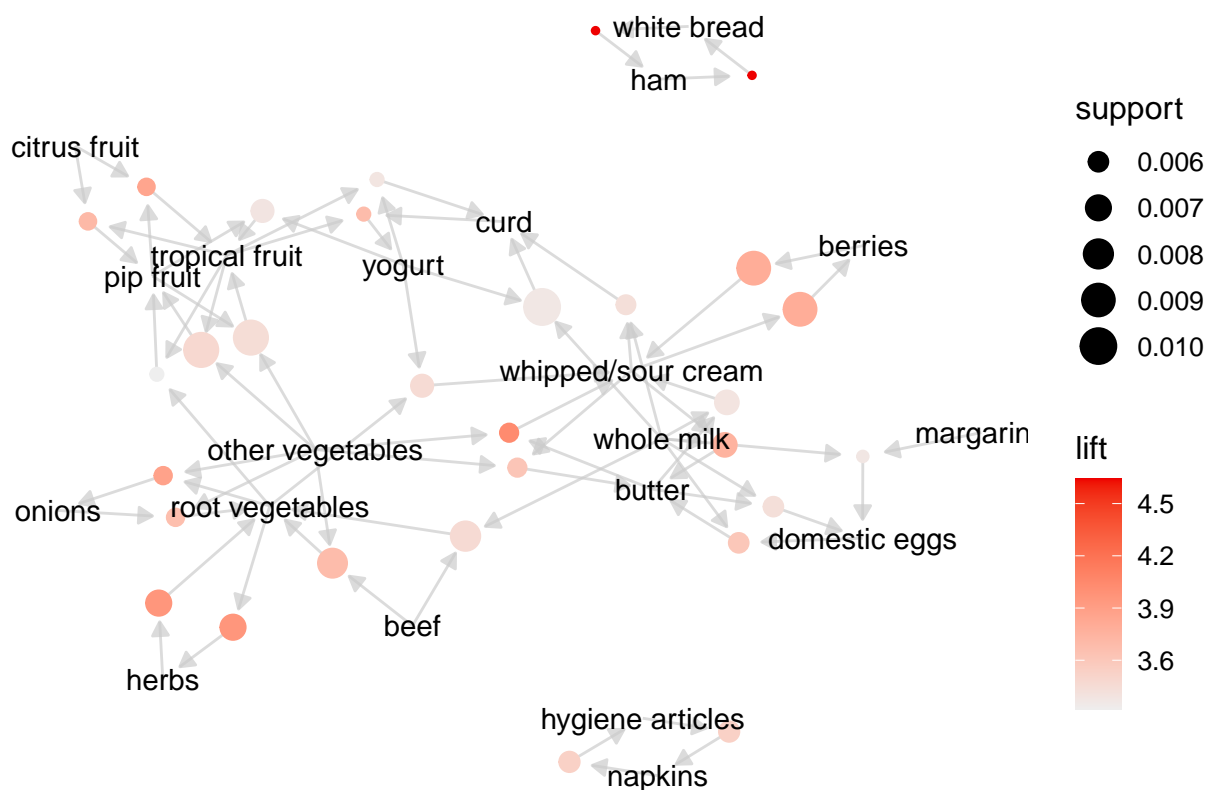
&nsbp;

Finally, we created another grouping to signify compliments, and identified these as groupings with high lift. Our lift cutoff is 3.05, which gives us a nice even group of 50 pairings.

```
##       lhs                    rhs                      support confidence    coverage     lift count
## [1]  {herbs}               => {root vegetables}   0.007015760 0.43125000 0.016268429 3.956477    69
## [2]  {root vegetables}     => {herbs}             0.007015760 0.06436567 0.108998475 3.956477    69
## [3]  {ham}                 => {white bread}       0.005083884 0.19531250 0.026029487 4.639851    50
## [4]  {white bread}         => {ham}               0.005083884 0.12077295 0.042094560 4.639851    50
## [5]  {berries}             => {whipped/sour cream} 0.009049314 0.27217125 0.033248602 3.796886    89
## [6]  {whipped/sour cream}  => {berries}           0.009049314 0.12624113 0.071682766 3.796886    89
## [7]  {hygiene articles}    => {napkins}           0.006100661 0.18518519 0.032943569 3.536498    60
## [8]  {napkins}             => {hygiene articles}  0.006100661 0.11650485 0.052364006 3.536498    60
## [9]  {chicken}             => {frozen vegetables} 0.006710727 0.15639810 0.042907982 3.251956    66
## [10] {frozen vegetables}   => {chicken}           0.006710727 0.13953488 0.048093543 3.251956    66
## [11] {onions,
##        root vegetables}     => {other vegetables}  0.005693950 0.60215054 0.009456024 3.112008    56
## [12] {onions,
##        other vegetables}    => {root vegetables}   0.005693950 0.40000000 0.014234875 3.669776    56
## [13] {other vegetables,
##        root vegetables}     => {onions}            0.005693950 0.12017167 0.047381800 3.875044    56
## [14] {other vegetables,
##        yogurt}              => {cream cheese }     0.005287239 0.12177986 0.043416370 3.071038    52
## [15] {chicken,
##        whole milk}          => {root vegetables}   0.005998983 0.34104046 0.017590239 3.128855    59
## [16] {frozen vegetables,
##        other vegetables}    => {root vegetables}   0.006100661 0.34285714 0.017793594 3.145522    60
## [17] {beef,
##        other vegetables}    => {root vegetables}   0.007930859 0.40206186 0.019725470 3.688692    78
## [18] {other vegetables,
##        root vegetables}     => {beef}              0.007930859 0.16738197 0.047381800 3.190313    78
## [19] {beef,
##        whole milk}          => {root vegetables}   0.008032537 0.37799043 0.021250635 3.467851    79
## [20] {root vegetables,
##        whole milk}          => {beef}              0.008032537 0.16424116 0.048906965 3.130449    79
## [21] {curd,
```

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```
##       whole milk}       => {whipped/sour cream} 0.005897306 0.22568093 0.026131164 3.148329    58
## [22] {whipped/sour cream,
##       whole milk}       => {curd}               0.005897306 0.18296530 0.032231825 3.434091    58
## [23] {curd,
##       tropical fruit}   => {yogurt}             0.005287239 0.51485149 0.010269446 3.690645    52
## [24] {tropical fruit,
##       yogurt}           => {curd}               0.005287239 0.18055556 0.029283172 3.388862    52
## [25] {whole milk,
##       yogurt}           => {curd}               0.010066090 0.17967332 0.056024403 3.372304    99
## [26] {margarine,
##       whole milk}       => {domestic eggs}      0.005185562 0.21428571 0.024199288 3.377404    51
## [27] {butter,
##       whole milk}       => {domestic eggs}      0.005998983 0.21771218 0.027554652 3.431409    59
## [28] {domestic eggs,
##       whole milk}       => {butter}             0.005998983 0.20000000 0.029994916 3.609174    59
## [29] {butter,
##       other vegetables} => {whipped/sour cream} 0.005795628 0.28934010 0.020030503 4.036397    57
## [30] {other vegetables,
##       whipped/sour cream} => {butter}           0.005795628 0.20070423 0.028876462 3.621883    57
## [31] {butter,
##       whole milk}       => {whipped/sour cream} 0.006710727 0.24354244 0.027554652 3.397503    66
## [32] {whipped/sour cream,
##       whole milk}       => {butter}             0.006710727 0.20820189 0.032231825 3.757185    66
## [33] {domestic eggs,
##       other vegetables} => {whipped/sour cream} 0.005083884 0.22831050 0.022267412 3.185012    50
## [34] {pip fruit,
##       whipped/sour cream} => {other vegetables} 0.005592272 0.60439560 0.009252669 3.123610    55
## [35] {tropical fruit,
##       whipped/sour cream} => {yogurt}           0.006202339 0.44852941 0.013828165 3.215224    61
## [36] {root vegetables,
##       yogurt}           => {whipped/sour cream} 0.006405694 0.24803150 0.025826131 3.460127    63
## [37] {other vegetables,
##       yogurt}           => {whipped/sour cream} 0.010167768 0.23419204 0.043416370 3.267062   100
## [38] {citrus fruit,
##       pip fruit}        => {tropical fruit}     0.005592272 0.40441176 0.013828165 3.854060    55
## [39] {pip fruit,
##       tropical fruit}   => {citrus fruit}       0.005592272 0.27363184 0.020437214 3.306105    55
## [40] {citrus fruit,
##       tropical fruit}   => {pip fruit}          0.005592272 0.28061224 0.019928826 3.709437    55
## [41] {pip fruit,
##       root vegetables}  => {tropical fruit}     0.005287239 0.33986928 0.015556685 3.238967    52
## [42] {root vegetables,
##       tropical fruit}   => {pip fruit}          0.005287239 0.25120773 0.021047280 3.320737    52
## [43] {pip fruit,
##       yogurt}           => {tropical fruit}     0.006405694 0.35593220 0.017996950 3.392048    63
## [44] {other vegetables,
##       pip fruit}        => {tropical fruit}     0.009456024 0.36186770 0.026131164 3.448613    93
## [45] {other vegetables,
##       tropical fruit}   => {pip fruit}          0.009456024 0.26345609 0.035892222 3.482649    93
## [46] {citrus fruit,
##       root vegetables}  => {tropical fruit}     0.005693950 0.32183908 0.017691917 3.067139    56
## [47] {root vegetables,
##       tropical fruit}   => {citrus fruit}       0.005693950 0.27053140 0.021047280 3.268644    56
## [48] {citrus fruit,
```

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```
##         other vegetables}    => {root vegetables}      0.010371124 0.35915493 0.028876462 3.295045     102
## [49] {rolls/buns,
##         shopping bags}       => {sausage}              0.005998983 0.30729167 0.019522115 3.270794      59
## [50] {other vegetables,
##         tropical fruit}      => {root vegetables}      0.012302999 0.34277620 0.035892222 3.144780     121


##         lhs                     rhs                        support confidence    coverage     lift count
## [1]  {herbs}               => {root vegetables}      0.007015760 0.43125000 0.016268429 3.956477      69
## [2]  {root vegetables}     => {herbs}                0.007015760 0.06436567 0.108998475 3.956477      69
## [3]  {ham}                 => {white bread}          0.005083884 0.19531250 0.026029487 4.639851      50
## [4]  {white bread}         => {ham}                  0.005083884 0.12077295 0.042094560 4.639851      50
## [5]  {berries}             => {whipped/sour cream}   0.009049314 0.27217125 0.033248602 3.796886      89
## [6]  {whipped/sour cream}  => {berries}              0.009049314 0.12624113 0.071682766 3.796886      89
## [7]  {hygiene articles}    => {napkins}              0.006100661 0.18518519 0.032943569 3.536498      60
## [8]  {napkins}             => {hygiene articles}     0.006100661 0.11650485 0.052364006 3.536498      60
## [9]  {chicken}             => {frozen vegetables}    0.006710727 0.15639810 0.042907982 3.251956      66
## [10] {frozen vegetables}   => {chicken}              0.006710727 0.13953488 0.048093543 3.251956      66
## [11] {onions,
##         root vegetables}   => {other vegetables}     0.005693950 0.60215054 0.009456024 3.112008      56
## [12] {onions,
##         other vegetables}  => {root vegetables}      0.005693950 0.40000000 0.014234875 3.669776      56
## [13] {other vegetables,
##         root vegetables}   => {onions}               0.005693950 0.12017167 0.047381800 3.875044      56
## [14] {other vegetables,
##         yogurt}            => {cream cheese }        0.005287239 0.12177986 0.043416370 3.071038      52
## [15] {chicken,
##         whole milk}        => {root vegetables}      0.005998983 0.34104046 0.017590239 3.128855      59
## [16] {frozen vegetables,
##         other vegetables}  => {root vegetables}      0.006100661 0.34285714 0.017793594 3.145522      60
## [17] {beef,
##         other vegetables}  => {root vegetables}      0.007930859 0.40206186 0.019725470 3.688692      78
## [18] {other vegetables,
##         root vegetables}   => {beef}                 0.007930859 0.16738197 0.047381800 3.190313      78
## [19] {beef,
##         whole milk}        => {root vegetables}      0.008032537 0.37799043 0.021250635 3.467851      79
## [20] {root vegetables,
##         whole milk}        => {beef}                 0.008032537 0.16424116 0.048906965 3.130449      79
## [21] {curd,
##         whole milk}        => {whipped/sour cream}   0.005897306 0.22568093 0.026131164 3.148329      58
## [22] {whipped/sour cream,
##         whole milk}        => {curd}                 0.005897306 0.18296530 0.032231825 3.434091      58
## [23] {curd,
##         tropical fruit}    => {yogurt}               0.005287239 0.51485149 0.010269446 3.690645      52
## [24] {tropical fruit,
##         yogurt}            => {curd}                 0.005287239 0.18055556 0.029283172 3.388862      52
## [25] {whole milk,
##         yogurt}            => {curd}                 0.010066090 0.17967332 0.056024403 3.372304      99
## [26] {margarine,
##         whole milk}        => {domestic eggs}        0.005185562 0.21428571 0.024199288 3.377404      51
## [27] {butter,
##         whole milk}        => {domestic eggs}        0.005998983 0.21771218 0.027554652 3.431409      59
## [28] {domestic eggs,
##         whole milk}        => {butter}               0.005998983 0.20000000 0.029994916 3.609174      59
## [29] {butter,
```

```
##          other vegetables}    => {whipped/sour cream} 0.005795628 0.28934010 0.020030503 4.036397    57
## [30] {other vegetables,
##          whipped/sour cream} => {butter}              0.005795628 0.20070423 0.028876462 3.621883    57
## [31] {butter,
##          whole milk}          => {whipped/sour cream} 0.006710727 0.24354244 0.027554652 3.397503    66
## [32] {whipped/sour cream,
##          whole milk}          => {butter}              0.006710727 0.20820189 0.032231825 3.757185    66
## [33] {domestic eggs,
##          other vegetables}    => {whipped/sour cream} 0.005083884 0.22831050 0.022267412 3.185012    50
## [34] {pip fruit,
##          whipped/sour cream} => {other vegetables}    0.005592272 0.60439560 0.009252669 3.123610    55
## [35] {tropical fruit,
##          whipped/sour cream} => {yogurt}              0.006202339 0.44852941 0.013828165 3.215224    61
## [36] {root vegetables,
##          yogurt}              => {whipped/sour cream} 0.006405694 0.24803150 0.025826131 3.460127    63
## [37] {other vegetables,
##          yogurt}              => {whipped/sour cream} 0.010167768 0.23419204 0.043416370 3.267062   100
## [38] {citrus fruit,
##          pip fruit}           => {tropical fruit}     0.005592272 0.40441176 0.013828165 3.854060    55
## [39] {pip fruit,
##          tropical fruit}      => {citrus fruit}       0.005592272 0.27363184 0.020437214 3.306105    55
## [40] {citrus fruit,
##          tropical fruit}      => {pip fruit}          0.005592272 0.28061224 0.019928826 3.709437    55
## [41] {pip fruit,
##          root vegetables}     => {tropical fruit}     0.005287239 0.33986928 0.015556685 3.238967    52
## [42] {root vegetables,
##          tropical fruit}      => {pip fruit}          0.005287239 0.25120773 0.021047280 3.320737    52
## [43] {pip fruit,
##          yogurt}              => {tropical fruit}     0.006405694 0.35593220 0.017996950 3.392048    63
## [44] {other vegetables,
##          pip fruit}           => {tropical fruit}     0.009456024 0.36186770 0.026131164 3.448613    93
## [45] {other vegetables,
##          tropical fruit}      => {pip fruit}          0.009456024 0.26345609 0.035892222 3.482649    93
## [46] {citrus fruit,
##          root vegetables}     => {tropical fruit}     0.005693950 0.32183908 0.017691917 3.067139    56
## [47] {root vegetables,
##          tropical fruit}      => {citrus fruit}       0.005693950 0.27053140 0.021047280 3.268644    56
## [48] {citrus fruit,
##          other vegetables}    => {root vegetables}    0.010371124 0.35915493 0.028876462 3.295045   102
## [49] {rolls/buns,
##          shopping bags}       => {sausage}            0.005998983 0.30729167 0.019522115 3.270794    59
## [50] {other vegetables,
##          tropical fruit}      => {root vegetables}    0.012302999 0.34277620 0.035892222 3.144780   121
```

The highest lifts are ham and white bread, butter/other vegetables and whipped/sour cream, and citrus fruit/pip fruit and tropical fruit. In looking through each of these high lift combinations and searching for unexpected associations, we find that they all make sense.