

# Part 2 R Project

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```
library(tidyverse)

## -- Attaching packages ----- tidyverse 1.2.1 --

## v ggplot2 3.2.0     v purrr   0.3.2
## v tibble  2.1.3     v dplyr    0.8.3
## v tidyr   0.8.3     v stringr  1.4.0
## v readr   1.3.1     vforcats  0.4.0

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()   masks stats::lag()

library(ggplot2)
library(dplyr)
library(lattice)
library(grid)
library(gridExtra)

## 
## Attaching package: 'gridExtra'

## The following object is masked from 'package:dplyr':
## 
##     combine

library(mosaic)

## Loading required package: ggformula

## Loading required package: ggstance

## 
## Attaching package: 'ggstance'

## The following objects are masked from 'package:ggplot2':
## 
##     geom_errorbarh, GeomErrorbarh

## 
## New to ggformula? Try the tutorials:
##   learnr::run_tutorial("introduction", package = "ggformula")
##   learnr::run_tutorial("refining", package = "ggformula")
```

```

## Loading required package: mosaicData

## Loading required package: Matrix

##
## Attaching package: 'Matrix'

## The following object is masked from 'package:tidyR':
## 
##     expand

## Registered S3 method overwritten by 'mosaic':
##   method           from
##   fortify.SpatialPolygonsDataFrame ggplot2

##
## The 'mosaic' package masks several functions from core packages in order to add
## additional features. The original behavior of these functions should not be affected by this.
##
## Note: If you use the Matrix package, be sure to load it BEFORE loading mosaic.

##
## Attaching package: 'mosaic'

## The following object is masked from 'package:Matrix':
## 
##     mean

## The following objects are masked from 'package:dplyr':
## 
##     count, do, tally

## The following object is masked from 'package:purrr':
## 
##     cross

## The following object is masked from 'package:ggplot2':
## 
##     stat

## The following objects are masked from 'package:stats':
## 
##     binom.test, cor, cor.test, cov, fivenum, IQR, median,
##     prop.test, quantile, sd, t.test, var

## The following objects are masked from 'package:base':
## 
##     max, mean, min, prod, range, sample, sum

```

```

library(quantmod)

## Loading required package: xts

## Loading required package: zoo

##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##       as.Date, as.Date.numeric

## Registered S3 method overwritten by 'xts':
##   method      from
##   as.zoo.xts zoo

##
## Attaching package: 'xts'

## The following objects are masked from 'package:dplyr':
##       first, last

## Loading required package: TTR

## Registered S3 method overwritten by 'quantmod':
##   method      from
##   as.zoo.data.frame zoo

## Version 0.4-0 included new data defaults. See ?getSymbols.

```

```

library(foreach)

##
## Attaching package: 'foreach'

## The following objects are masked from 'package:purrr':
##       accumulate, when

set.seed(1)

```

##Question 1 ##### Approach

After going through our excel guru's analysis of the situation, we felt that some important details were overlooked. We will look through those missing details and some more as we go ahead with our analysis. Once we determine the effect of the factors that are unaccounted for in the analysis, we can give an unbiased opinion, solely based on the data

```

df <- read.csv(file = 'greenbuildings.csv')
head(df)

##   CS_PropertyID cluster    size empl_gr   Rent leasing_rate stories age
## 1      379105       1 260300    2.22 38.56      91.39     14 16
## 2      122151       1 67861     2.22 28.57      87.14      5 27
## 3      379839       1 164848    2.22 33.31      88.94     13 36
## 4      94614        1 93372     2.22 35.00      97.04     13 46
## 5      379285       1 174307    2.22 40.69      96.58     16  5
## 6      94765        1 231633    2.22 43.16      92.74     14 20
##   renovated class_a class_b LEED Energystar green_rating net amenities
## 1          0       1       0     0         1           1     0       1
## 2          0       0       1     0         0           0     0       1
## 3          1       0       1     0         0           0     0       1
## 4          1       0       1     0         0           0     0       0
## 5          0       1       0     0         0           0     0       1
## 6          0       1       0     0         0           0     0       1
##   cd_total_07 hd_total07 total_dd_07 Precipitation Gas_Costs
## 1      4988        58      5046      42.57 0.01370000
## 2      4988        58      5046      42.57 0.01373149
## 3      4988        58      5046      42.57 0.01373149
## 4      4988        58      5046      42.57 0.01373149
## 5      4988        58      5046      42.57 0.01373149
## 6      4988        58      5046      42.57 0.01373149
##   Electricity_Costs cluster_rent
## 1      0.02900000     36.78
## 2      0.02904455     36.78
## 3      0.02904455     36.78
## 4      0.02904455     36.78
## 5      0.02904455     36.78
## 6      0.02904455     36.78

```

## Possible considerations

1. EDA before outlier removal
2. Occupancy as a dependant - Avg. occupancy rate assumed to be 100%/90% throughout the 8/9 year period (if changed, will affect investment recovery time)
3. Avg. rent calculation - rent can be calculated for smaller, more specific sections of the building population (by amenities, renovated, rating etc.)

### EDA before outlier removal

While the ability of these buildings to distort the analysis is real, there was no mention of an EDA for these buildings or any outliers. Let's just confirm if the intuition is right.

Upon checking the distribution of data in the different bins of leasing rate, we find that data is sparsely present for rates upto 60%. In the graph below, we can clearly see that majority of the buildings are on the higher side of the spectrum.

```

##   Occupancy Percent_Data
## 1      10      2.723588
## 2      20      3.103623

```

```

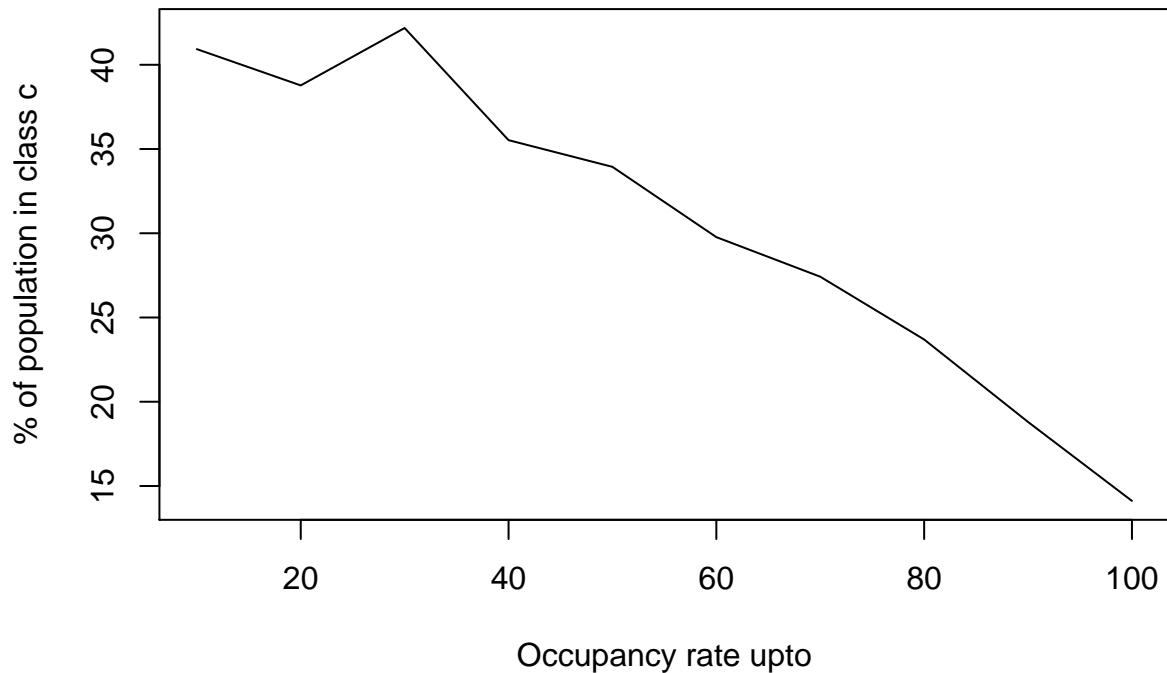
## 3      30    4.294401
## 4      40    5.776539
## 5      50    8.652141
## 6      60   11.641753
## 7      70   17.798328
## 8      80   27.514568
## 9      90   50.975424
## 10     100 100.000000

```

Since the dataset does not mention the class and amenities of the new building, for simplicity of computation we assume that our building will belong to class a, have amenities=1, rent as net=0 (Since green buildings can lower costs, this can be a potential addition to the income stream)

Further looking at how many class c buildings are present in different data sections,

### Occupancy rate vs. % of class c buildings



After some eyeballing on the summary statistics, we can say the following about buildings with less than 60% occupancy(set60):

1. These are smaller buildings, with lesser floors on an average.
2. These buildings are generally older - their mean and median is much above those of the mean and median of the population, even though the max(population)>max(set60)
3. 30% of these buildings belong to class c as compared to 14% in the overall population
4. 2% of set60 buildings are green rated vs. almost 10% of population
5. Majority((70%)) of these buildings do not have amenities

Based on our assumptions and observations, we extend the outlier removal to buildings with less than 60% occupancy.

## **What all affects occupancy?**

One big underlying assumption behind the prediction of the ~8yr time frame for recovering the premium amount is that the building operates at 100% occupancy from day 1. We will run a linear model to find the factors that significantly affect our occupancy rate.

From our model, we found that out of the significant ones, the positive are:

1. Size
2. Rent/sq.ft. / Cluster Rent
3. Class a/b
4. net
5. Gas costs

The ones that affect occupancy negatively are:

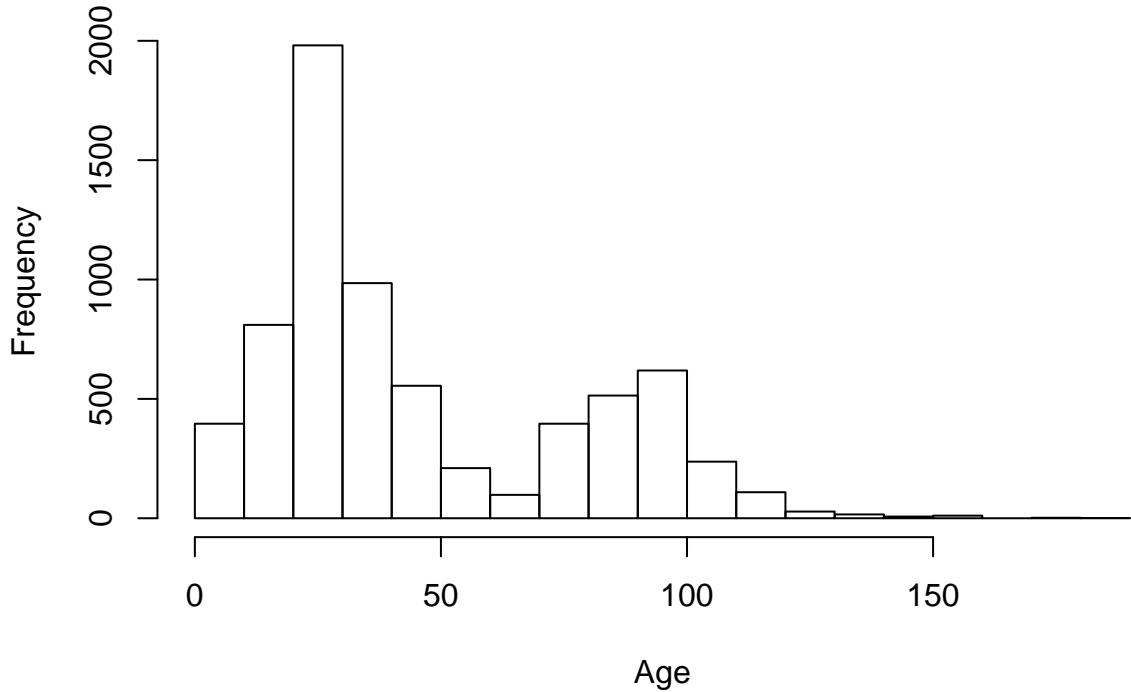
1. Employment Growth Rate
2. Age of the building
3. Having net contracts
4. Precipitation
5. Electricity costs

Since we do not have exact numbers for these factors for our building, we will assume our rent to be 90% as a safer bet than a complete 100%.

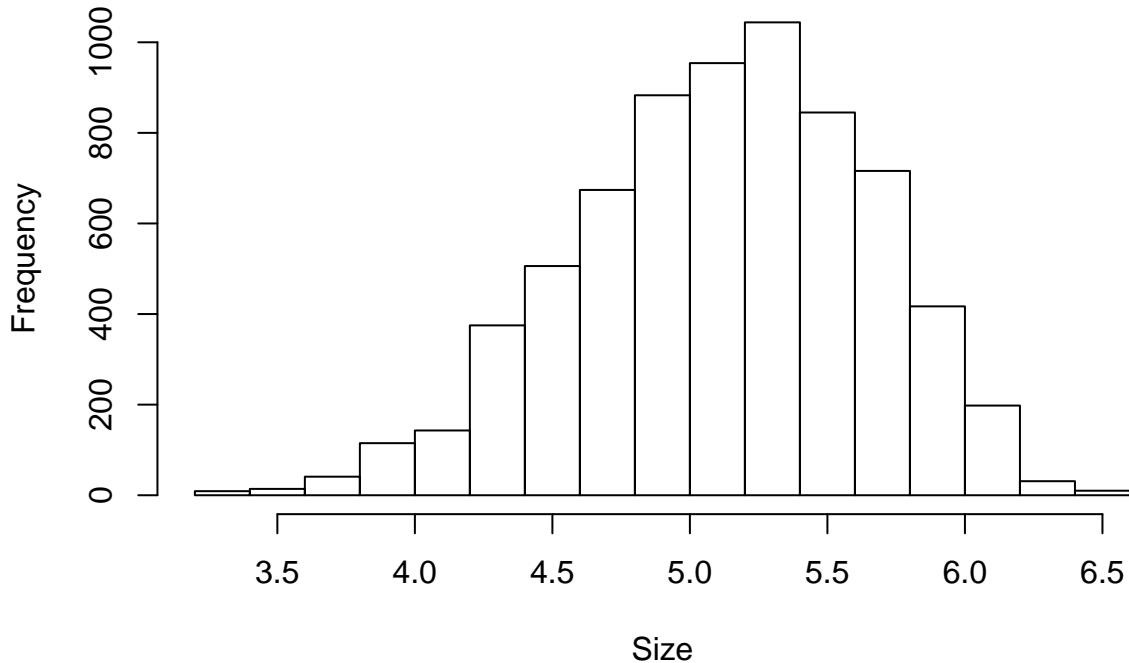
## **Average rent for specific building types**

After observing the distribution of the variables, we will assign buckets for different variables to our data based and couple data points to compare similar buildings for rent as time progresses.

## Histogram of Building Age



## Histogram of log Building Size



We grouped our data into segments, and based on those our building lies in the following group:

1. Amenities = 1 (Assumption)
2. net = 0 (Assumption)
3. Class = a (assumption)
4. Size = Between 100k and 500k (Given as 250k)
5. Age = Less than 20 years (new building)

And we will compare green vs. non-green average rents for this cut of the data. Since we do not have any information about the cluster that this building will lie in, we rely on the randomness of the data to give an answer close to real.

```
## # A tibble: 3 x 5
##   green_rating LEED  class_a  mean     sd
##   <fct>        <fct> <fct>    <dbl>   <dbl>
## 1 0            0     1        36.4    12.2
## 2 1            0     1        34.1    13.2
## 3 1            1     1        34.9    21.6
```

We can observe from the computations above that the mean rent for green buildings of class a is lesser than the mean rent for non-green buildings of class a. Same is the case with the median. What's more is that the standard deviation is higher for green buildings, making the investment riskier in short term.

If we go ahead and observe this for older buildings:

```
## # A tibble: 3 x 5
```

```

##   green_rating LEED  class_a  mean     sd
##   <fct>        <fct> <fct>  <dbl> <dbl>
## 1 0            0     1      32.6  12.7
## 2 1            0     1      32.0  12.8
## 3 1            1     1      24     0

```

Slightly longer term projections of rent from the given data for comparable buildings in size bucket and amenities are much lesser than those for non-green buildings.

Solely based on the data, our suggestion is against the green building for now. If we are able to obtain some more data and information about the location of the clusters and the building in questions, we might be able to further refine the analysis to revise the answer. While from an environmental point of view, a green building sounds sustainable, future-proof and a PR generating asset, we are not able to monetise the effects of electricity costs, PR costs and returns, CSR costs and returns etc. With this kind of a situation and uncertainty due to lack of data on a lot of the important variables that can tell a better story, our recommendation is not to invest an extra \$5 Million as there is no guarantee of any extra returns.

###Question 2: Visual story telling part 2: flights at ABIA

```

data<-read.csv("ABIA.csv", header=TRUE)
attach(data)

```

## Find the delays of planes

```

dep_delay<-aggregate(DepDelay~Origin, data, mean)
# Order them in ascending order
dep_delay[order(dep_delay$DepDelay),]

```

```

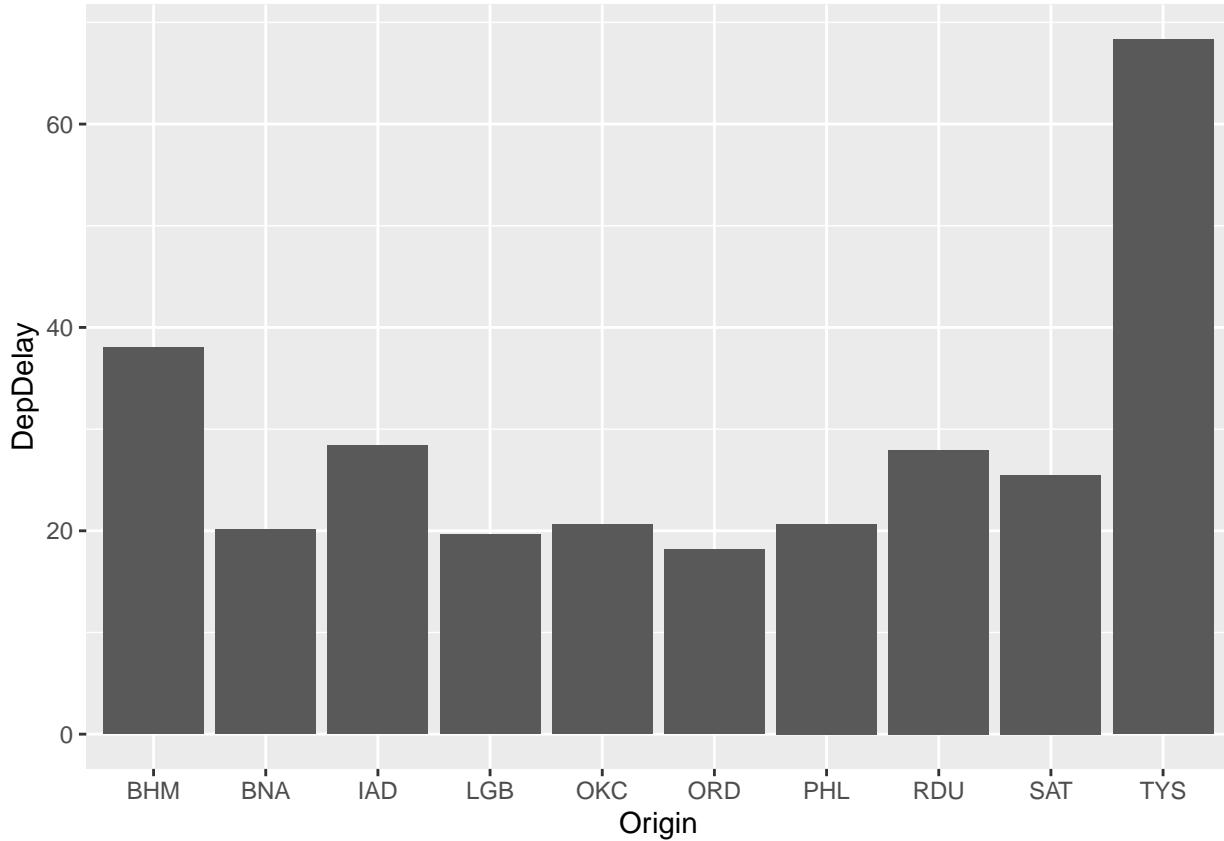
##    Origin DepDelay
## 35    OAK  2.508475
## 21    IND  2.660465
## 51    TUL  3.157303
## 28    MAF  3.236674
## 26    LBB  4.118841
## 22    JAX  4.136564
## 49    STL  4.382022
## 50    TPA  4.531335
## 25    LAX  4.852326
## 1     ABQ  4.943794
## 34    MSY  5.092971
## 6     BOS  5.193989
## 3     AUS  7.424662
## 18    HRL  7.454039
## 8     CLE  7.485333
## 30    MCO  7.541139
## 14    ELP  7.790022
## 46    SJC  7.962726
## 29    MCI  8.109620
## 40    PHX  8.356603
## 10    CVG  8.596923
## 47    SLC  8.670310

```

```
## 33    MSP  8.703704
## 32    MEM  8.846814
## 42    SAN  8.862937
## 20    IAH  8.999726
## 12    DEN  9.323996
## 52    TUS  9.397380
## 11    DAL  9.440563
## 45    SFO  9.614876
## 16    FLL  9.745833
## 24    LAS  10.084622
## 13    DFW  11.677383
## 17    HOU  11.902246
## 7     BWI  12.079670
## 48    SNA  12.361789
## 37    ONT  13.003289
## 44    SEA  13.020690
## 2     ATL  14.507879
## 9     CLT  14.852584
## 23    JFK  16.519274
## 31    MDW  17.404795
## 15    EWR  17.531183
## 38    ORD  18.179794
## 27    LGB  19.646091
## 5     BNA  20.155975
## 36    OKC  20.620690
## 39    PHL  20.672414
## 43    SAT  25.500000
## 41    RDU  27.934498
## 19    IAD  28.395498
## 4     BHM  38.000000
## 53    TYS  68.333333
```

```
top10_depdelays<-tail(dep_delay[order(dep_delay$DepDelay),],10)
top10_depdelays$Origin<-as.factor(top10_depdelays$Origin)

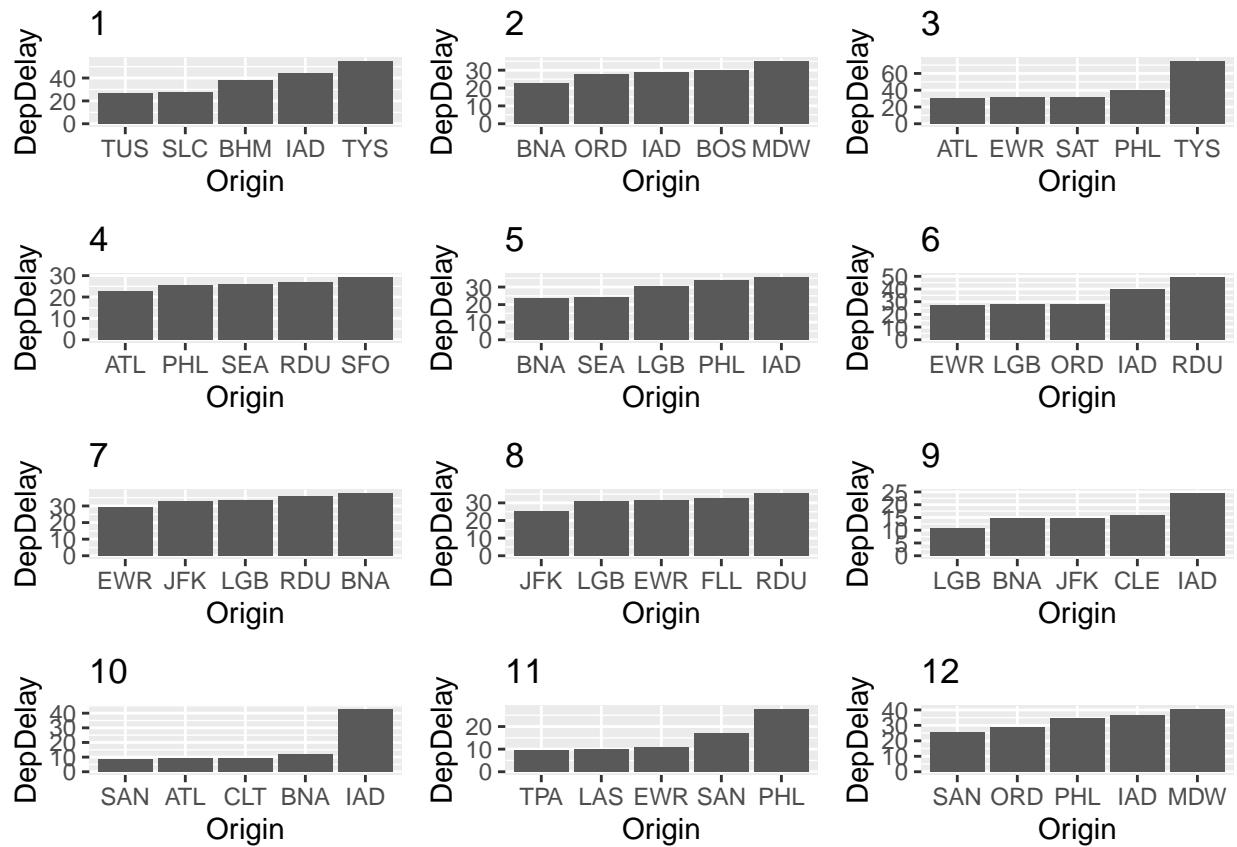
ggplot(top10_depdelays,aes(Origin, DepDelay))+geom_bar(stat='identity')
```



```

months<- list()
for (i in 1:12) {
  dep_delay<-aggregate(DepDelay~Origin, subset(data, data['Month']==i), mean)
  dep_delay[order(dep_delay$DepDelay),]
  top10_depdelays<-tail(dep_delay[order(dep_delay$DepDelay),],5)
  top10_depdelays$Origin<-factor(top10_depdelays$Origin, levels=top10_depdelays$Origin[order(top10_depdelays$Origin),])
  months[[i]]<-ggplot(top10_depdelays, aes(Origin, DepDelay)) + gtitle(i)+ geom_bar(stat='identity')
}
do.call(grid.arrange,months)

```



## Departure delays by departure time- Austin Airport

```

data$DepHour<-round(data$CRSDepTime/100,0)
# subsetting flights flying out of Austin
outbound <-subset(data, data$Origin == 'AUS')
outbound_delay <- subset(data, data$Origin == 'AUS' & data$DepDelay>0)
by_hr <-aggregate(outbound_delay$DepDelay,by=list(outbound_delay$DepHour), FUN=mean, na.rm=TRUE)

names(by_hr)[1] <- "Departure.hour"
names(by_hr)[2] <- "Avg.Delay"

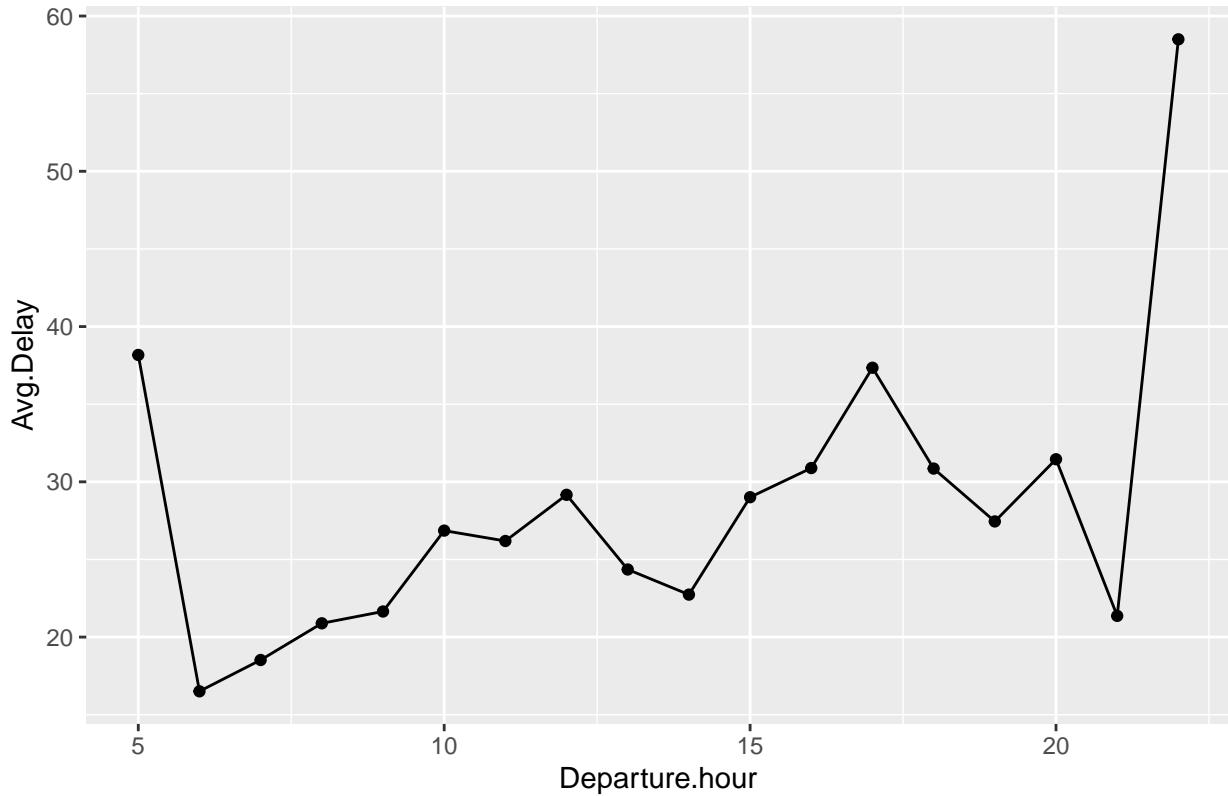
by_hr <- by_hr[order(by_hr$Departure.hour),]

by_hr <- subset(by_hr,by_hr$Departure.hour != 1)

ggplot(data= by_hr, aes(x=Departure.hour, y=Avg.Delay)) + geom_line() + geom_point() + ggtitle("Average")

```

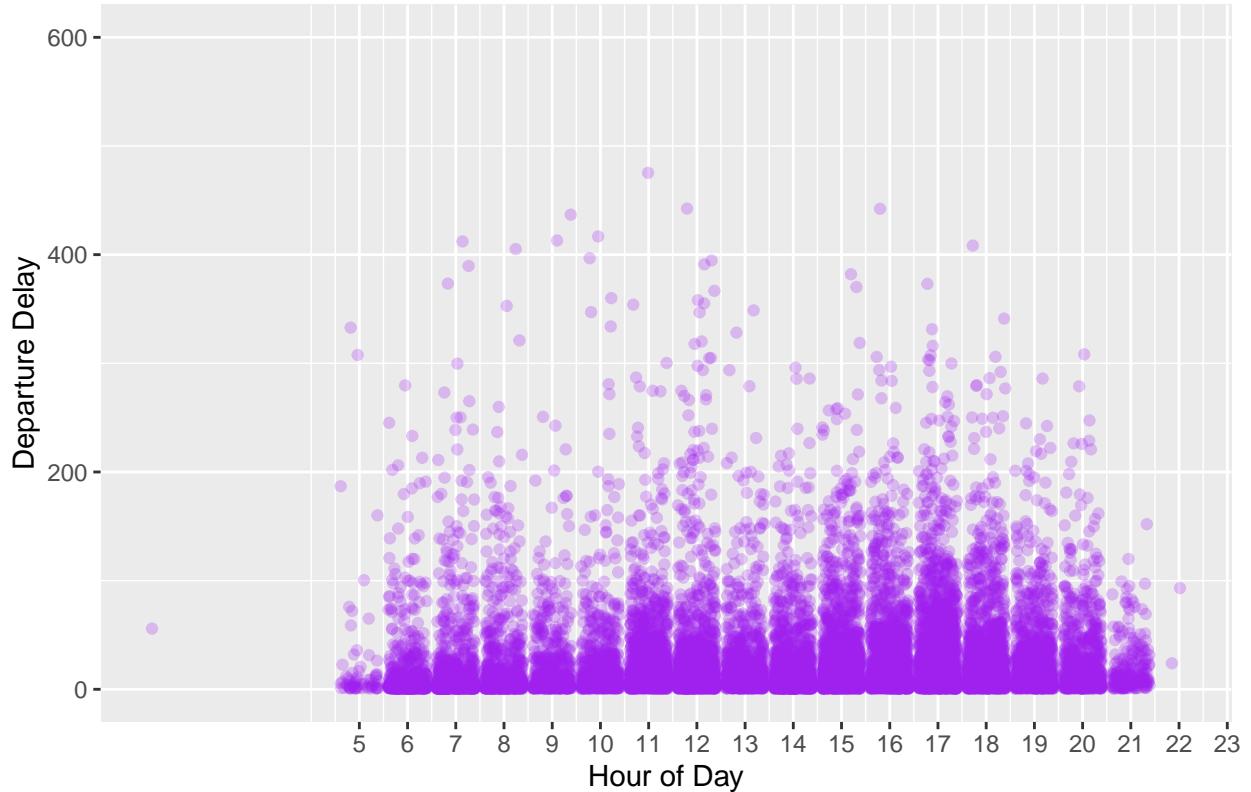
### Average delay based on scheduled departure time



```
b1<-ggplot(outbound_delay, aes(DepHour, DepDelay)) + ylim(0, 600) +
  geom_jitter(alpha=I(1/4), col = "purple") +
  theme(legend.position = "none") +
  scale_x_continuous(breaks=seq(5,23)) +
  labs(x="Hour of Day",y="Departure Delay",title="Departure Delays by Scheduled Departure Time")
b1
```

```
## Warning: Removed 2 rows containing missing values (geom_point).
```

## Departure Delays by Scheduled Departure Time



## Summary:

The best time to fly out of Austin to avoid delays, would be early morning or late night. If the origin of the flight is from BHM or TYS, people will have to expect more delays than usual. Additionally, by dividing the delaying of the origin of the flight by different months, TYS recorded the most delays especially in January and March. Other than that, IAD is the worst origin when it comes to delay in May, September, and October.

### ###Question 3: Portfolio Modeling

The following models will estimate the 4-week (20-trading day) value at risk of 3 portfolios at the 5% level.

```
#Portfolio 1
#Import 5 highest-performing ETFS
#Source:https://www.bankrate.com/investing/best-etfs/
mystocks = c("VIXY", "QQQ", "IVV", "VYM", "VHT")
getSymbols(mystocks)

## '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.

## [1] "VIXY" "QQQ"  "IVV"  "VYM"  "VHT"

# Adjust for splits and any dividends during the period so for loop is unnecessary
VIXYa = adjustOHLC(VIXY)
QQQa = adjustOHLC(QQQ)
IVVa = adjustOHLC(IVV)
VYMa = adjustOHLC(VYM)
VHTa = adjustOHLC(VHT)

#Imported five years of data of each ETF
mystocks = c("VIXY", "QQQ", "IVV", "VYM", "VHT")
myprices = getSymbols(mystocks, from = "2007-01-01")

```

The team chose these 5 ETF's because we researched the highest performing ETF's and wanted to determine if consistently high-performing ETF's would outperform more volatile ETF's such as tech and hedge fund ETFs.

```

#Combines close to close changes in a single matrix to keep everything uniform
all_returns = cbind(C1C1(VIXYa),
                    C1C1(QQQa),
                    C1C1(IVVa),
                    C1C1(VYMa),
                    C1C1(VHTa))
all_returns = as.matrix(na.omit(all_returns))
return.today = resample(all_returns, 1, orig.ids=FALSE) #sampling random return to simulate a random day

```

```

#Update the value of all holdings
total_wealth = 100000
my_weights = c(0.2,0.2,0.2, 0.2, 0.2) #assumes equal weight allocation for each ETF
set.seed(99)
holdings = total_wealth*my_weights
holdings = holdings*(1 + return.today)

# Compute new total wealth
total_wealth = sum(holdings)
total_wealth

```

```
## [1] 100175.3
```

The total value of this portfolio after allocating the weights of the ETF's is \$99963.60.

```

#Loop over four trading weeks
total_wealth = 100000
weights = c(0.2, 0.2, 0.2, 0.2, 0.2) #weight of ETFS
holdings = weights * total_wealth
n_days = 20
wealthtracker = rep(0, n_days) # Set up a placeholder to track total wealth
set.seed(99)
for(today in 1:n_days) {
  return.today = resample(all_returns, 1, orig.ids=FALSE)
  total_wealth = sum(holdings*(1 + return.today))
  wealthtracker[today] = total_wealth
}
```

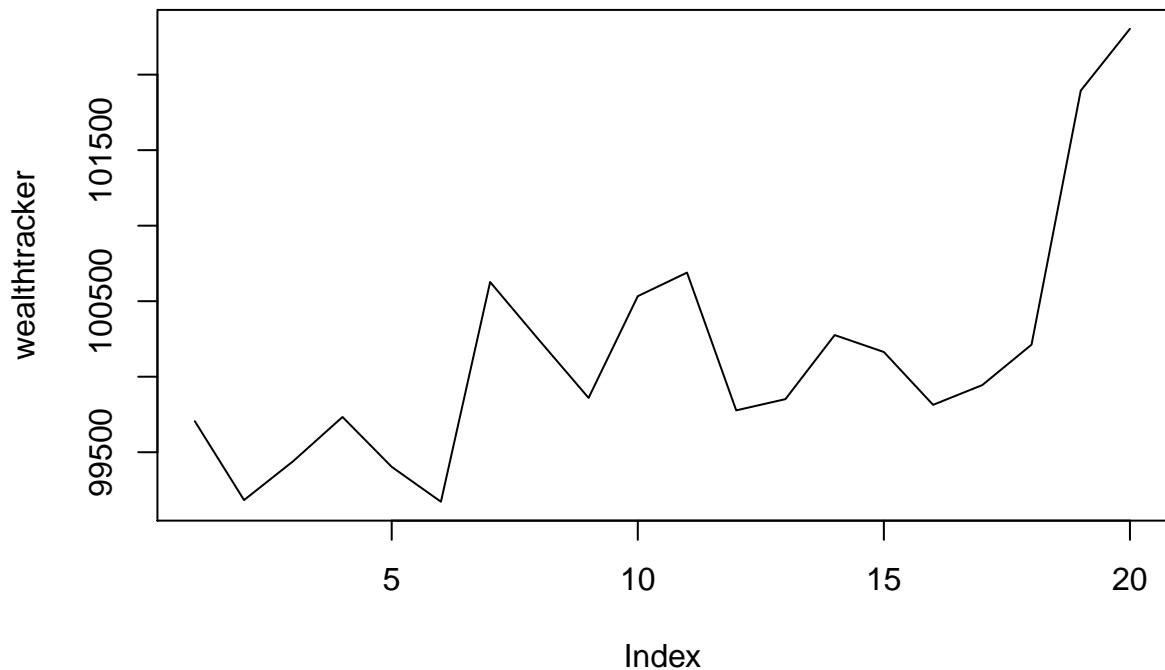
```

holdings = holdings + holdings*return.today
total_wealth = sum(holdings)
wealthtracker[today] = total_wealth
}
total_wealth

## [1] 102303.2

plot(wealthtracker, type='l')

```



If we were to trade these ETF's for a period of 4 weeks, the total value of the portfolio will fluctuate but this simulation outputs a value of \$102303.20 if the model seed is set. This overall value is much higher than the baseline value of the portfolio previously calculated without trading.

```

#simulate various trading scenarios
initial_wealth = 100000
set.seed(99)
sim1 = foreach(i=1:5000, .combine='rbind') %do% {
  total_wealth = initial_wealth
  weights = c(0.2, 0.2, 0.2, 0.2, 0.2)
  holdings = weights * total_wealth
  n_days = 20 #must change to 20
  wealthtracker = rep(0, n_days)
  for(today in 1:n_days) {
    return.today = resample(all_returns, 1, orig.ids=FALSE)

```

```

        holdings = holdings + holdings*return.today
        total_wealth = sum(holdings)
        wealthtracker[today] = total_wealth
    }
    wealthtracker
}

head(sim1)

##          [,1]      [,2]      [,3]      [,4]      [,5]      [,6]
## result.1 99705.07 99183.23 99441.11 99733.36 99403.26 99172.3
## result.2 100438.64 100990.49 100837.81 101058.43 101843.26 102039.8
## result.3 99661.02 99966.65 100109.14 99589.60 100006.79 100212.5
## result.4 100597.72 100847.09 100796.85 100939.43 101581.92 101296.3
## result.5 100398.73 99881.39 99036.41 98792.21 99063.77 99204.2
## result.6 100049.87 99581.21 99321.71 99663.69 99916.62 100369.9
##          [,7]      [,8]      [,9]      [,10]     [,11]     [,12]
## result.1 100626.84 100240.1 99859.84 100533.17 100689.14 99777.05
## result.2 102110.39 101301.4 100996.03 101056.29 101229.24 101547.10
## result.3 101015.84 101064.9 102330.07 101791.28 102141.43 101762.88
## result.4 101872.68 101858.5 102698.88 102571.23 102308.10 102261.45
## result.5 98944.22 99198.9 99139.01 99127.41 99798.03 99512.55
## result.6 100859.32 100610.6 101248.84 102052.33 103062.75 102444.01
##          [,13]     [,14]     [,15]     [,16]     [,17]     [,18]
## result.1 99851.54 100275.8 100163.62 99813.62 99944.49 100211.99
## result.2 101114.37 100135.0 99774.22 99451.17 99089.74 98699.41
## result.3 101423.46 101486.7 101026.32 101181.28 101883.28 102687.60
## result.4 102157.59 102271.4 102145.27 102229.54 102413.86 102714.41
## result.5 100247.38 100561.4 100122.68 100287.51 99720.69 100260.83
## result.6 101490.29 100981.2 100784.34 100466.84 100674.86 99942.38
##          [,19]     [,20]
## result.1 101894.12 102303.25
## result.2 98788.61 99034.86
## result.3 102604.01 102272.24
## result.4 102406.90 101629.18
## result.5 99680.24 99253.77
## result.6 99741.45 100238.50

```

```
min(head(sim1))
```

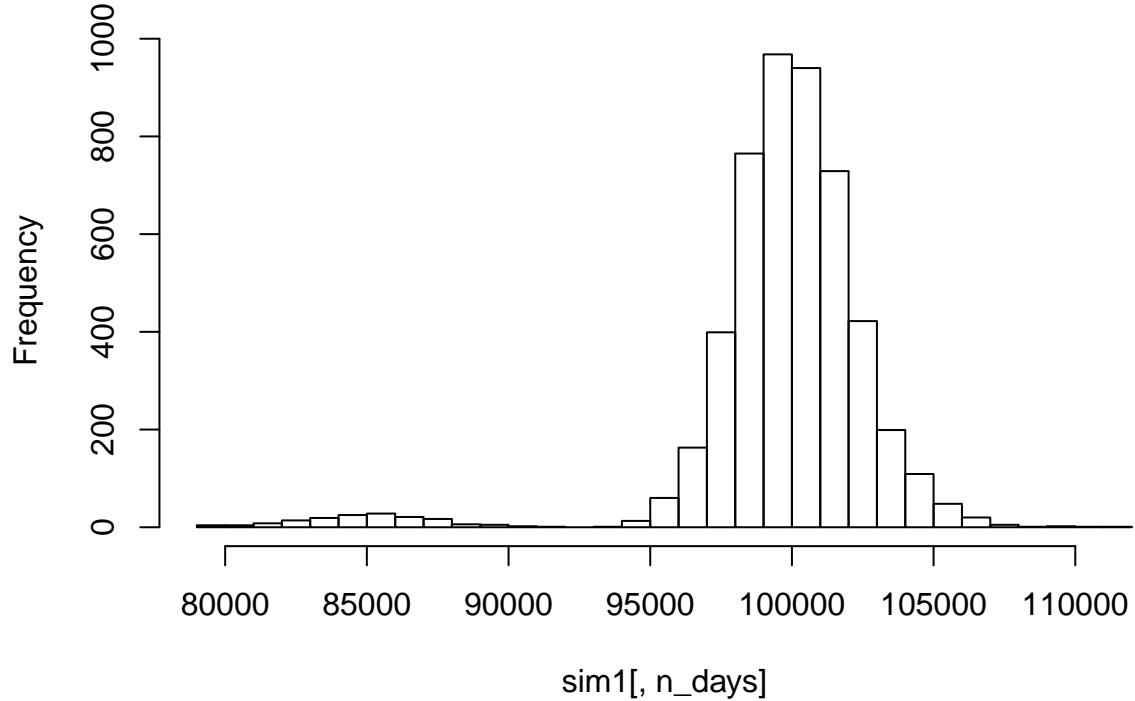
```
## [1] 98699.41
```

```
max(head(sim1))
```

```
## [1] 103062.7
```

```
hist(sim1[,n_days], 25)
```

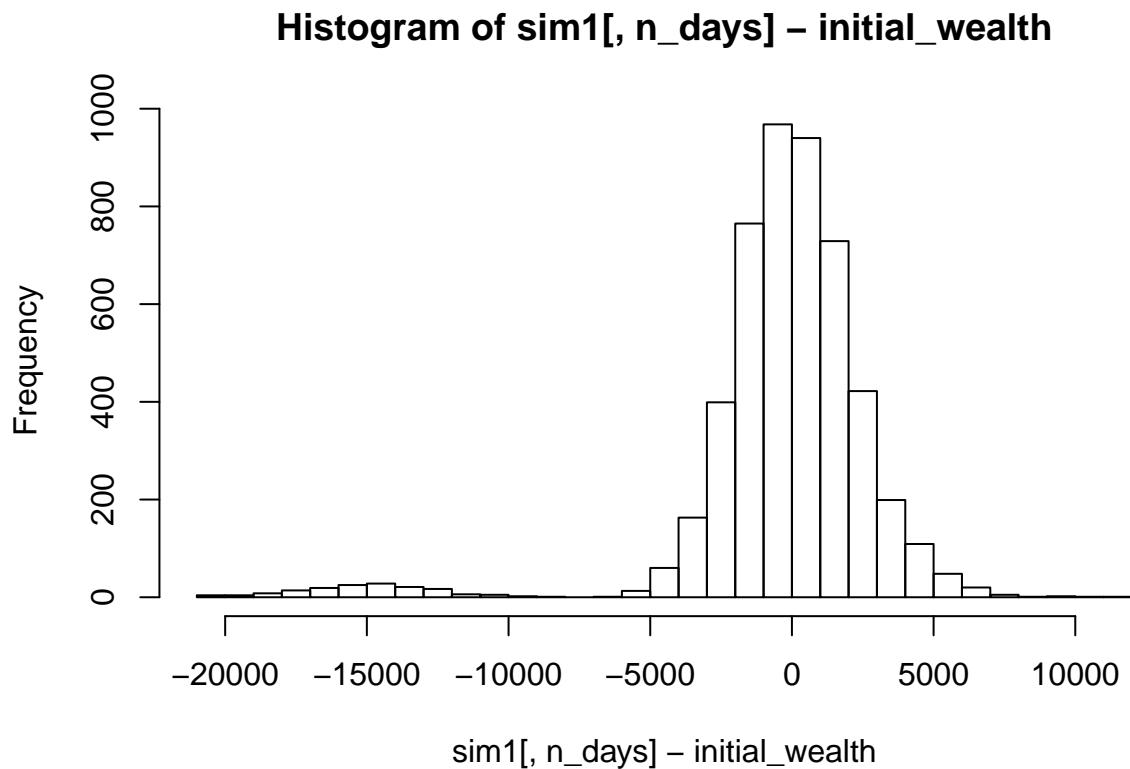
### Histogram of sim1[, n\_days]



```
# Profit/loss  
mean(sim1[,n_days])
```

```
## [1] 99680.09
```

```
hist(sim1[,n_days] - initial_wealth, breaks=30)
```



After bootstrapping the ETF's to model the uncertainty of trading ETFs, the value of the portfolio was \$99673.95 which is lower than the value in part b but higher than the baseline value of the ETFs. The value fluctuated between \$98699.41 and \$103062.70.

```
#Value at Risk
#Calculate value at risk at the 5% level for each portfolio
VAR = quantile(sim1[,n_days], .05)
VAR
```

```
##      5%
## 96182.49
```

```
#loss for this portfolio is calculated as VAR - initial investment
```

The VaR estimates how much the portfolio might lose if the portfolio is performing at the 5% level, thus the value at risk is \$-3748.61. #####

```
#Portfolio 2
#no markdown because code functions just like the code in Portfolio 1
#Import 4 tech ETFS
mystocks = c("XLK", "VGT", "IYW", "IGV")
getSymbols(mystocks)
```

```
## [1] "XLK" "VGT" "IYW" "IGV"
```

```

XLKa = adjustOHLC(XLK)
VGTa = adjustOHLC(VGT)
IYWa = adjustOHLC(IYW)
IGVa = adjustOHLC(IGV)
mystocks = c("XLK", "VGT", "IYW", "IGV")
myprices = getSymbols(mystocks, from = "2007-01-01")

```

The team chose this group of ETF's because the tech industry is booming and we wanted to discover the effect of this popularity on the overall value of a portfolio with tech ETFs.

```

all_returns = cbind(C1C1(XLKa),
                     C1C1(VGTa),
                     C1C1(IYWa),
                     C1C1(IGVa))
all_returns = as.matrix(na.omit(all_returns))
return.today = resample(all_returns, 1, orig.ids=FALSE)

```

```

total_wealth = 100000
my_weights = c(0.25, 0.25, 0.25, 0.25)
holdings = total_wealth * my_weights
holdings = holdings * (1 + return.today)

total_wealth4 = sum(holdings)
total_wealth4

```

```
## [1] 99024.02
```

The total value of this portfolio after allocating the weights of the ETF's is \$99263.93.

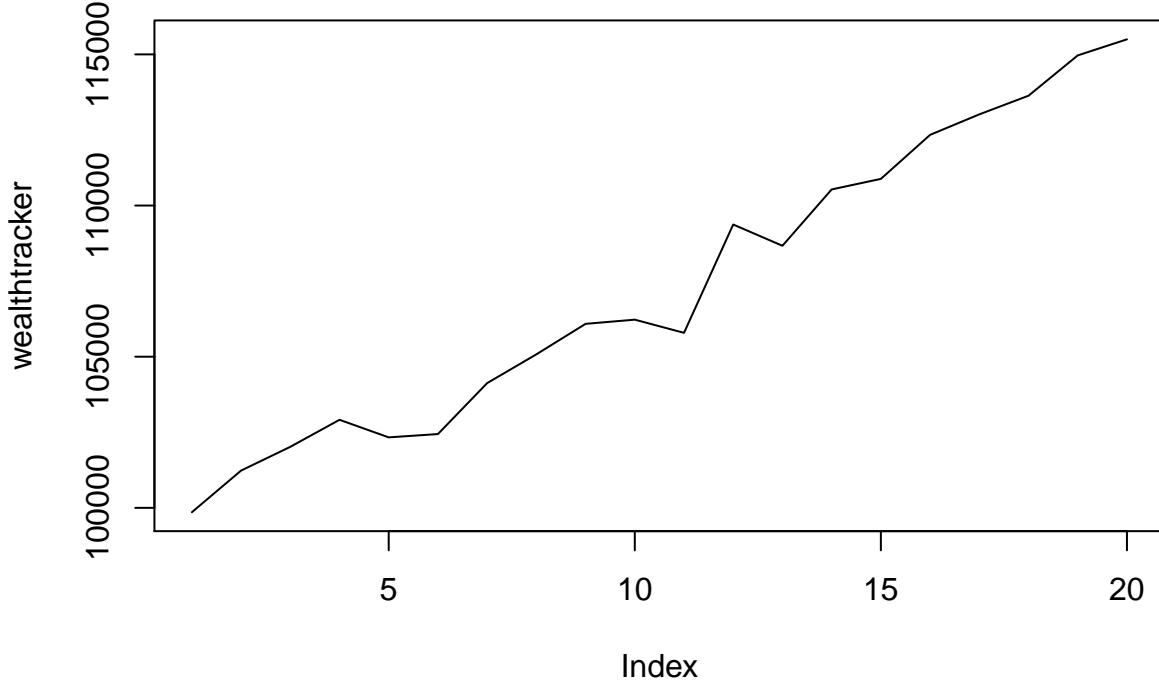
```

#Loop over four trading weeks
total_wealth = 100000
weights = c(0.25, 0.25, 0.25, 0.25) #weight of ETFS
holdings = weights * total_wealth
n_days = 20
set.seed(99)
wealthtracker = rep(0, n_days)
for(today in 1:n_days) {
  return.today = resample(all_returns, 1, orig.ids=FALSE)
  holdings = holdings + holdings * return.today
  total_wealth = sum(holdings)
  wealthtracker[today] = total_wealth
}
total_wealth

## [1] 115497.1

plot(wealthtracker, type='l')

```



If we were to trade these ETF's for a period of 4 weeks, the total value of the portfolio will fluctuate but this simulation outputs a value of \$86913.29 if the model seed is set. This overall value is much lower than the initial investment as well as the initial value of the portfolio previously calculated without trading.

```
#Simulate many different possible scenarios
initial_wealth = 100000
set.seed(99)
sim1 = foreach(i=1:5000, .combine='rbind') %do% {
  total_wealth = initial_wealth
  weights = c(0.25, 0.25, 0.25, 0.25)
  holdings = weights * total_wealth
  n_days = 20
  wealthtracker = rep(0, n_days)
  for(today in 1:n_days) {
    return.today = resample(all_returns, 1, orig.ids=FALSE)
    holdings = holdings + holdings*return.today
    total_wealth = sum(holdings)
    wealthtracker[today] = total_wealth
  }
  wealthtracker
}

head(sim1)
```

```
##           [,1]      [,2]      [,3]      [,4]      [,5]      [,6]
## result.1 99855.02 101232.17 102018.34 102912.42 102331.49 102441.06
## result.2 99517.11  99427.37  99803.74 102411.83 102830.83 102151.10
```

```

## result.3 99846.18 91772.84 92880.39 93078.58 90591.34 90735.23
## result.4 99707.07 99651.52 96882.72 96845.46 96858.25 96916.68
## result.5 99087.07 100469.05 102156.13 101769.27 102720.54 101535.94
## result.6 99723.56 100085.20 100309.84 101371.67 101896.79 100612.68
##           [,7]      [,8]      [,9]      [,10]     [,11]     [,12]
## result.1 104126.00 105077.04 106086.66 106225.24 105789.03 109372.02
## result.2 104525.73 104163.12 104845.53 105802.88 106018.49 105471.82
## result.3 91764.47 93555.64 92233.66 91831.12 91021.54 90791.02
## result.4 98404.98 98998.65 100250.22 100419.72 99921.69 100772.27
## result.5 102694.59 103010.36 104508.14 104464.95 106196.69 104091.59
## result.6 96603.01 99294.17 100879.01 99208.28 98808.02 100783.16
##           [,13]     [,14]     [,15]     [,16]     [,17]     [,18]
## result.1 108669.09 110533.02 110881.59 112337.97 113014.9 113632.38
## result.2 105082.96 104980.61 105674.15 103435.96 104054.6 104399.54
## result.3 90230.12 89199.28 89192.62 86952.58 87244.3 88269.84
## result.4 99447.76 99959.94 100680.47 100706.81 98278.2 99135.24
## result.5 104665.08 105654.18 106656.64 106731.47 106672.5 106903.15
## result.6 98294.81 100531.45 100690.53 101659.88 101338.5 101971.07
##           [,19]     [,20]
## result.1 114966.03 115497.08
## result.2 104684.57 105094.20
## result.3 86791.53 86301.47
## result.4 98284.45 97884.97
## result.5 106299.42 106231.12
## result.6 100241.05 99814.49

```

```
min(head(sim1))
```

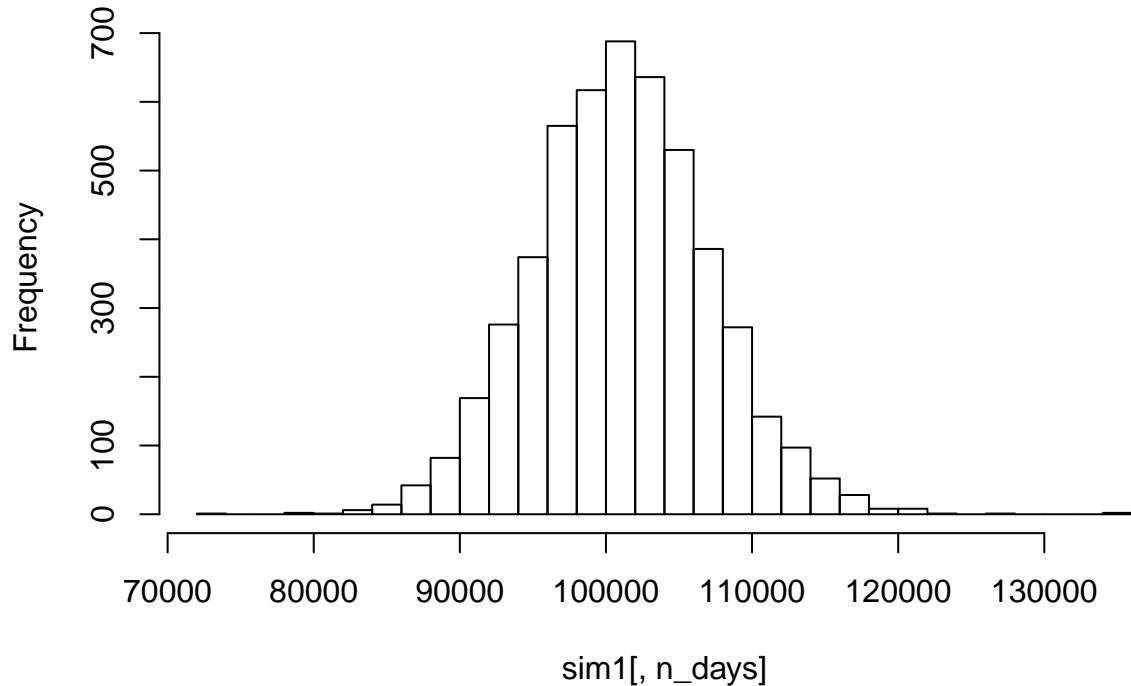
```
## [1] 86301.47
```

```
max(head(sim1))
```

```
## [1] 115497.1
```

```
hist(sim1[,n_days], 25)
```

**Histogram of sim1[, n\_days]**

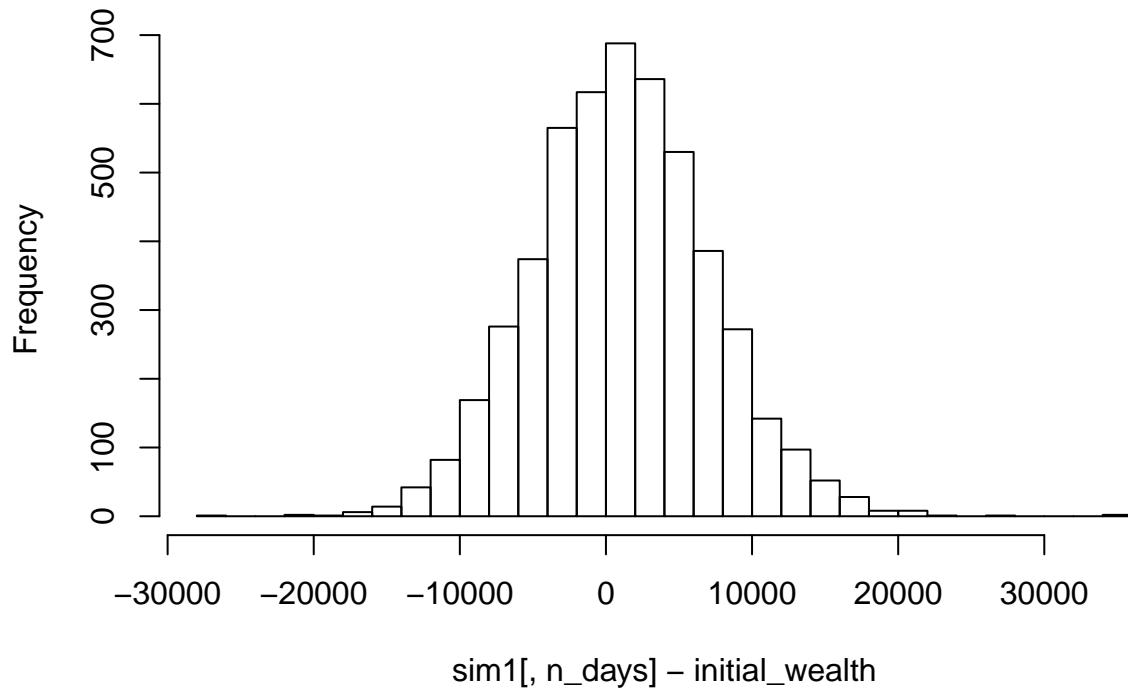


```
# Profit/loss  
mean(sim1[,n_days])
```

```
## [1] 101076.9
```

```
hist(sim1[,n_days] - initial_wealth, breaks=30)
```

## Histogram of sim1[, n\_days] – initial\_wealth



After bootstrapping the ETF's to model the uncertainty of trading ETFs, the value of the portfolio was \$101105.10 which is higher than the value in part b and higher than the baseline value of the ETFs. This could be a result of the ETFs volatility as tech stocks are rapidly changing since its an industry that is constantly innovating. The value fluctuated between \$86752.15 and \$114724.10.

```
#Value at Risk
set.seed(99)
VAR = quantile(sim1[,n_days], .05)
VAR

##           5%
## 91298.54
```

If the portfolio is performing at the worst 5% level, the VaR is \$-8692.08. #####

```
#Portfolio 3
#Import 3 hedge-funds ETFs
mystocks = c("MNA", "PUTW", "WTMF")
getSymbols(mystocks)

## [1] "MNA"   "PUTW"  "WTMF"

MNAa = adjustOHLC(MNA)
PUTWa = adjustOHLC(PUTW)
WTMFa = adjustOHLC(WTMF)
mystocks = c("MNA", "PUTW", "WTMF")
myprices = getSymbols(mystocks, from = "2007-01-01")
```

We chose 3 hedge-fund ETFs because hedge funds are the most volatile investments therefore we assumed these firms would have the highest value but they would also have the highest risk and we wanted to see if they consistently outperform other ETFs.

```
all_returns = cbind(C1C1(MNAa),
                     C1C1(PUTWa),
                     C1C1(WTMFa))
all_returns = as.matrix(na.omit(all_returns))
return.today = resample(all_returns, 1, orig.ids=FALSE)

total_wealth = 100000
my_weights = c(0.33,0.33,0.34) #weight of ETFS
set.seed(99)
holdings = total_wealth*my_weights
holdings = holdings*(1 + return.today)

total_wealth3 = sum(holdings)
total_wealth3

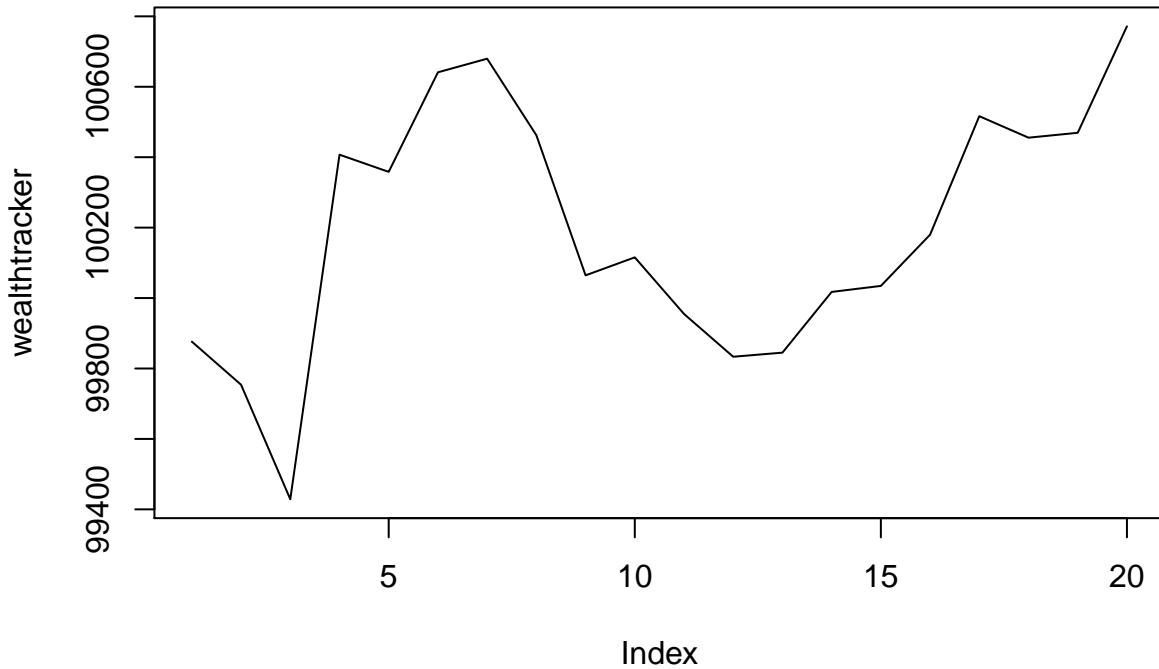
## [1] 99876.2
```

The total value of this portfolio after allocating the weights of the ETF's is \$99876.20.

```
# Loop over four trading weeks
total_wealth = 100000
weights = c(0.33,0.33,0.34) #weight of ETFS
holdings = weights * total_wealth
n_days = 20
wealthtracker = rep(0, n_days)
set.seed(99)
for(today in 1:n_days) {
  return.today = resample(all_returns, 1, orig.ids=FALSE)
  holdings = holdings + holdings*return.today
  total_wealth = sum(holdings)
  wealthtracker[today] = total_wealth
}
total_wealth

## [1] 100771.5

plot(wealthtracker, type='l')
```



If we were to trade these ETF's for a period of 4 weeks, the total value of the portfolio will fluctuate but this simulation outputs a value of \$100771.50 if the model seed is set. This overall value is higher than the initial investment as well as the initial value of the portfolio previously calculated without trading.

```
#Simulate many different possible scenarios
initial_wealth = 100000
sim1 = foreach(i=1:5000, .combine='rbind') %do% {
  total_wealth = initial_wealth
  weights = c(0.34,0.33,0.33)
  holdings = weights * total_wealth
  n_days = 20
  wealthtracker = rep(0, n_days)
  for(today in 1:n_days) {
    return.today = resample(all_returns, 1, orig.ids=FALSE)
    holdings = holdings + holdings*return.today
    total_wealth = sum(holdings)
    wealthtracker[today] = total_wealth
  }
  wealthtracker
}

head(sim1)

##           [,1]      [,2]      [,3]      [,4]      [,5]      [,6]
## result.1 100052.49 100106.18 100251.97 100139.43 100083.76 99890.56
## result.2 100009.84 100082.34 100415.91 100387.11 100516.19 100372.22
## result.3 100297.04 100380.77 100085.14 100237.19 99882.84 100017.82
```

```

## result.4 99495.84 99462.61 99364.89 99191.75 99106.78 99451.16
## result.5 99804.76 99671.87 99876.41 99956.96 100057.20 100140.59
## result.6 100156.87 99893.04 99515.65 99317.21 99443.60 99786.90
##          [,7]      [,8]      [,9]      [,10]     [,11]     [,12]
## result.1 99908.58 99674.69 99863.34 99915.52 99786.63 99941.66
## result.2 100542.97 100507.57 100377.10 100331.13 100280.87 100235.77
## result.3 100413.61 100476.57 100411.43 100535.16 100538.39 100152.73
## result.4 99316.99 99193.44 99205.22 99131.56 99092.72 99015.92
## result.5 100277.38 100662.44 101396.81 101663.64 101817.82 101819.43
## result.6 99655.39 99784.04 99725.69 99745.09 99664.33 99808.86
##          [,13]     [,14]     [,15]     [,16]     [,17]     [,18]
## result.1 99823.54 99597.03 99822.13 100239.8 100273.09 100477.85
## result.2 100291.84 100293.22 100221.31 100163.1 100070.72 99925.53
## result.3 100302.69 100239.38 100376.12 100344.4 100370.32 100234.29
## result.4 98916.03 98982.28 99135.68 98970.2 98965.57 98928.12
## result.5 101680.66 101536.87 101468.56 101802.7 101666.30 101390.25
## result.6 99653.55 99363.90 99420.83 99341.9 99316.48 99215.42
##          [,19]     [,20]
## result.1 100614.04 100675.14
## result.2 99352.22 99804.86
## result.3 100294.74 100071.67
## result.4 99077.71 99142.34
## result.5 101041.59 101085.26
## result.6 99199.32 98849.27

```

```
min(head(sim1))
```

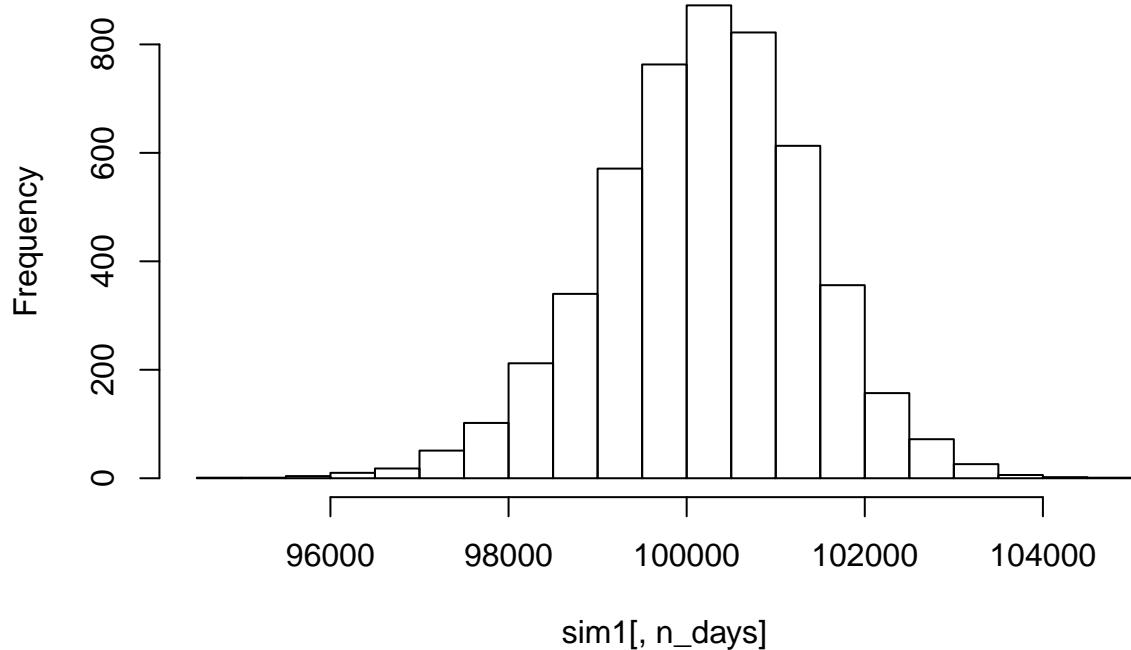
```
## [1] 98849.27
```

```
max(head(sim1))
```

```
## [1] 101819.4
```

```
hist(sim1[,n_days], 25)
```

**Histogram of sim1[, n\_days]**

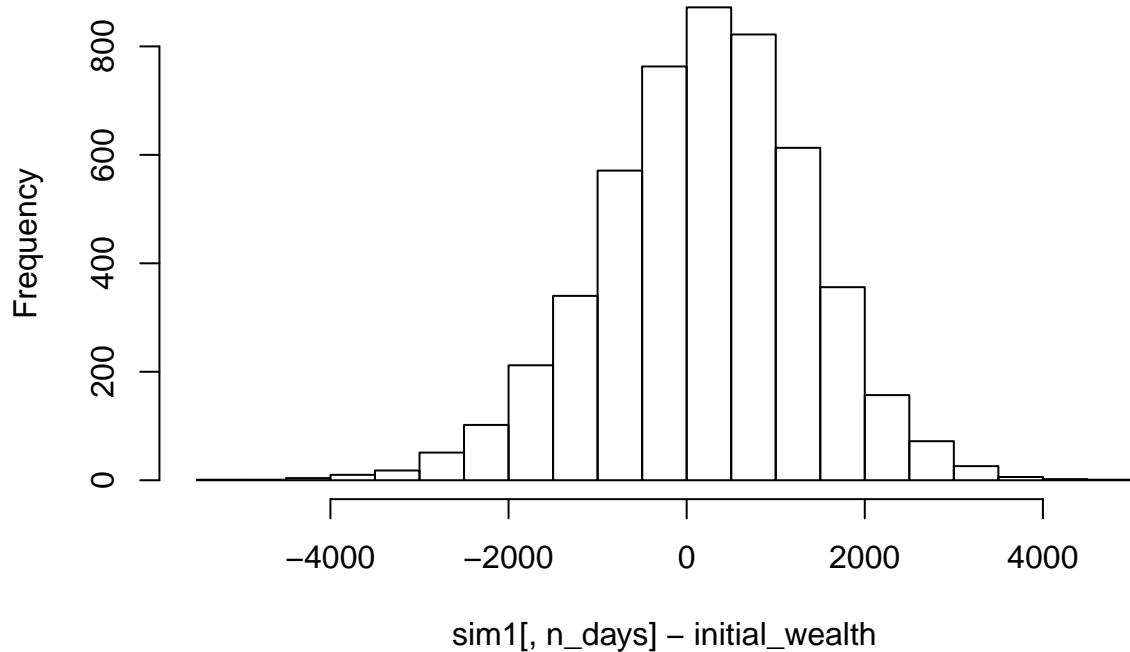


```
# Profit/loss  
mean(sim1[,n_days])
```

```
## [1] 100196.6
```

```
hist(sim1[,n_days] - initial_wealth, breaks=30)
```

## Histogram of sim1[, n\_days] – initial\_wealth



After bootstrapping the ETF's to model the uncertainty of trading ETFs, the value of the portfolio was \$100156.10 which is higher than the value in part b and higher than the baseline value of the ETFs. This could be a result of the ETFs volatility as hedge funds are consistently investing at different levels so their value quickly changes. The value fluctuated between \$98241.02 and \$101871.20.

```
#Value at Risk
set.seed(99)
VAR = quantile(sim1[,n_days], .05)
VAR

##      5%
## 98207.99
```

If the portfolio is performing at the worst 5% level, the VaR is \$-1786.73. ##### In the long-run, the hedge funds ETFs will perform the best since it gives the smallest loss on your investment. In the short-run, the tech ETF's will have the highest value, but this shows they are incredibly risky as they also have the largest loss. Therefore if one is interested in diversifying their ETF portfolios, the team recommends that this person purchases a mixture of hedge-fund and tech ETFs as the risk and return will be relatively balanced.

```
##Quetion 4
```

```
library(dplyr)
```

## Tweet dataset

We have a dataset that includes 36 tweet categories for 7882 users, where each cell represents how many times each user has posted a tweet that can be tagged to that category. We investigate this dataset for **NutrientH2O**, which for the sake of this case we will consider as a nutrient water brand which is entering the market of flavoured electrolytes. Categories include the following:

```
df <- read.csv('social_marketing.csv', row.names=1)
head(df)
```

```
##          chatter current_events travel photo_sharing uncategorized
## hmjoe4g3k      2            0      2            2            2
## clk1m5w8s      3            3      2            1            1
## jcsovtak3      6            3      4            3            1
## 3oeb4hiln      1            5      2            2            0
## fd75x1vgk      5            2      0            6            1
## h6nvj91yp      6            4      2            7            0
##          tv_film sports_fandom politics food family home_and_garden music
## hmjoe4g3k      1            1      0      4      1            2            0
## clk1m5w8s      1            4      1      2      2            1            0
## jcsovtak3      5            0      2      1      1            1            1
## 3oeb4hiln      1            0      1      0      1            0            0
## fd75x1vgk      0            0      2      0      1            0            0
## h6nvj91yp      1            1      0      2      1            1            1
##          news online_gaming shopping health_nutrition college_uni
## hmjoe4g3k      0            0      1            17           0
## clk1m5w8s      0            0      0            0           0
## jcsovtak3      1            0      2            0           0
## 3oeb4hiln      0            0      0            0           1
## fd75x1vgk      0            3      2            0           4
## h6nvj91yp      0            0      5            0           0
##          sports_playing cooking eco computers business outdoors crafts
## hmjoe4g3k      2            5      1            1            0            2            1
## clk1m5w8s      1            0      0            0            1            0            2
## jcsovtak3      0            2      1            0            0            0            2
## 3oeb4hiln      0            0      0            0            1            0            3
## fd75x1vgk      0            1      0            1            0            1            0
## h6nvj91yp      0            0      0            1            1            0            0
##          automotive art religion beauty parenting dating school
## hmjoe4g3k      0            0      1            0            1            1            0
## clk1m5w8s      0            0      0            0            0            1            4
## jcsovtak3      0            8      0            1            0            1            0
## 3oeb4hiln      0            2      0            1            0            0            0
## fd75x1vgk      0            0      0            0            0            0            0
## h6nvj91yp      1            0      0            0            0            0            0
##          personal_fitness fashion small_business spam adult
## hmjoe4g3k      11            0            0            0            0
## clk1m5w8s      0            0            0            0            0
## jcsovtak3      0            1            0            0            0
## 3oeb4hiln      0            0            0            0            0
## fd75x1vgk      0            0            1            0            0
## h6nvj91yp      0            0            0            0            0
```

```

nrow(df)

## [1] 7882

ncol(df)

## [1] 36

sort(colnames(df))

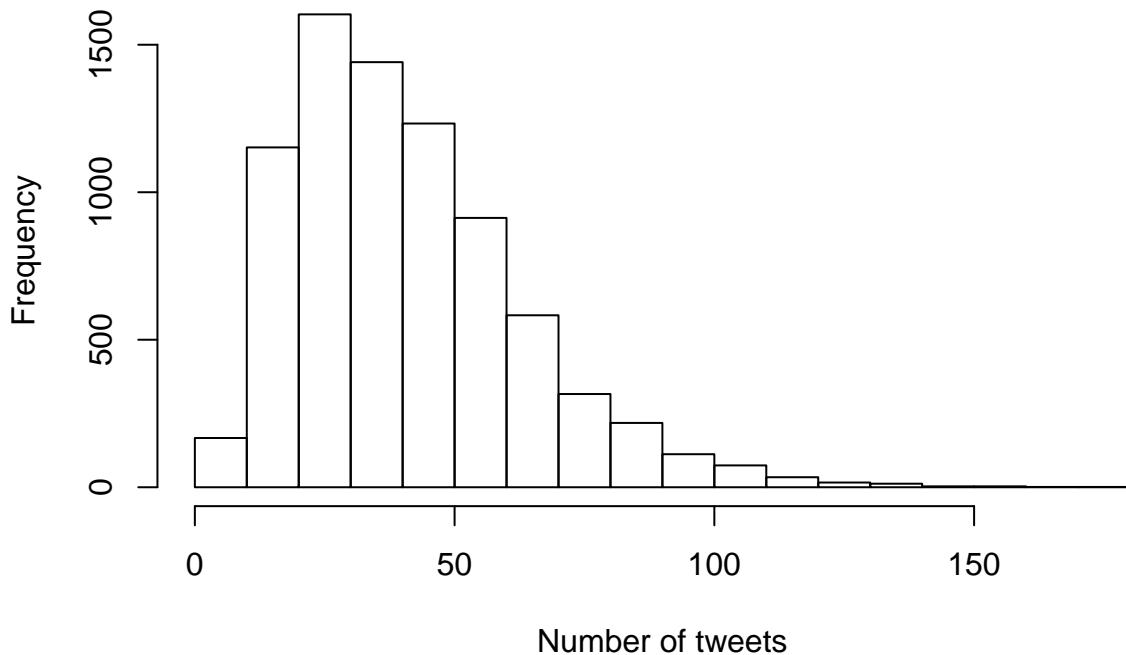
## [1] "adult"          "art"            "automotive"
## [4] "beauty"          "business"        "chatter"
## [7] "college_uni"    "computers"       "cooking"
## [10] "crafts"         "current_events" "dating"
## [13] "eco"             "family"          "fashion"
## [16] "food"            "health_nutrition" "home_and_garden"
## [19] "music"           "news"            "online_gaming"
## [22] "outdoors"        "parenting"       "personal_fitness"
## [25] "photo_sharing"   "politics"        "religion"
## [28] "school"          "shopping"        "small_business"
## [31] "spam"             "sports_fandom"  "sports_playing"
## [34] "travel"          "tv_film"         "uncategorized"

```

## Data normalisation

As with any problem where the columns are similar items with values as frequency of occurrence (typical text analytics base data), we calculate the term frequencies as % of tweets tagged to a category per user. This normalises for the difference in number of tweets per user, giving us an intuition of weightage of a category in the tweet profile for the user.

## Histogram – number of tweets by user



## Correlated categories

When we looked at the set of categories, we expected some categories to have a strong correlation - eg. personal\_fitness & health\_nutrition seem intuitively correlated. To set a cutoff, we looked at the number of pairs that made the different cutoffs for correlation.

```
##   Correlation Cutoff Pair Counts
## 1           0.50      23
## 2           0.55      17
## 3           0.60      11
## 4           0.65       6
## 5           0.70       3
## 6           0.75       2
## 7           0.80       1
## 8           0.85       0
## 9           0.90       0
```

Shown above are the number of unique pairs of categories that made the cut above a certain correlation value. 11 seems to be a reasonable number to compare - let's take a look at the categories with correlation>0.60, which we can expect to see together as the features of the clusters we are going to create.

```
cor_df %>% filter(Freq>0.6) %>% filter(Var1!=Var2) %>% arrange(desc(Freq)) %>% distinct(Freq, .keep_all=TRUE)
```

```

##           Var1          Var2      Freq
## 1 personal_fitness health_nutrition 0.8099024
## 2 college_uni     online_gaming 0.7728393
## 3         fashion        cooking 0.7214027
## 4         beauty        cooking 0.6642389
## 5       politics        travel 0.6602100
## 6    parenting        religion 0.6555973
## 7     religion   sports_fandom 0.6379748
## 8         fashion        beauty 0.6349739
## 9     outdoors  health_nutrition 0.6082254
## 10   parenting   sports_fandom 0.6077181
## 11 computers        travel 0.6029349

```

## Category Intuition

By looking at these pairs, we feel that we should look for 5 broad clusters of customers:

### 1. The fit ones

**personal\_fitness**, **health\_nutrition** come with the highest correlation of 0.8, followed by the pair of **health\_nutrition** and **outdoors** with a correlation of 0.6. We expect our first category to be populated by people who are fitness-oriented and focus on keeping a healthy lifestyle.. We are not sure about any age-based demographics for this cluster as of now.

### 2. Gen X

**parenting**, **religion** and **sports\_fandom** - all 3 categories have correlation of ~0.60 between them (all 3 unique pairs) which hint at a uniform association among all three. We are assuming Gen X (people aged 39-54) to fall in this category.

### 3. The Instagrammers

**Beauty**, **Cooking** and **fashion** - all 3 categories are correlated reasonable well with each other with values ranging from 0.63-0.72, hinting at an association among the 3. While these people might not be focused on a healthy lifestyle in terms of exercise and eating right, they are focused on how they look, what they eat - which in this day and age of social media hints at the one stop shop for sharing the perfect reel life.

### 4. The centennial gamer

We see one particular pair (**college\_uni** and **online\_gaming**) with a high correlation of 0.77, which hits at the age group between later teens and early 20s.

### 5. Politics and Travel?

We don't know what to call this category yet - the intersection of politics and travel is unique yet not uncommon. Politically aware people who like to travel, social workers, stand-up comedians, legal consultants, management consultants - there are many people who are likely to tweet about both of these categories. Let's hope our clustering exercise helps us understand these people better.

# Approach

Based on these broad intuitions, we expect the range of clear clusters to be between 3 & 6. We plan to:

1. Remove outliers
2. Run KNN for 3-6 clusters
3. Run PCA for rank 2/3
4. Try to see clusters in PCA output by visualising the KNN results with PCA results
5. Look at PCA composition to verify intuitions from correlations
6. Finalise clusters
7. Present recommendations

## Outlier removal

We look at the 4 unwanted categories - **chatter**, **uncategorized**, **adult** and **spam** and see the % of data filtered when we set a range of cutoffs on the term frequency of that particular category for every user.

1. Chatter

```
##   TF_Chatter      % Data
## 1          10 49.5305760
## 2          15 30.4237503
## 3          20 17.2925653
## 4          25  9.0332403
## 5          30  4.2375032
## 6          35  1.8015732
## 7          40  0.6470439
```

2. Adult

```
##   TF_Adult      % Data
## 1          10 3.95838620
## 2          15 2.58817559
## 3          20 1.54783050
## 4          25 0.87541233
## 5          30 0.46942400
## 6          35 0.17761989
## 7          40 0.03806141
## 8          45 0.02537427
## 9          50 0.00000000
```

3. Spam

```
##   TF_Spam      % Data
## 1          1 0.59629536
## 2          6 0.03806141
## 3         11 0.00000000
## 4         16 0.00000000
## 5         21 0.00000000
## 6         26 0.00000000
## 7         31 0.00000000
```

```

## 8      36 0.00000000
## 9      41 0.00000000
## 10     46 0.00000000
## 11     51 0.00000000
## 12     56 0.00000000
## 13     61 0.00000000
## 14     66 0.00000000

```

#### 4. Uncategorized

```

##   TF_Uncat    % Data
## 1      10 2.49936564
## 2      13 1.09109363
## 3      16 0.57092109
## 4      19 0.25374270
## 5      22 0.12687135
## 6      25 0.05074854
## 7      28 0.03806141
## 8      31 0.02537427
## 9      34 0.02537427
## 10     37 0.01268714
## 11     40 0.00000000

```

We identified the following cutoffs for outliers our base data:

1. chatter>0.25 (9%)
2. adult>0.20 (1.5%)
3. spam>0.01 (0.6%)
4. uncategorized>0.16 (0.57%)

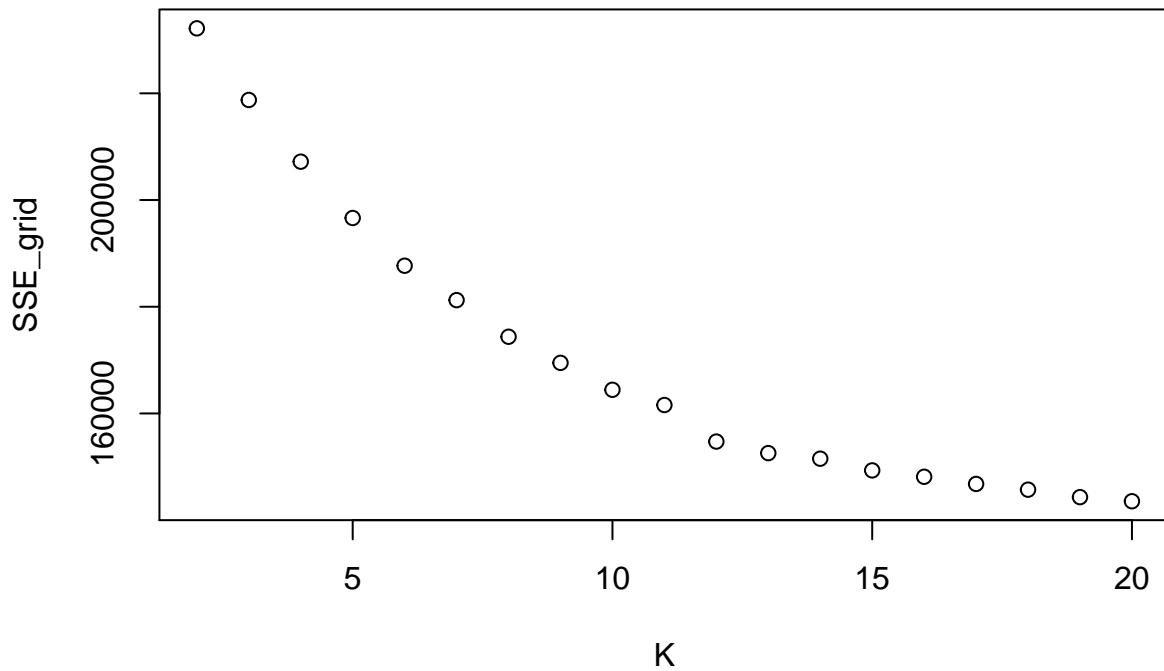
We also checked for mutual exclusivity of these rows (max data loss if all are Mutually Exclusive) and for that if we remove rows with these features, we lose about 12-13% of the data, which seems like a practical enough trade off for removing a lot of noise from the, mainly due to these 4 columns

#### **Why these columns?**

1. Chatter and uncategorized tweets will anyway not help in clustering, their correlation with any field is being assumed as a coincidence
2. Spam and adult are categories that we do not want in our clusters

#### **Data normalisation - 2.0**

We perform z-scoring on our tf dataset and create a grid for number of clusters in KNN to see where the elbow comes in our curve (to decide k for KNN)

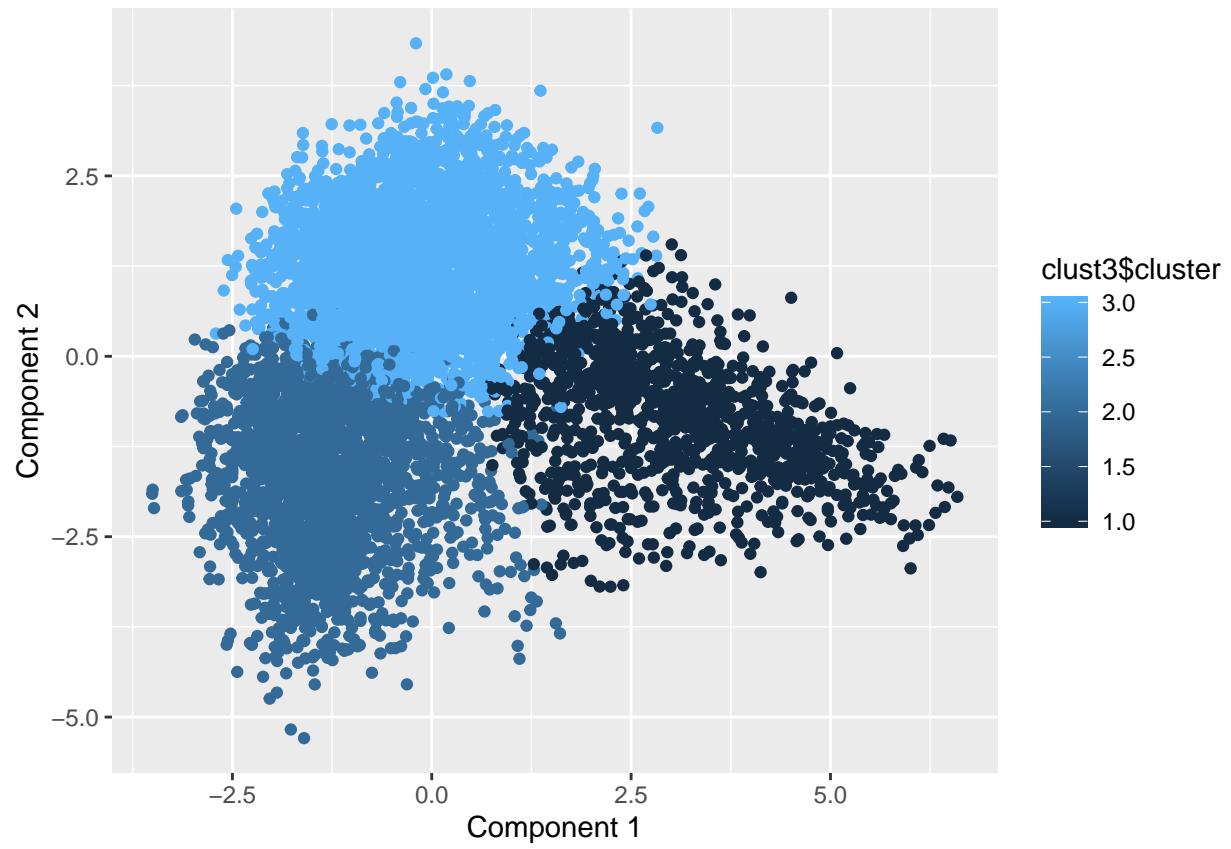


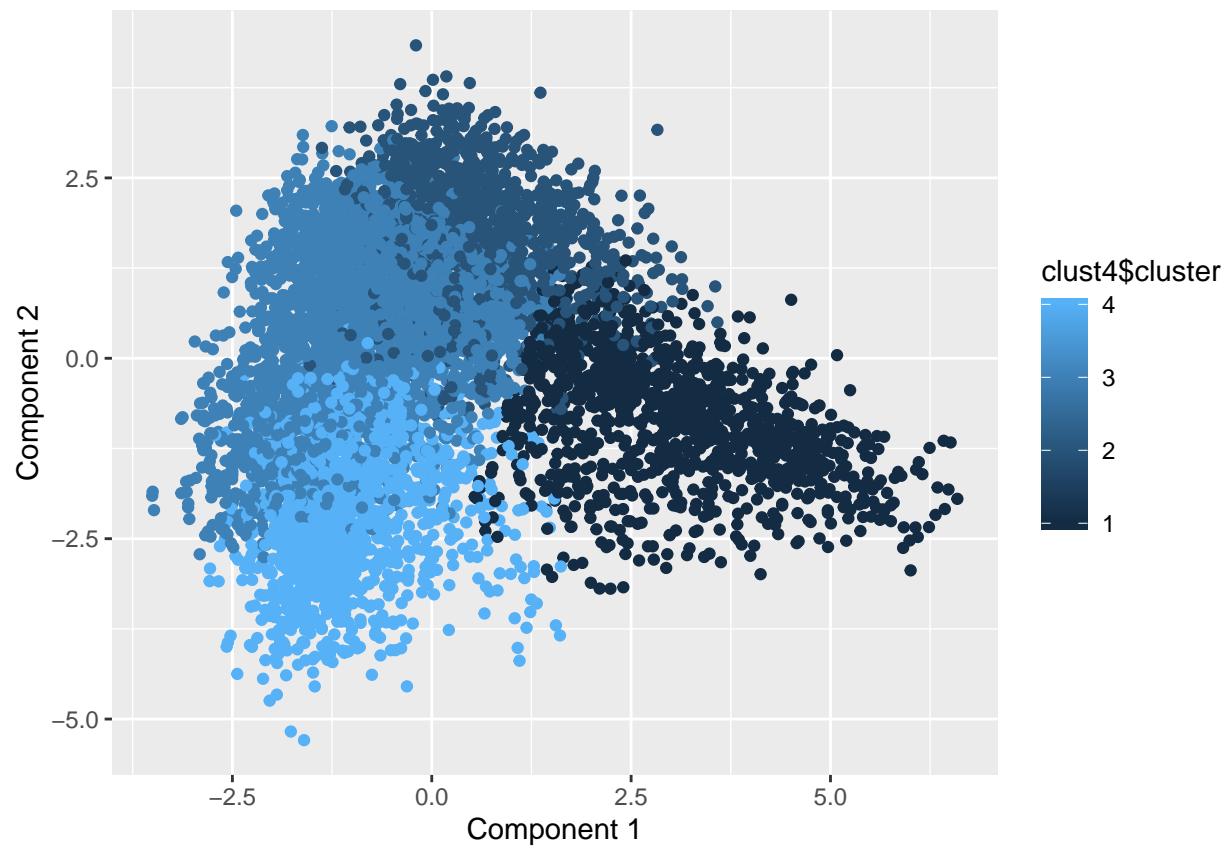
## KNN & PCA

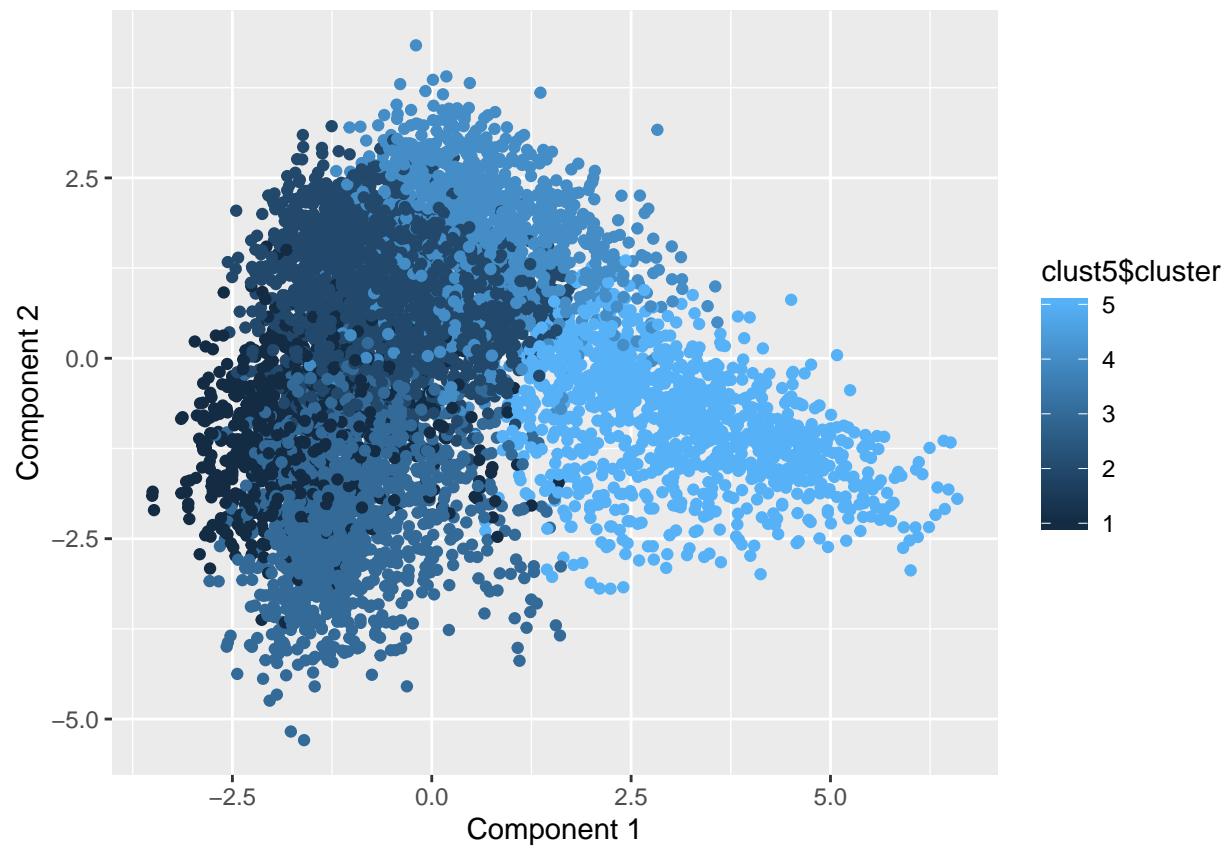
Clearly, there is no clear edge - we will go ahead with our range of k in [3,6] for clustering.

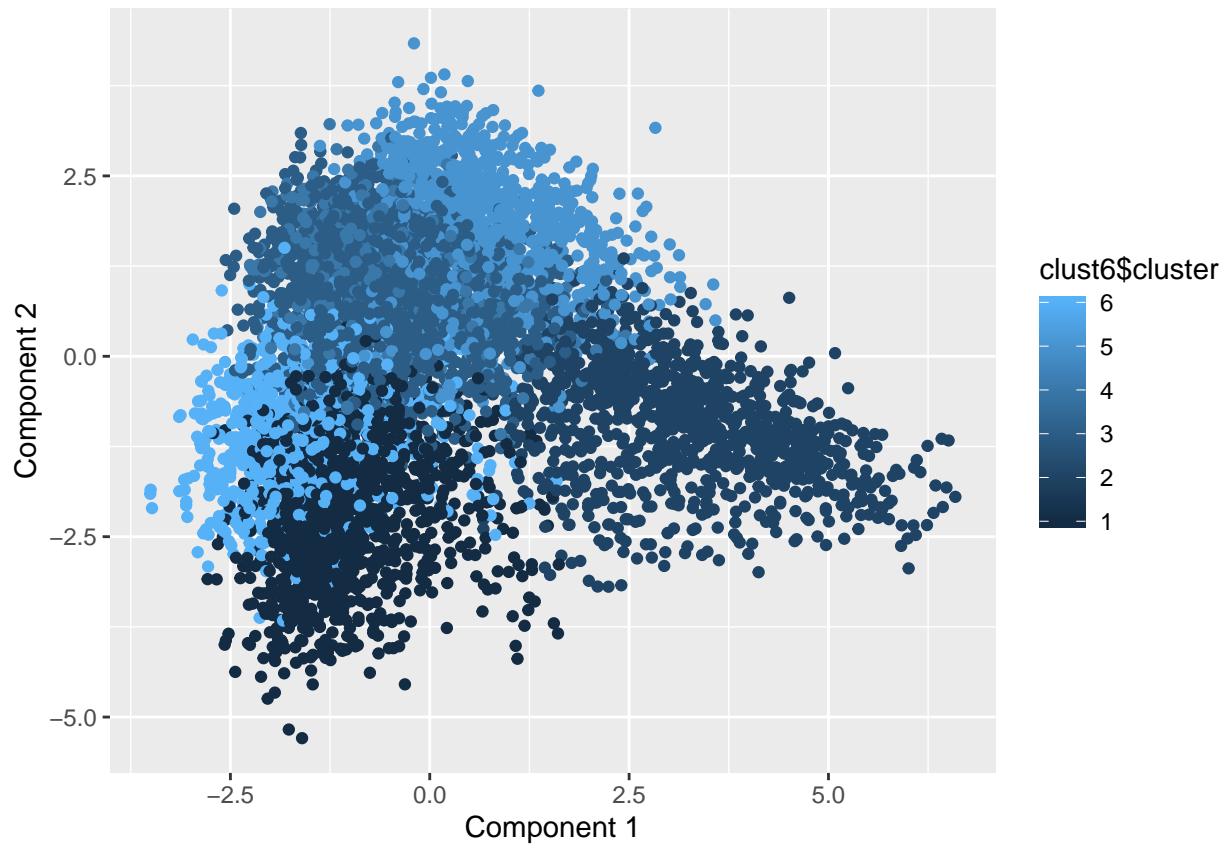
Following KNN, we will perform PCA and consider only the first two principal components. We will then compare the results for k=[3:6] by coloring for those number of clusters.

Different cluster plots look like:

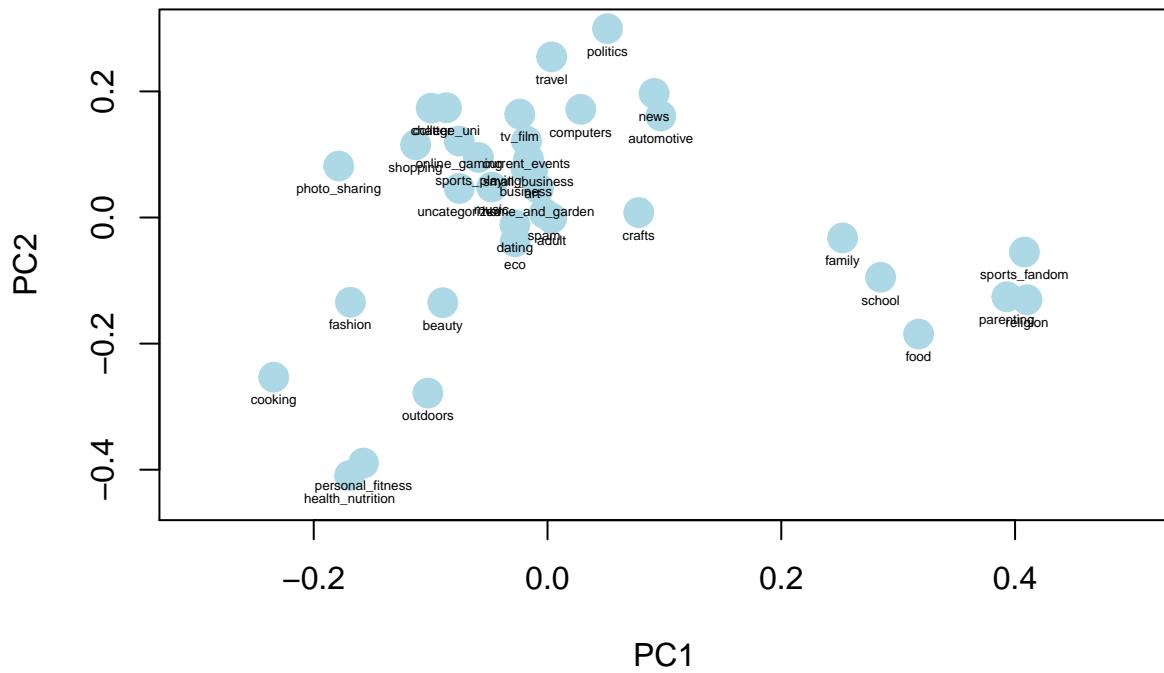




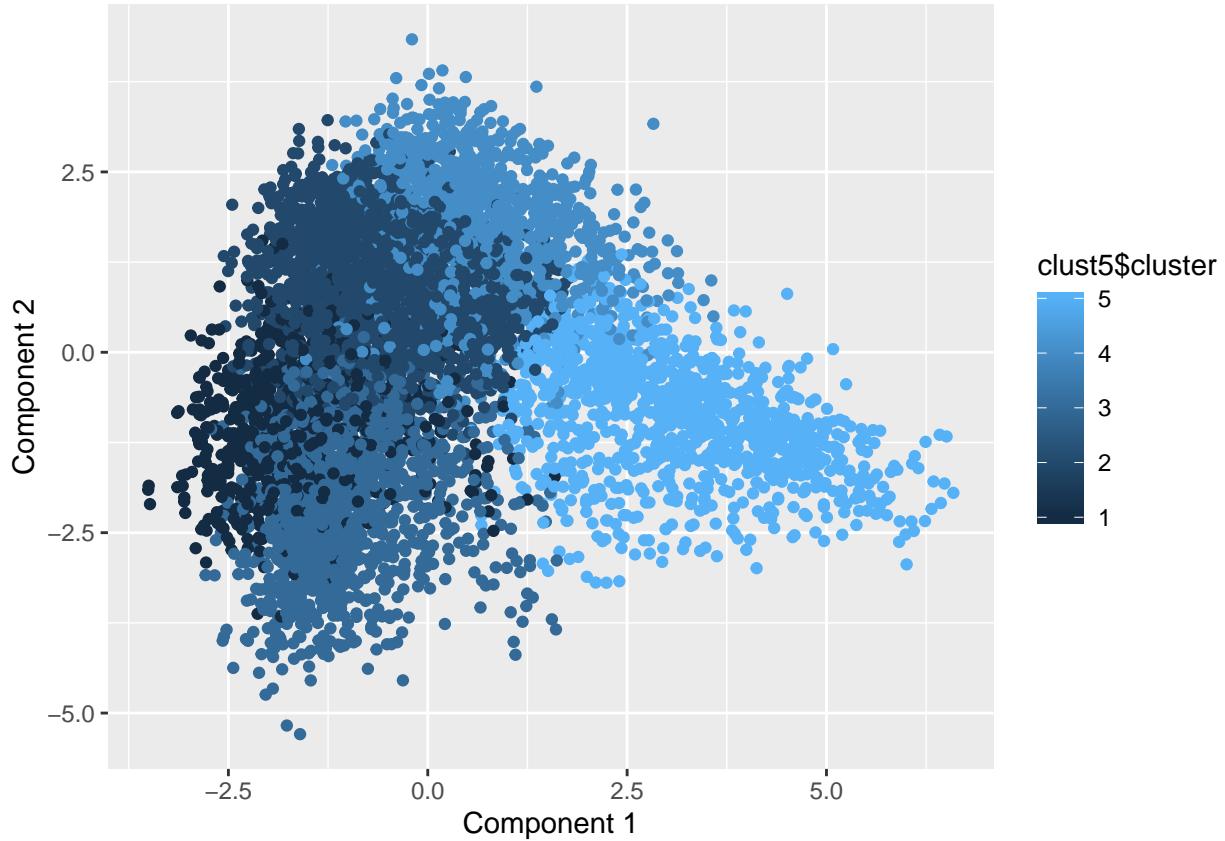




Looking at how PC1 and PC2 are formed in terms of categories:



We can see 5 clusters - let's look at our data points coloured in 5 clusters again:



## Cluster Identification

Comparing plots for both categories along PC1 and PC2, we can identify the 5 segments

### 1. The fit ones

**personal\_fitness**, **health\_nutrition** and **outdoors** appear close by between  $\text{PC1}=[-0.2, -0.1]$  and  $\text{PC2}=[-0.45, -0.3]$

### 2. The Instagrammer

Going slightly wider on PC1 and a little up on PC2, we reach **Beauty**, **Cooking** and **fashion** - all 3 categories lying between the younger age reflecting categories like **college\_uni**, **online\_gaming**, **photo\_sharing** and fitness focused **personal\_fitness**, **health\_nutrition**, **outdoors**. We can consider these people active on social media and aware of their looks and food.

### 3. The net-savvy student

Further up PC2 on similar PC1 range as the 2 clusters above, **college\_uni** and **online\_gaming** interact with other categories that net-savvy high school and college students are likely to tweet about like **shopping**, **tv\_film**, **sports\_playing** etc.

#### **4. The aware traveller**

After observing **politics** and **travel** land near **news**, we can take 1 step closer to identifying this cluster as aware travellers who keep up with current events, tv, film and computers. These are likely to be working professionals that have travelling jobs.

#### **5. The homely parents (Gen X)**

**parenting, religion** and **sports\_fandom** - all 3 categories appear on the far right along PCA, right after **food, school** and **family**. Reflects traits and interests of traditional American parents - sports, religion, food, family, school and the most obvious, parenting.

## **Recommendations**

### **1. The fit ones**

Appeal to the importance of electrolytes in a balanced diet and how they help achieve fitness goals.

### **2. The Instagrammer**

These people can be approached for collabs as marketing opportunities where both parties end-up in a win-win situation.

### **3. The net-savvy student**

Appeal to this being as an easy, all-in-one solution to carry around campus to stay hydrated and enjoy flavoured, non-fattening drinks at the same time.

### **4. The aware traveller**

Travelling takes a toll on the body - place this item at popular ports of travel and advertise the advantages of staying hydrated while travelling. These can include better sleep, prevention of ear-blockage during take-offs and landings or change in altitude in general.

#### **5. The homely parents (Gen X)**

Display the product in the light of a healthy alternative to sodas for their children - delivering great taste AND replacement. This is the new party drink!

##Question 5

```
setwd("ReutersC50/C50train")
authors = list.files()

files.train <- c()
for(i in authors){
  textName = list.files(path = i)
  for(j in textName){
    textName = paste(i, j, sep='/')
    files.train <- append(files.train, textName, after = length(files.train))
  }
}
```

We need to start by reading in all of the text files from each individual authors. We started with the training data. Using `list.files()` we were able to access the names of all of the files (or the authors), and then with a for loop we looped into everyone of these files and to access the names of all of the authors files. We then appended the authors name to the begining of the file so we could access the file later, and appended it to the `files.train` vector.

```
setwd("ReutersC50/C50test")
files.test <- c()
for(i in authors){
  textName = list.files(path = i)
  for(j in textName){
    textName = paste(i,j, sep='/')
    files.test <- append(files.test, textName, after = length(files.test))
  }
}
```

We then repeated the same process with the test files and saved the file names into `files.test`.

```
readerPlain = function(fname){
  readPlain(elem=list(content=readLines(fname)),
            id=fname, language='en' ) }
```

We created a `read` in function that uses `readPlain` in order to read in all of the text files.

```
classLabels <- c()
for(i in authors){
  classLabels <- append(classLabels, rep(i, 50), after = length(classLabels))
}
```

Created a class labels vector which holds each author 50 times for all 50 of their articles.

```
setwd("ReutersC50/C50train")

allTrain = lapply(files.train, readerPlain)

names_train = files.train %>%
  { strsplit(., '/', fixed=TRUE) } %>%
  { lapply(., tail, n=2) } %>%
  { lapply(., paste0, collapse = '') } %>%
  unlist

trainText <- c()
for(i in 1:length(names_train)){
  trainText <- c(trainText, paste0(content(allTrain[[i]]), collapse = " "))
}
trainDF <- data.frame(doc_id = names_train,
                      text = trainText)
```

We then created a list of all of the text files and saved that into `allTrain`, then stripped the text names and saved them into `trainText`. We then created a dataframe called `trainDF` that has all of the texts saved with their text file name as their id.

```

train_raw = VCorpus(DataframeSource(trainDF))
corpus_train = train_raw
corpus_train = tm_map(corpus_train, content_transformer(tolower))
corpus_train = tm_map(corpus_train, content_transformer(removeNumbers))
corpus_train = tm_map(corpus_train, content_transformer(removePunctuation))
corpus_train = tm_map(corpus_train, content_transformer(stripWhitespace))
corpus_train = tm_map(corpus_train, content_transformer(removeWords), stopwords("en"))
DTM_train = DocumentTermMatrix(corpus_train)

DTM_train = removeSparseTerms(DTM_train, .97)

```

Using this dataframe we created a corpus. We transformed the data by making it all lower case, removed all numbers and punctuation, split on the white space and removed extra words like “a”, “the”, and “and”. Words like those do not add anything to the text besides making it readable. We then removed all of the sparse terms with .97. Since we had so many text files it was impractical to not remove the sparse words at such a high level. Without removing the sparse words we would not be able to run a model with our available technology.

```

setwd("ReutersC50/C50test")

allTest = lapply(files.test, readerPlain)

names_test = files.test %>%
  { strsplit(., '/', fixed=TRUE) } %>%
  { lapply(., tail, n=2) } %>%
  { lapply(., paste0, collapse = '') } %>%
  unlist

testText <- c()
for(i in 1:length(names_test)){
  testText <- c(testText, paste0(content(allTest[[i]]), collapse = " "))
}
testDF <- data.frame(doc_id = names_test,
                      text = testText)

test_raw = VCorpus(DataframeSource(testDF))
corpus_test = test_raw
corpus_test = tm_map(corpus_test, content_transformer(tolower))
corpus_test = tm_map(corpus_test, content_transformer(removeNumbers))
corpus_test = tm_map(corpus_test, content_transformer(removePunctuation))
corpus_test = tm_map(corpus_test, content_transformer(stripWhitespace))
corpus_test = tm_map(corpus_test, content_transformer(removeWords), stopwords("en"))
DTM_test = DocumentTermMatrix(corpus_test)

DTM_test = removeSparseTerms(DTM_test, .97)

```

We then repeated the exact same process with the testing data.

```

summary(Terms(DTM_test) %in% Terms(DTM_train))

##      Mode      FALSE     TRUE
## logical      125    1222

DTM_test2 = DocumentTermMatrix(corpus_test,
                               control = list(dictionary=Terms(DTM_train)))
summary(Terms(DTM_test2) %in% Terms(DTM_train))

##      Mode      TRUE
## logical     1319

```

However if we look at the test vs train data we can see words exist in the test that do not exist in the train. This will be a problem later when we are modeling. We decided to remove those words. We do admit that this could be potentially taking value away from the model, however we still chose to do it in this case. If we check the words in each DTM after we remove the extra words we can see that this is no longer a problem.

```

tfidf_train = weightTfIdf(DTM_train)
tfidf_test = weightTfIdf(DTM_test2)

tfidf_train = as.matrix(tfidf_train)
tfidf_train = tfidf_train[, apply(tfidf_train, 2, var) != 0]

tfidf_test = as.matrix(tfidf_test)

```

Above, we created term frequency matiricies for the training and the testing sets.

```

pc_train = prcomp(as.matrix(tfidf_train), scale=TRUE)

X_train = pc_train$x[,1:330]
X_train = cbind(X_train, classLabels)

scaled_tfidf_test = scale(tfidf_test, center=TRUE, scale=TRUE)

X_test <- scaled_tfidf_test %*% pc_train$rotation[,1:330]

X_test = X_test[,1:330]

```

Even though we created sparse matiricies they are still to large to perform classificsation on, so we next decided to use PCA to reduce the matrix.

```

X_train = as.data.frame(X_train)

for (name in names(X_train)){
  if (name == "classLabels"){
    next
  }else{
    X_train[[name]] <- as.numeric(as.character(X_train[[name]]))
  }
}
X_test = as.data.frame(X_test)
set.seed(1)
library(randomForest)

```

```

## randomForest 4.6-14

## Type rfNews() to see new features/changes/bug fixes.

##
## Attaching package: 'randomForest'

## The following object is masked from 'package:gridExtra':
##       combine

## The following object is masked from 'package:dplyr':
##       combine

## The following object is masked from 'package:ggplot2':
##       margin

author.rf = randomForest(classLabels ~.,
                        data = X_train,
                        ntrees = 500,
                        importance = TRUE)

predict_test = predict(author.rf,X_test,type="response")
rf_confusion_matrix = table(predict_test,classLabels)
accuracy = sum(diag(rf_confusion_matrix)) / sum(rf_confusion_matrix)
accuracy

## [1] 0.5504

```

While 55% accuracy is far from perfect for a prediction as abstract as this one it is pretty good. Using real world data like this will not result in perfect models, and sometimes over half of the time is acceptable.

```

library(dplyr)
topAuthors = as.data.frame(cbind(unique(classLabels),
                                diag(rf_confusion_matrix)))
colnames(topAuthors) = c("Authors","Correct_Predictions")
topAuthors$Correct_Predictions = as.numeric(as.character(topAuthors$Correct_Predictions))
topAuthors$Authors = as.character(topAuthors$Authors)
sorted = topAuthors[order(-topAuthors$Correct_Predictions),]
sorted$percentage_accuracy = sorted$Correct_Predictions/50
head(sorted,10)

```

	Authors	Correct_Predictions
## JimGilchrist	JimGilchrist	48
## FumikoFujisaki	FumikoFujisaki	46
## LynnleyBrowning	LynnleyBrowning	46
## NickLouth	NickLouth	46
## RobinSidel	RobinSidel	46
## GrahamEarnshaw	GrahamEarnshaw	42

```

## KeithWeir           KeithWeir      41
## PeterHumphrey     PeterHumphrey  40
## KarlPenhaul        KarlPenhaul    39
## KouroshKarimkhany KouroshKarimkhany 38
##                           percentage_accuracy
## JimGilchrist          0.96
## FumikoFujisaki       0.92
## LynnleyBrowning      0.92
## NickLouth            0.92
## RobinSidel           0.92
## GrahamEarnshaw      0.84
## KeithWeir             0.82
## PeterHumphrey         0.80
## KarlPenhaul           0.78
## KouroshKarimkhany    0.76

```

We can also see which authors we are doing the best at predicting. Some explanation for this could be that they could have a very unique writing style and use words that no other authors use, or they write about topics no other authors write about.

```
tail(sorted, 10)
```

	Authors	Correct_Predictions	percentage_accuracy
## BenjaminKangLim	BenjaminKangLim	16	0.32
## PierreTran	PierreTran	16	0.32
## MartinWolk	MartinWolk	14	0.28
## EricAuchard	EricAuchard	13	0.26
## WilliamKazer	WilliamKazer	13	0.26
## DarrenSchuettler	DarrenSchuettler	12	0.24
## DavidLawder	DavidLawder	10	0.20
## ScottHillis	ScottHillis	8	0.16
## TanEeLyn	TanEeLyn	5	0.10
## EdnaFernandes	EdnaFernandes	4	0.08

We can also see our worst predictions. ##Question 6

```

grocery <- readLines('groceries.txt')
lst = matrix(nrow = length(grocery), ncol = 1)

for(i in 0:length(grocery)){
  j <- strsplit(grocery[i], ',')
  lst[i] <-j
}

```

Read in data file using readline. From there I seperated every line use strstrip and added them to a large list called lst

```

lst = lapply(lst, unique)

trans = as(lst, "transactions")
summary(trans)

```

```

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

```

Created transaction term after creating a unique list of all of the grocery items.

```
rules = apriori(trans, parameter=list(support=.005, confidence=.1, maxlen=4))
```

```

## Apriori
##
## Parameter specification:
##   confidence minval smax arem aval originalSupport maxtime support minlen
##           0.1     0.1     1 none FALSE             TRUE      5  0.005     1
##   maxlen target ext
##           4   rules FALSE
##
## Algorithmic control:
##   filter tree heap memopt load sort verbose
##   0.1 TRUE TRUE FALSE TRUE    2   TRUE
##
## Absolute minimum support count: 49
##
## set item appearances ...[0 item(s)] done [0.00s].
## set transactions ...[169 item(s), 9835 transaction(s)] done [0.01s].
## sorting and recoding items ... [120 item(s)] done [0.00s].
## creating transaction tree ... done [0.01s].
## checking subsets of size 1 2 3 4

## Warning in apriori(trans, parameter = list(support = 0.005, confidence =
## 0.1, : Mining stopped (maxlen reached). Only patterns up to a length of 4
## returned!

```

```

##  done [0.01s].
## writing ... [1582 rule(s)] done [0.00s].
## creating S4 object ... done [0.00s].

```

```
inspect(rules)
```

##	lhs	rhs	support	confidence	lift	count
## [1]	{}	=> {bottled water}	0.110523640	0.1105236	1.0000000	108
## [2]	{}	=> {tropical fruit}	0.104931368	0.1049314	1.0000000	103
## [3]	{}	=> {root vegetables}	0.108998475	0.1089985	1.0000000	107
## [4]	{}	=> {soda}	0.174377224	0.1743772	1.0000000	177
## [5]	{}	=> {yogurt}	0.139501779	0.1395018	1.0000000	137
## [6]	{}	=> {rolls/buns}	0.183934926	0.1839349	1.0000000	180
## [7]	{}	=> {other vegetables}	0.193492628	0.1934926	1.0000000	190
## [8]	{}	=> {whole milk}	0.255516014	0.2555160	1.0000000	251
## [9]	{cake bar}	=> {whole milk}	0.005592272	0.4230769	1.6557746	5
## [10]	{dishes}	=> {other vegetables}	0.005998983	0.3410405	1.7625502	5
## [11]	{dishes}	=> {whole milk}	0.005287239	0.3005780	1.1763569	5
## [12]	{mustard}	=> {whole milk}	0.005185562	0.4322034	1.6914924	5
## [13]	{pot plants}	=> {whole milk}	0.006914082	0.4000000	1.5654596	0
## [14]	{chewing gum}	=> {soda}	0.005388917	0.2560386	1.4683033	5
## [15]	{chewing gum}	=> {whole milk}	0.005083884	0.2415459	0.9453259	5
## [16]	{canned fish}	=> {other vegetables}	0.005083884	0.3378378	1.7459985	5
## [17]	{pasta}	=> {whole milk}	0.006100661	0.4054054	1.5866145	0
## [18]	{herbs}	=> {root vegetables}	0.007015760	0.4312500	3.9564774	0
## [19]	{herbs}	=> {other vegetables}	0.007727504	0.4750000	2.4548739	0
## [20]	{herbs}	=> {whole milk}	0.007727504	0.4750000	1.8589833	0
## [21]	{processed cheese}	=> {soda}	0.005287239	0.3190184	1.8294729	5
## [22]	{processed cheese}	=> {other vegetables}	0.005490595	0.3312883	1.7121497	5
## [23]	{processed cheese}	=> {whole milk}	0.007015760	0.4233129	1.6566981	0
## [24]	{semi-finished bread}	=> {other vegetables}	0.005185562	0.2931034	1.5148042	5
## [25]	{semi-finished bread}	=> {whole milk}	0.007117438	0.4022989	1.5744565	0
## [26]	{beverages}	=> {yogurt}	0.005490595	0.2109375	1.5120775	0
## [27]	{beverages}	=> {rolls/buns}	0.005388917	0.2070312	1.1255679	0
## [28]	{beverages}	=> {other vegetables}	0.005185562	0.1992188	1.0295935	0
## [29]	{beverages}	=> {whole milk}	0.006812405	0.2617188	1.0242753	0
## [30]	{ice cream}	=> {soda}	0.006100661	0.2439024	1.3987058	0
## [31]	{ice cream}	=> {other vegetables}	0.005083884	0.2032520	1.0504381	0
## [32]	{ice cream}	=> {whole milk}	0.005897306	0.2357724	0.9227303	0
## [33]	{detergent}	=> {other vegetables}	0.006405694	0.3333333	1.7227185	0
## [34]	{detergent}	=> {whole milk}	0.008947636	0.4656085	1.8222281	0
## [35]	{pickled vegetables}	=> {other vegetables}	0.006405694	0.3579545	1.8499648	0
## [36]	{pickled vegetables}	=> {whole milk}	0.007117438	0.3977273	1.5565650	0
## [37]	{baking powder}	=> {other vegetables}	0.007320793	0.4137931	2.1385471	0
## [38]	{baking powder}	=> {whole milk}	0.009252669	0.5229885	2.0467935	0
## [39]	{flour}	=> {other vegetables}	0.006304016	0.3625731	1.8738342	0
## [40]	{flour}	=> {whole milk}	0.008439248	0.4853801	1.8996074	0
## [41]	{soft cheese}	=> {yogurt}	0.005998983	0.3511905	2.5174623	0
## [42]	{soft cheese}	=> {rolls/buns}	0.005388917	0.3154762	1.7151511	0
## [43]	{soft cheese}	=> {other vegetables}	0.007117438	0.4166667	2.1533981	0
## [44]	{soft cheese}	=> {whole milk}	0.007524148	0.4404762	1.7238692	0
## [45]	{specialty bar}	=> {soda}	0.007219115	0.2639405	1.5136181	0
## [46]	{specialty bar}	=> {rolls/buns}	0.005592272	0.2044610	1.1115940	0
## [47]	{specialty bar}	=> {other vegetables}	0.005592272	0.2044610	1.0566861	0

## [48]	{specialty bar}	=> {whole milk}	0.006507372	0.2379182	0.9311284
## [49]	{misc. beverages}	=> {bottled water}	0.005287239	0.1863799	1.6863354
## [50]	{misc. beverages}	=> {soda}	0.007320793	0.2580645	1.4799210
## [51]	{misc. beverages}	=> {other vegetables}	0.005592272	0.1971326	1.0188120
## [52]	{misc. beverages}	=> {whole milk}	0.007015760	0.2473118	0.9678917
## [53]	{grapes}	=> {tropical fruit}	0.006100661	0.2727273	2.5991015
## [54]	{grapes}	=> {other vegetables}	0.009049314	0.4045455	2.0907538
## [55]	{grapes}	=> {whole milk}	0.007320793	0.3272727	1.2808306
## [56]	{cat food}	=> {yogurt}	0.006202339	0.2663755	1.9094778
## [57]	{cat food}	=> {other vegetables}	0.006507372	0.2794760	1.4443753
## [58]	{cat food}	=> {whole milk}	0.008845958	0.3799127	1.4868448
## [59]	{specialty chocolate}	=> {soda}	0.006304016	0.2073579	1.1891338
## [60]	{specialty chocolate}	=> {rolls/buns}	0.005592272	0.1839465	1.0000629
## [61]	{specialty chocolate}	=> {other vegetables}	0.006100661	0.2006689	1.0370881
## [62]	{specialty chocolate}	=> {whole milk}	0.008032537	0.2642140	1.0340410
## [63]	{meat}	=> {sausage}	0.005287239	0.2047244	2.1790742
## [64]	{meat}	=> {root vegetables}	0.005083884	0.1968504	1.8059922
## [65]	{meat}	=> {soda}	0.005490595	0.2125984	1.2191869
## [66]	{meat}	=> {yogurt}	0.005287239	0.2047244	1.4675398
## [67]	{meat}	=> {rolls/buns}	0.006914082	0.2677165	1.4554959
## [68]	{meat}	=> {other vegetables}	0.009964413	0.3858268	1.9940128
## [69]	{meat}	=> {whole milk}	0.009964413	0.3858268	1.5099906
## [70]	{frozen meals}	=> {tropical fruit}	0.005490595	0.1935484	1.8445236
## [71]	{frozen meals}	=> {soda}	0.006202339	0.2186380	1.2538220
## [72]	{frozen meals}	=> {yogurt}	0.006202339	0.2186380	1.5672774
## [73]	{frozen meals}	=> {other vegetables}	0.007524148	0.2652330	1.3707653
## [74]	{frozen meals}	=> {whole milk}	0.009862735	0.3476703	1.3606593
## [75]	{hard cheese}	=> {sausage}	0.005185562	0.2116183	2.2524519
## [76]	{hard cheese}	=> {root vegetables}	0.005592272	0.2282158	2.0937519
## [77]	{hard cheese}	=> {yogurt}	0.006405694	0.2614108	1.8738886
## [78]	{hard cheese}	=> {rolls/buns}	0.005897306	0.2406639	1.3084187
## [79]	{hard cheese}	=> {other vegetables}	0.009456024	0.3858921	1.9943505
## [80]	{hard cheese}	=> {whole milk}	0.010066090	0.4107884	1.6076815
## [81]	{butter milk}	=> {pip fruit}	0.005083884	0.1818182	2.4034702
## [82]	{butter milk}	=> {tropical fruit}	0.005490595	0.1963636	1.8713531
## [83]	{butter milk}	=> {root vegetables}	0.005083884	0.1818182	1.6680801
## [84]	{butter milk}	=> {yogurt}	0.008540925	0.3054545	2.1896104
## [85]	{butter milk}	=> {rolls/buns}	0.007625826	0.2727273	1.4827378
## [86]	{butter milk}	=> {other vegetables}	0.010371124	0.3709091	1.9169159
## [87]	{butter milk}	=> {whole milk}	0.011591256	0.4145455	1.6223854
## [88]	{candy}	=> {tropical fruit}	0.005388917	0.1802721	1.7180002
## [89]	{candy}	=> {soda}	0.008642603	0.2891156	1.6579897
## [90]	{candy}	=> {yogurt}	0.005490595	0.1836735	1.3166389
## [91]	{candy}	=> {rolls/buns}	0.007117438	0.2380952	1.2944537
## [92]	{candy}	=> {other vegetables}	0.006914082	0.2312925	1.1953557
## [93]	{candy}	=> {whole milk}	0.008235892	0.2755102	1.0782502
## [94]	{ham}	=> {white bread}	0.005083884	0.1953125	4.6398513
## [95]	{white bread}	=> {ham}	0.005083884	0.1207729	4.6398513
## [96]	{ham}	=> {tropical fruit}	0.005388917	0.2070312	1.9730158
## [97]	{ham}	=> {yogurt}	0.006710727	0.2578125	1.8480947
## [98]	{ham}	=> {rolls/buns}	0.006914082	0.2656250	1.4441249
## [99]	{ham}	=> {other vegetables}	0.009150991	0.3515625	1.8169297
## [100]	{ham}	=> {whole milk}	0.011489578	0.4414062	1.7275091
## [101]	{sliced cheese}	=> {sausage}	0.007015760	0.2863071	3.0474349

## [102]	{sliced cheese}	=> {tropical fruit}	0.005287239	0.2157676	2.0562739
## [103]	{sliced cheese}	=> {root vegetables}	0.005592272	0.2282158	2.0937519
## [104]	{sliced cheese}	=> {soda}	0.005083884	0.2074689	1.1897705
## [105]	{sliced cheese}	=> {yogurt}	0.008032537	0.3278008	2.3497968
## [106]	{sliced cheese}	=> {rolls/buns}	0.007625826	0.3112033	1.6919208
## [107]	{sliced cheese}	=> {other vegetables}	0.009049314	0.3692946	1.9085720
## [108]	{sliced cheese}	=> {whole milk}	0.010777834	0.4398340	1.7213560
## [109]	{UHT-milk}	=> {bottled water}	0.007320793	0.2188450	1.9800740
## [110]	{UHT-milk}	=> {soda}	0.007625826	0.2279635	1.3073010
## [111]	{UHT-milk}	=> {yogurt}	0.007422471	0.2218845	1.5905496
## [112]	{UHT-milk}	=> {rolls/buns}	0.006405694	0.1914894	1.0410712
## [113]	{UHT-milk}	=> {other vegetables}	0.008134215	0.2431611	1.2566944
## [114]	{oil}	=> {root vegetables}	0.007015760	0.2500000	2.2936101
## [115]	{oil}	=> {yogurt}	0.005287239	0.1884058	1.3505620
## [116]	{oil}	=> {rolls/buns}	0.005083884	0.1811594	0.9849104
## [117]	{oil}	=> {other vegetables}	0.009964413	0.3550725	1.8350697
## [118]	{oil}	=> {whole milk}	0.011286223	0.4021739	1.5739675
## [119]	{onions}	=> {whipped/sour cream}	0.005083884	0.1639344	2.2869434
## [120]	{onions}	=> {citrus fruit}	0.005592272	0.1803279	2.1787771
## [121]	{onions}	=> {bottled water}	0.005897306	0.1901639	1.7205725
## [122]	{onions}	=> {tropical fruit}	0.005693950	0.1836066	1.7497776
## [123]	{onions}	=> {root vegetables}	0.009456024	0.3049180	2.7974523
## [124]	{onions}	=> {soda}	0.005287239	0.1704918	0.9777183
## [125]	{onions}	=> {yogurt}	0.007219115	0.2327869	1.6687019
## [126]	{onions}	=> {rolls/buns}	0.006812405	0.2196721	1.1942927
## [127]	{onions}	=> {other vegetables}	0.014234875	0.4590164	2.3722681
## [128]	{onions}	=> {whole milk}	0.012099644	0.3901639	1.5269647
## [129]	{berries}	=> {whipped/sour cream}	0.009049314	0.2721713	3.7968855
## [130]	{whipped/sour cream}	=> {berries}	0.009049314	0.1262411	3.7968855
## [131]	{berries}	=> {citrus fruit}	0.005388917	0.1620795	1.9582948
## [132]	{berries}	=> {tropical fruit}	0.006710727	0.2018349	1.9234941
## [133]	{berries}	=> {root vegetables}	0.006609049	0.1987768	1.8236655
## [134]	{berries}	=> {soda}	0.007320793	0.2201835	1.2626849
## [135]	{berries}	=> {yogurt}	0.010574479	0.3180428	2.2798477
## [136]	{berries}	=> {rolls/buns}	0.006609049	0.1987768	1.0806907
## [137]	{berries}	=> {other vegetables}	0.010269446	0.3088685	1.5962805
## [138]	{berries}	=> {whole milk}	0.011794611	0.3547401	1.3883281
## [139]	{hamburger meat}	=> {sausage}	0.005185562	0.1559633	1.6600639
## [140]	{hamburger meat}	=> {root vegetables}	0.006202339	0.1865443	1.7114399
## [141]	{hamburger meat}	=> {soda}	0.005795628	0.1743119	0.9996255
## [142]	{hamburger meat}	=> {yogurt}	0.006507372	0.1957187	1.4029832
## [143]	{hamburger meat}	=> {rolls/buns}	0.008642603	0.2599388	1.4132109
## [144]	{hamburger meat}	=> {other vegetables}	0.013828165	0.4159021	2.1494470
## [145]	{hamburger meat}	=> {whole milk}	0.014743264	0.4434251	1.7354101
## [146]	{hygiene articles}	=> {napkins}	0.006100661	0.1851852	3.5364977
## [147]	{napkins}	=> {hygiene articles}	0.006100661	0.1165049	3.5364977
## [148]	{hygiene articles}	=> {citrus fruit}	0.005287239	0.1604938	1.9391361
## [149]	{hygiene articles}	=> {shopping bags}	0.005185562	0.1574074	1.5976283
## [150]	{hygiene articles}	=> {bottled water}	0.005693950	0.1728395	1.5638239
## [151]	{hygiene articles}	=> {tropical fruit}	0.006710727	0.2037037	1.9413042
## [152]	{hygiene articles}	=> {root vegetables}	0.005388917	0.1635802	1.5007572
## [153]	{hygiene articles}	=> {soda}	0.007015760	0.2129630	1.2212774
## [154]	{hygiene articles}	=> {yogurt}	0.007320793	0.2222222	1.5929705
## [155]	{hygiene articles}	=> {rolls/buns}	0.005897306	0.1790123	0.9732374

## [156]	{hygiene articles}	=> {other vegetables}	0.009557702	0.2901235	1.4994032	1
## [157]	{hygiene articles}	=> {whole milk}	0.012811388	0.3888889	1.5219746	1
## [158]	{salty snack}	=> {fruit/vegetable juice}	0.005998983	0.1586022	2.1938849	1
## [159]	{salty snack}	=> {whipped/sour cream}	0.005185562	0.1370968	1.9125486	1
## [160]	{salty snack}	=> {pastry}	0.005185562	0.1370968	1.5409677	1
## [161]	{salty snack}	=> {shopping bags}	0.005998983	0.1586022	1.6097545	1
## [162]	{salty snack}	=> {sausage}	0.005287239	0.1397849	1.4878625	1
## [163]	{salty snack}	=> {tropical fruit}	0.005592272	0.1478495	1.4090111	1
## [164]	{salty snack}	=> {soda}	0.009354347	0.2473118	1.4182576	1
## [165]	{salty snack}	=> {yogurt}	0.006202339	0.1639785	1.1754581	1
## [166]	{salty snack}	=> {other vegetables}	0.010777834	0.2849462	1.4726465	1
## [167]	{salty snack}	=> {whole milk}	0.011184545	0.2956989	1.1572618	1
## [168]	{sugar}	=> {margarine}	0.005490595	0.1621622	2.7688626	1
## [169]	{sugar}	=> {pastry}	0.005185562	0.1531532	1.7214414	1
## [170]	{sugar}	=> {root vegetables}	0.006405694	0.1891892	1.7357049	1
## [171]	{sugar}	=> {soda}	0.007320793	0.2162162	1.2399338	1
## [172]	{sugar}	=> {yogurt}	0.006914082	0.2042042	1.4638107	1
## [173]	{sugar}	=> {rolls/buns}	0.007015760	0.2072072	1.1265245	1
## [174]	{sugar}	=> {other vegetables}	0.010777834	0.3183183	1.6451186	1
## [175]	{sugar}	=> {whole milk}	0.015048297	0.4444444	1.7393996	1
## [176]	{waffles}	=> {chocolate}	0.005795628	0.1507937	3.0390483	1
## [177]	{chocolate}	=> {waffles}	0.005795628	0.1168033	3.0390483	1
## [178]	{waffles}	=> {whipped/sour cream}	0.005083884	0.1322751	1.8452850	1
## [179]	{waffles}	=> {pastry}	0.007015760	0.1825397	2.0517460	1
## [180]	{waffles}	=> {shopping bags}	0.005490595	0.1428571	1.4499484	1
## [181]	{waffles}	=> {tropical fruit}	0.006100661	0.1587302	1.5127046	1
## [182]	{waffles}	=> {root vegetables}	0.006609049	0.1719577	1.5776154	1
## [183]	{waffles}	=> {soda}	0.009557702	0.2486772	1.4260879	1
## [184]	{waffles}	=> {yogurt}	0.007524148	0.1957672	1.4033312	1
## [185]	{waffles}	=> {rolls/buns}	0.009150991	0.2380952	1.2944537	1
## [186]	{waffles}	=> {other vegetables}	0.010066090	0.2619048	1.3535645	1
## [187]	{waffles}	=> {whole milk}	0.012709710	0.3306878	1.2941961	1
## [188]	{long life bakery product}	=> {chocolate}	0.005287239	0.1413043	2.8478038	1
## [189]	{chocolate}	=> {long life bakery product}	0.005287239	0.1065574	2.8478038	1
## [190]	{long life bakery product}	=> {fruit/vegetable juice}	0.006202339	0.1657609	2.2929088	1
## [191]	{long life bakery product}	=> {whipped/sour cream}	0.005795628	0.1548913	2.1607886	1
## [192]	{long life bakery product}	=> {pastry}	0.005897306	0.1576087	1.7715217	1
## [193]	{long life bakery product}	=> {shopping bags}	0.005388917	0.1440217	1.4617686	1
## [194]	{long life bakery product}	=> {sausage}	0.005388917	0.1440217	1.5329587	1
## [195]	{long life bakery product}	=> {tropical fruit}	0.006304016	0.1684783	1.6056044	1
## [196]	{long life bakery product}	=> {root vegetables}	0.005287239	0.1413043	1.2963883	1
## [197]	{long life bakery product}	=> {soda}	0.007625826	0.2038043	1.1687555	1
## [198]	{long life bakery product}	=> {yogurt}	0.008744281	0.2336957	1.6752163	1
## [199]	{long life bakery product}	=> {rolls/buns}	0.007930859	0.2119565	1.1523452	1
## [200]	{long life bakery product}	=> {other vegetables}	0.010676157	0.2853261	1.4746096	1
## [201]	{long life bakery product}	=> {whole milk}	0.013523132	0.3614130	1.4144438	1
## [202]	{dessert}	=> {curd}	0.005185562	0.1397260	2.6225295	1
## [203]	{dessert}	=> {fruit/vegetable juice}	0.005998983	0.1616438	2.2359594	1
## [204]	{dessert}	=> {pastry}	0.005388917	0.1452055	1.6321096	1
## [205]	{dessert}	=> {shopping bags}	0.006202339	0.1671233	1.6962410	1
## [206]	{dessert}	=> {sausage}	0.005897306	0.1589041	1.6913657	1
## [207]	{dessert}	=> {bottled water}	0.005185562	0.1397260	1.2642185	1
## [208]	{dessert}	=> {tropical fruit}	0.006304016	0.1698630	1.6188011	1
## [209]	{dessert}	=> {root vegetables}	0.005795628	0.1561644	1.4327208	1

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## [210] {dessert}          => {soda}           0.009862735 0.2657534 1.5240145
## [211] {dessert}          => {yogurt}          0.009862735 0.2657534 1.9050182
## [212] {dessert}          => {rolls/buns}      0.006812405 0.1835616 0.9979706
## [213] {dessert}          => {other vegetables} 0.011591256 0.3123288 1.6141636
## [214] {dessert}          => {whole milk}       0.013726487 0.3698630 1.4475140
## [215] {canned beer}      => {shopping bags}   0.011387900 0.1465969 1.4879052
## [216] {shopping bags}    => {canned beer}      0.011387900 0.1155831 1.4879052
## [217] {canned beer}      => {bottled water}     0.008032537 0.1034031 0.9355749
## [218] {canned beer}      => {soda}             0.013828165 0.1780105 1.0208356
## [219] {canned beer}      => {rolls/buns}      0.011286223 0.1452880 0.7898878
## [220] {canned beer}      => {other vegetables} 0.009049314 0.1164921 0.6020495
## [221] {canned beer}      => {whole milk}       0.008845958 0.1138743 0.4456642
## [222] {cream cheese }    => {curd}            0.005083884 0.1282051 2.4062928
## [223] {cream cheese }    => {domestic eggs}    0.005083884 0.1282051 2.0206690
## [224] {cream cheese }    => {fruit/vegetable juice} 0.005693950 0.1435897 1.9862238
## [225] {cream cheese }    => {whipped/sour cream} 0.006405694 0.1615385 2.2535188
## [226] {cream cheese }    => {pip fruit}        0.006100661 0.1538462 2.0337055
## [227] {cream cheese }    => {citrus fruit}      0.005693950 0.1435897 1.7348957
## [228] {cream cheese }    => {shopping bags}    0.005592272 0.1410256 1.4313593
## [229] {cream cheese }    => {sausage}          0.005592272 0.1410256 1.5010684
## [230] {cream cheese }    => {bottled water}     0.005897306 0.1487179 1.3455759
## [231] {cream cheese }    => {tropical fruit}   0.007219115 0.1820513 1.7349558
## [232] {cream cheese }    => {root vegetables}  0.007524148 0.1897436 1.7407912
## [233] {cream cheese }    => {soda}              0.006812405 0.1717949 0.9851910
## [234] {cream cheese }    => {yogurt}            0.012404677 0.3128205 2.2424123
## [235] {cream cheese }    => {rolls/buns}      0.009964413 0.2512821 1.3661465
## [236] {cream cheese }    => {other vegetables} 0.013726487 0.3461538 1.7889769
## [237] {cream cheese }    => {whole milk}       0.016471784 0.4153846 1.6256696
## [238] {chicken}          => {frozen vegetables} 0.006710727 0.1563981 3.2519564
## [239] {frozen vegetables}=> {chicken}          0.006710727 0.1395349 3.2519564
## [240] {chicken}          => {pork}              0.005795628 0.1350711 2.3428998
## [241] {pork}              => {chicken}          0.005795628 0.1005291 2.3428998
## [242] {chicken}          => {butter}            0.005795628 0.1350711 2.4374755
## [243] {butter}            => {chicken}          0.005795628 0.1045872 2.4374755
## [244] {chicken}          => {newspapers}       0.005185562 0.1208531 1.5141274
## [245] {chicken}          => {domestic eggs}    0.006202339 0.1445498 2.2782803
## [246] {chicken}          => {whipped/sour cream} 0.007219115 0.1682464 2.3470976
## [247] {whipped/sour cream}=> {chicken}          0.007219115 0.1007092 2.3470976
## [248] {chicken}          => {citrus fruit}      0.006914082 0.1611374 1.9469124
## [249] {chicken}          => {sausage}          0.005287239 0.1232227 1.3115755
## [250] {chicken}          => {bottled water}     0.005287239 0.1232227 1.1148995
## [251] {chicken}          => {tropical fruit}   0.006405694 0.1492891 1.4227309
## [252] {chicken}          => {root vegetables}  0.010879512 0.2535545 2.3262206
## [253] {chicken}          => {soda}              0.008337570 0.1943128 1.1143244
## [254] {chicken}          => {yogurt}            0.008337570 0.1943128 1.3929055
## [255] {chicken}          => {rolls/buns}      0.009659380 0.2251185 1.2239029
## [256] {chicken}          => {other vegetables} 0.017895272 0.4170616 2.1554393
## [257] {chicken}          => {whole milk}       0.017590239 0.4099526 1.6044106
## [258] {white bread}       => {frankfurter}      0.005185562 0.1231884 2.0888931
## [259] {white bread}       => {domestic eggs}    0.005795628 0.1376812 2.1700228
## [260] {white bread}       => {fruit/vegetable juice} 0.007422471 0.1763285 2.4390869
## [261] {fruit/vegetable juice}=> {white bread}      0.007422471 0.1026723 2.4390869
## [262] {white bread}       => {whipped/sour cream} 0.005490595 0.1304348 1.8196115
## [263] {white bread}       => {pip fruit}        0.006609049 0.1570048 2.0754604

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## [264]	{white bread}	=> {pastry}	0.005592272	0.1328502	1.4932367
## [265]	{white bread}	=> {shopping bags}	0.007422471	0.1763285	1.7896706
## [266]	{white bread}	=> {sausage}	0.007219115	0.1714976	1.8254099
## [267]	{white bread}	=> {tropical fruit}	0.008744281	0.2077295	1.9796699
## [268]	{white bread}	=> {root vegetables}	0.007930859	0.1884058	1.7285177
## [269]	{white bread}	=> {soda}	0.010269446	0.2439614	1.3990437
## [270]	{white bread}	=> {yogurt}	0.009049314	0.2149758	1.5410258
## [271]	{white bread}	=> {rolls/buns}	0.006507372	0.1545894	0.8404569
## [272]	{white bread}	=> {other vegetables}	0.013726487	0.3260870	1.6852681
## [273]	{white bread}	=> {whole milk}	0.017081851	0.4057971	1.5881474
## [274]	{chocolate}	=> {butter}	0.006202339	0.1250000	2.2557339
## [275]	{butter}	=> {chocolate}	0.006202339	0.1119266	2.2557339
## [276]	{chocolate}	=> {newspapers}	0.005490595	0.1106557	1.3863684
## [277]	{chocolate}	=> {fruit/vegetable juice}	0.006812405	0.1372951	1.8991521
## [278]	{chocolate}	=> {pip fruit}	0.006100661	0.1229508	1.6252975
## [279]	{chocolate}	=> {pastry}	0.008032537	0.1618852	1.8195902
## [280]	{chocolate}	=> {citrus fruit}	0.006405694	0.1290984	1.5598064
## [281]	{chocolate}	=> {shopping bags}	0.008134215	0.1639344	1.6638752
## [282]	{chocolate}	=> {sausage}	0.006609049	0.1331967	1.4177378
## [283]	{chocolate}	=> {bottled water}	0.005795628	0.1168033	1.0568172
## [284]	{chocolate}	=> {tropical fruit}	0.008134215	0.1639344	1.5623014
## [285]	{chocolate}	=> {root vegetables}	0.006405694	0.1290984	1.1844052
## [286]	{chocolate}	=> {soda}	0.013523132	0.2725410	1.5629391
## [287]	{chocolate}	=> {yogurt}	0.009252669	0.1864754	1.3367242
## [288]	{chocolate}	=> {rolls/buns}	0.011794611	0.2377049	1.2923316
## [289]	{chocolate}	=> {other vegetables}	0.012709710	0.2561475	1.3238103
## [290]	{chocolate}	=> {whole milk}	0.016675140	0.3360656	1.3152427
## [291]	{coffee}	=> {fruit/vegetable juice}	0.005998983	0.1033275	1.4292910
## [292]	{coffee}	=> {whipped/sour cream}	0.006100661	0.1050788	1.4658866
## [293]	{coffee}	=> {pip fruit}	0.006914082	0.1190893	1.5742519
## [294]	{coffee}	=> {pastry}	0.006914082	0.1190893	1.3385639
## [295]	{coffee}	=> {citrus fruit}	0.006405694	0.1103327	1.3330744
## [296]	{coffee}	=> {shopping bags}	0.009354347	0.1611208	1.6353183
## [297]	{coffee}	=> {sausage}	0.006914082	0.1190893	1.2675795
## [298]	{coffee}	=> {bottled water}	0.007320793	0.1260946	1.1408833
## [299]	{coffee}	=> {tropical fruit}	0.007117438	0.1225919	1.1683060
## [300]	{coffee}	=> {root vegetables}	0.007320793	0.1260946	1.1568471
## [301]	{coffee}	=> {soda}	0.009964413	0.1716287	0.9842382
## [302]	{coffee}	=> {yogurt}	0.009761057	0.1681261	1.2051896
## [303]	{coffee}	=> {rolls/buns}	0.010981190	0.1891419	1.0283085
## [304]	{coffee}	=> {other vegetables}	0.013421454	0.2311734	1.1947400
## [305]	{coffee}	=> {whole milk}	0.018708693	0.3222417	1.2611408
## [306]	{frozen vegetables}	=> {pork}	0.006405694	0.1331924	2.3103124
## [307]	{pork}	=> {frozen vegetables}	0.006405694	0.1111111	2.3103124
## [308]	{frozen vegetables}	=> {frankfurter}	0.005083884	0.1057082	1.7924838
## [309]	{frozen vegetables}	=> {margarine}	0.005083884	0.1057082	1.8049316
## [310]	{frozen vegetables}	=> {butter}	0.005795628	0.1205074	2.1746611
## [311]	{butter}	=> {frozen vegetables}	0.005795628	0.1045872	2.1746611
## [312]	{frozen vegetables}	=> {domestic eggs}	0.005185562	0.1078224	1.6994125
## [313]	{frozen vegetables}	=> {fruit/vegetable juice}	0.007829181	0.1627907	2.2518235
## [314]	{fruit/vegetable juice}	=> {frozen vegetables}	0.007829181	0.1082982	2.2518235
## [315]	{frozen vegetables}	=> {whipped/sour cream}	0.007930859	0.1649049	2.3004813
## [316]	{whipped/sour cream}	=> {frozen vegetables}	0.007930859	0.1106383	2.3004813
## [317]	{frozen vegetables}	=> {pip fruit}	0.007320793	0.1522199	2.0122076

## [318]	{frozen vegetables}	=> {citrus fruit}	0.006609049	0.1374207	1.6603597
## [319]	{frozen vegetables}	=> {sausage}	0.005998983	0.1247357	1.3276795
## [320]	{frozen vegetables}	=> {bottled water}	0.006202339	0.1289641	1.1668459
## [321]	{frozen vegetables}	=> {tropical fruit}	0.008744281	0.1818182	1.7327343
## [322]	{frozen vegetables}	=> {root vegetables}	0.011591256	0.2410148	2.2111759
## [323]	{root vegetables}	=> {frozen vegetables}	0.011591256	0.1063433	2.2111759
## [324]	{frozen vegetables}	=> {soda}	0.008642603	0.1797040	1.0305475
## [325]	{frozen vegetables}	=> {yogurt}	0.012404677	0.2579281	1.8489235
## [326]	{frozen vegetables}	=> {rolls/buns}	0.010167768	0.2114165	1.1494092
## [327]	{frozen vegetables}	=> {other vegetables}	0.017793594	0.3699789	1.9121083
## [328]	{frozen vegetables}	=> {whole milk}	0.020437214	0.4249471	1.6630940
## [329]	{beef}	=> {pork}	0.007625826	0.1453488	2.5211743
## [330]	{pork}	=> {beef}	0.007625826	0.1322751	2.5211743
## [331]	{beef}	=> {margarine}	0.006202339	0.1182171	2.0185152
## [332]	{margarine}	=> {beef}	0.006202339	0.1059028	2.0185152
## [333]	{beef}	=> {butter}	0.005795628	0.1104651	1.9934393
## [334]	{butter}	=> {beef}	0.005795628	0.1045872	1.9934393
## [335]	{beef}	=> {newspapers}	0.006405694	0.1220930	1.5296623
## [336]	{beef}	=> {domestic eggs}	0.005998983	0.1143411	1.8021548
## [337]	{beef}	=> {whipped/sour cream}	0.006710727	0.1279070	1.7843477
## [338]	{beef}	=> {pastry}	0.006304016	0.1201550	1.3505426
## [339]	{beef}	=> {citrus fruit}	0.008439248	0.1608527	1.9434723
## [340]	{citrus fruit}	=> {beef}	0.008439248	0.1019656	1.9434723
## [341]	{beef}	=> {sausage}	0.005592272	0.1065891	1.1345284
## [342]	{beef}	=> {bottled water}	0.006202339	0.1182171	1.0696088
## [343]	{beef}	=> {tropical fruit}	0.007625826	0.1453488	1.3851801
## [344]	{beef}	=> {root vegetables}	0.017386884	0.3313953	3.0403668
## [345]	{root vegetables}	=> {beef}	0.017386884	0.1595149	3.0403668
## [346]	{beef}	=> {soda}	0.008134215	0.1550388	0.8890998
## [347]	{beef}	=> {yogurt}	0.011692933	0.2228682	1.5976012
## [348]	{beef}	=> {rolls/buns}	0.013624809	0.2596899	1.4118576
## [349]	{beef}	=> {other vegetables}	0.019725470	0.3759690	1.9430662
## [350]	{other vegetables}	=> {beef}	0.019725470	0.1019443	1.9430662
## [351]	{beef}	=> {whole milk}	0.021250635	0.4050388	1.5851795
## [352]	{curd}	=> {margarine}	0.006304016	0.1183206	2.0202833
## [353]	{margarine}	=> {curd}	0.006304016	0.1076389	2.0202833
## [354]	{curd}	=> {butter}	0.006812405	0.1278626	2.3073920
## [355]	{butter}	=> {curd}	0.006812405	0.1229358	2.3073920
## [356]	{curd}	=> {newspapers}	0.005693950	0.1068702	1.3389410
## [357]	{curd}	=> {domestic eggs}	0.006507372	0.1221374	1.9250343
## [358]	{domestic eggs}	=> {curd}	0.006507372	0.1025641	1.9250343
## [359]	{curd}	=> {whipped/sour cream}	0.010472801	0.1965649	2.7421499
## [360]	{whipped/sour cream}	=> {curd}	0.010472801	0.1460993	2.7421499
## [361]	{curd}	=> {pip fruit}	0.007829181	0.1469466	1.9424993
## [362]	{pip fruit}	=> {curd}	0.007829181	0.1034946	1.9424993
## [363]	{curd}	=> {pastry}	0.007524148	0.1412214	1.5873282
## [364]	{curd}	=> {citrus fruit}	0.007117438	0.1335878	1.6140490
## [365]	{curd}	=> {shopping bags}	0.005388917	0.1011450	1.0265856
## [366]	{curd}	=> {sausage}	0.007625826	0.1431298	1.5234646
## [367]	{curd}	=> {bottled water}	0.006100661	0.1145038	1.0360120
## [368]	{curd}	=> {tropical fruit}	0.010269446	0.1927481	1.8368968
## [369]	{curd}	=> {root vegetables}	0.010879512	0.2041985	1.8734067
## [370]	{curd}	=> {soda}	0.008134215	0.1526718	0.8755258
## [371]	{curd}	=> {yogurt}	0.017285206	0.3244275	2.3256154

## [372]	{yogurt}	=> {curd}	0.017285206	0.1239067	2.3256154	1
## [373]	{curd}	=> {rolls/buns}	0.010066090	0.1889313	1.0271638	9
## [374]	{curd}	=> {other vegetables}	0.017183528	0.3225191	1.6668288	10
## [375]	{curd}	=> {whole milk}	0.026131164	0.4904580	1.9194805	20
## [376]	{whole milk}	=> {curd}	0.026131164	0.1022682	1.9194805	20
## [377]	{napkins}	=> {newspapers}	0.006202339	0.1184466	1.4839775	0
## [378]	{napkins}	=> {domestic eggs}	0.005998983	0.1145631	1.8056541	!
## [379]	{napkins}	=> {fruit/vegetable juice}	0.006914082	0.1320388	1.8264444	0
## [380]	{napkins}	=> {whipped/sour cream}	0.007219115	0.1378641	1.9232528	1
## [381]	{whipped/sour cream}	=> {napkins}	0.007219115	0.1007092	1.9232528	1
## [382]	{napkins}	=> {pip fruit}	0.006710727	0.1281553	1.6940965	0
## [383]	{napkins}	=> {pastry}	0.007015760	0.1339806	1.5059417	0
## [384]	{napkins}	=> {citrus fruit}	0.007625826	0.1456311	1.7595596	1
## [385]	{napkins}	=> {shopping bags}	0.007219115	0.1378641	1.3992706	1
## [386]	{napkins}	=> {sausage}	0.006710727	0.1281553	1.3640777	0
## [387]	{napkins}	=> {bottled water}	0.008642603	0.1650485	1.4933325	8
## [388]	{napkins}	=> {tropical fruit}	0.010066090	0.1922330	1.8319880	9
## [389]	{napkins}	=> {root vegetables}	0.009964413	0.1902913	1.7458158	9
## [390]	{napkins}	=> {soda}	0.011997966	0.2291262	1.3139687	11
## [391]	{napkins}	=> {yogurt}	0.012302999	0.2349515	1.6842183	11
## [392]	{napkins}	=> {rolls/buns}	0.011692933	0.2233010	1.2140216	11
## [393]	{napkins}	=> {other vegetables}	0.014438231	0.2757282	1.4250060	14
## [394]	{napkins}	=> {whole milk}	0.019725470	0.3766990	1.4742678	19
## [395]	{pork}	=> {frankfurter}	0.005897306	0.1022928	1.7345679	5
## [396]	{frankfurter}	=> {pork}	0.005897306	0.1000000	1.7345679	5
## [397]	{pork}	=> {margarine}	0.006405694	0.1111111	1.8971836	0
## [398]	{margarine}	=> {pork}	0.006405694	0.1093750	1.8971836	0
## [399]	{pork}	=> {newspapers}	0.006609049	0.1146384	1.4362664	0
## [400]	{pork}	=> {whipped/sour cream}	0.008235892	0.1428571	1.9929078	8
## [401]	{whipped/sour cream}	=> {pork}	0.008235892	0.1148936	1.9929078	8
## [402]	{pork}	=> {pip fruit}	0.006100661	0.1058201	1.3988451	0
## [403]	{pork}	=> {pastry}	0.006304016	0.1093474	1.2290653	0
## [404]	{pork}	=> {citrus fruit}	0.006507372	0.1128748	1.3637880	0
## [405]	{pork}	=> {shopping bags}	0.006405694	0.1111111	1.1277376	0
## [406]	{pork}	=> {sausage}	0.006507372	0.1128748	1.2014323	0
## [407]	{pork}	=> {bottled water}	0.007422471	0.1287478	1.1648892	1
## [408]	{pork}	=> {tropical fruit}	0.008540925	0.1481481	1.4118576	8
## [409]	{pork}	=> {root vegetables}	0.013624809	0.2363316	2.1682099	10
## [410]	{root vegetables}	=> {pork}	0.013624809	0.1250000	2.1682099	10
## [411]	{pork}	=> {soda}	0.011896289	0.2063492	1.1833495	11
## [412]	{pork}	=> {yogurt}	0.009557702	0.1657848	1.1884066	9
## [413]	{pork}	=> {rolls/buns}	0.011286223	0.1957672	1.0643286	11
## [414]	{pork}	=> {other vegetables}	0.021657346	0.3756614	1.9414764	21
## [415]	{other vegetables}	=> {pork}	0.021657346	0.1119285	1.9414764	21
## [416]	{pork}	=> {whole milk}	0.022165735	0.3844797	1.5047187	21
## [417]	{frankfurter}	=> {brown bread}	0.007117438	0.1206897	1.8604745	1
## [418]	{brown bread}	=> {frankfurter}	0.007117438	0.1097179	1.8604745	1
## [419]	{frankfurter}	=> {margarine}	0.006405694	0.1086207	1.8546606	0
## [420]	{margarine}	=> {frankfurter}	0.006405694	0.1093750	1.8546606	0
## [421]	{frankfurter}	=> {domestic eggs}	0.007015760	0.1189655	1.8750414	0
## [422]	{domestic eggs}	=> {frankfurter}	0.007015760	0.1105769	1.8750414	0
## [423]	{frankfurter}	=> {whipped/sour cream}	0.006202339	0.1051724	1.4671925	0
## [424]	{frankfurter}	=> {pip fruit}	0.007219115	0.1224138	1.6181985	1
## [425]	{frankfurter}	=> {pastry}	0.008337570	0.1413793	1.5891034	0

## [426]	{frankfurter}	=> {citrus fruit}	0.006507372	0.1103448	1.3332204
## [427]	{frankfurter}	=> {shopping bags}	0.008235892	0.1396552	1.4174496
## [428]	{frankfurter}	=> {sausage}	0.010066090	0.1706897	1.8168103
## [429]	{sausage}	=> {frankfurter}	0.010066090	0.1071429	1.8168103
## [430]	{frankfurter}	=> {bottled water}	0.007320793	0.1241379	1.1231799
## [431]	{frankfurter}	=> {tropical fruit}	0.009456024	0.1603448	1.5280924
## [432]	{frankfurter}	=> {root vegetables}	0.010167768	0.1724138	1.5818001
## [433]	{frankfurter}	=> {soda}	0.011286223	0.1913793	1.0975018
## [434]	{frankfurter}	=> {yogurt}	0.011184545	0.1896552	1.3595179
## [435]	{frankfurter}	=> {rolls/buns}	0.019217082	0.3258621	1.7716161
## [436]	{rolls/buns}	=> {frankfurter}	0.019217082	0.1044776	1.7716161
## [437]	{frankfurter}	=> {other vegetables}	0.016471784	0.2793103	1.4435193
## [438]	{frankfurter}	=> {whole milk}	0.020538892	0.3482759	1.3630295
## [439]	{margarine}	=> {bottled beer}	0.006100661	0.1041667	1.2935343
## [440]	{butter}	=> {bottled beer}	0.005795628	0.1045872	1.2987559
## [441]	{bottled beer}	=> {bottled water}	0.015760041	0.1957071	1.7707259
## [442]	{bottled water}	=> {bottled beer}	0.015760041	0.1425943	1.7707259
## [443]	{bottled beer}	=> {tropical fruit}	0.008235892	0.1022727	0.9746631
## [444]	{bottled beer}	=> {root vegetables}	0.009659380	0.1199495	1.1004695
## [445]	{bottled beer}	=> {soda}	0.016980173	0.2108586	1.2092094
## [446]	{bottled beer}	=> {yogurt}	0.009252669	0.1148990	0.8236382
## [447]	{bottled beer}	=> {rolls/buns}	0.013624809	0.1691919	0.9198466
## [448]	{bottled beer}	=> {other vegetables}	0.016166751	0.2007576	1.0375464
## [449]	{bottled beer}	=> {whole milk}	0.020437214	0.2537879	0.9932367
## [450]	{brown bread}	=> {margarine}	0.006507372	0.1003135	1.7128178
## [451]	{margarine}	=> {brown bread}	0.006507372	0.1111111	1.7128178
## [452]	{butter}	=> {brown bread}	0.005795628	0.1045872	1.6122487
## [453]	{brown bread}	=> {newspapers}	0.007625826	0.1175549	1.4728051
## [454]	{brown bread}	=> {domestic eggs}	0.006812405	0.1050157	1.6551749
## [455]	{domestic eggs}	=> {brown bread}	0.006812405	0.1073718	1.6551749
## [456]	{brown bread}	=> {fruit/vegetable juice}	0.008337570	0.1285266	1.7778615
## [457]	{fruit/vegetable juice}	=> {brown bread}	0.008337570	0.1153305	1.7778615
## [458]	{brown bread}	=> {pip fruit}	0.007625826	0.1175549	1.5539678
## [459]	{pip fruit}	=> {brown bread}	0.007625826	0.1008065	1.5539678
## [460]	{brown bread}	=> {pastry}	0.009659380	0.1489028	1.6736677
## [461]	{pastry}	=> {brown bread}	0.009659380	0.1085714	1.6736677
## [462]	{brown bread}	=> {citrus fruit}	0.008337570	0.1285266	1.5528987
## [463]	{citrus fruit}	=> {brown bread}	0.008337570	0.1007371	1.5528987
## [464]	{brown bread}	=> {shopping bags}	0.009252669	0.1426332	1.4476758
## [465]	{brown bread}	=> {sausage}	0.010676157	0.1645768	1.7517455
## [466]	{sausage}	=> {brown bread}	0.010676157	0.1136364	1.7517455
## [467]	{brown bread}	=> {bottled water}	0.008235892	0.1269592	1.1487067
## [468]	{brown bread}	=> {tropical fruit}	0.010676157	0.1645768	1.5684233
## [469]	{tropical fruit}	=> {brown bread}	0.010676157	0.1017442	1.5684233
## [470]	{brown bread}	=> {root vegetables}	0.010167768	0.1567398	1.4380000
## [471]	{brown bread}	=> {soda}	0.012608033	0.1943574	1.1145800
## [472]	{brown bread}	=> {yogurt}	0.014539908	0.2241379	1.6067030
## [473]	{yogurt}	=> {brown bread}	0.014539908	0.1042274	1.6067030
## [474]	{brown bread}	=> {rolls/buns}	0.012608033	0.1943574	1.0566637
## [475]	{brown bread}	=> {other vegetables}	0.018708693	0.2884013	1.4905025
## [476]	{brown bread}	=> {whole milk}	0.025216065	0.3887147	1.5212930
## [477]	{margarine}	=> {butter}	0.006710727	0.1145833	2.0677561
## [478]	{butter}	=> {margarine}	0.006710727	0.1211009	2.0677561
## [479]	{margarine}	=> {newspapers}	0.007117438	0.1215278	1.5225805

## [480]	{margarine}	=> {domestic eggs}	0.008337570	0.1423611	2.2437845
## [481]	{domestic eggs}	=> {margarine}	0.008337570	0.1314103	2.2437845
## [482]	{margarine}	=> {fruit/vegetable juice}	0.006202339	0.1059028	1.4649140
## [483]	{margarine}	=> {whipped/sour cream}	0.006812405	0.1163194	1.6226975
## [484]	{margarine}	=> {pip fruit}	0.008540925	0.1458333	1.9277834
## [485]	{pip fruit}	=> {margarine}	0.008540925	0.1129032	1.9277834
## [486]	{margarine}	=> {pastry}	0.006812405	0.1163194	1.3074306
## [487]	{margarine}	=> {citrus fruit}	0.007930859	0.1354167	1.6361461
## [488]	{margarine}	=> {sausage}	0.007117438	0.1215278	1.2935343
## [489]	{margarine}	=> {bottled water}	0.010269446	0.1753472	1.5865133
## [490]	{margarine}	=> {tropical fruit}	0.009354347	0.1597222	1.5221590
## [491]	{margarine}	=> {root vegetables}	0.011082867	0.1892361	1.7361354
## [492]	{root vegetables}	=> {margarine}	0.011082867	0.1016791	1.7361354
## [493]	{margarine}	=> {soda}	0.010167768	0.1736111	0.9956066
## [494]	{margarine}	=> {yogurt}	0.014234875	0.2430556	1.7423115
## [495]	{yogurt}	=> {margarine}	0.014234875	0.1020408	1.7423115
## [496]	{margarine}	=> {rolls/buns}	0.014743264	0.2517361	1.3686151
## [497]	{margarine}	=> {other vegetables}	0.019725470	0.3368056	1.7406635
## [498]	{other vegetables}	=> {margarine}	0.019725470	0.1019443	1.7406635
## [499]	{margarine}	=> {whole milk}	0.024199288	0.4131944	1.6170980
## [500]	{butter}	=> {newspapers}	0.005795628	0.1045872	1.3103372
## [501]	{butter}	=> {domestic eggs}	0.009659380	0.1743119	2.7473683
## [502]	{domestic eggs}	=> {butter}	0.009659380	0.1522436	2.7473683
## [503]	{butter}	=> {fruit/vegetable juice}	0.008032537	0.1449541	2.0050968
## [504]	{fruit/vegetable juice}	=> {butter}	0.008032537	0.1111111	2.0050968
## [505]	{butter}	=> {whipped/sour cream}	0.010167768	0.1834862	2.5596981
## [506]	{whipped/sour cream}	=> {butter}	0.010167768	0.1418440	2.5596981
## [507]	{butter}	=> {pip fruit}	0.007320793	0.1321101	1.7463747
## [508]	{butter}	=> {pastry}	0.007625826	0.1376147	1.5467890
## [509]	{butter}	=> {citrus fruit}	0.009150991	0.1651376	1.9952438
## [510]	{citrus fruit}	=> {butter}	0.009150991	0.1105651	1.9952438
## [511]	{butter}	=> {sausage}	0.008642603	0.1559633	1.6600639
## [512]	{butter}	=> {bottled water}	0.008947636	0.1614679	1.4609353
## [513]	{butter}	=> {tropical fruit}	0.009964413	0.1798165	1.7136583
## [514]	{butter}	=> {root vegetables}	0.012913066	0.2330275	2.1378971
## [515]	{root vegetables}	=> {butter}	0.012913066	0.1184701	2.1378971
## [516]	{butter}	=> {soda}	0.008845958	0.1596330	0.9154465
## [517]	{butter}	=> {yogurt}	0.014641586	0.2642202	1.8940273
## [518]	{yogurt}	=> {butter}	0.014641586	0.1049563	1.8940273
## [519]	{butter}	=> {rolls/buns}	0.013421454	0.2422018	1.3167800
## [520]	{butter}	=> {other vegetables}	0.020030503	0.3614679	1.8681223
## [521]	{other vegetables}	=> {butter}	0.020030503	0.1035208	1.8681223
## [522]	{butter}	=> {whole milk}	0.027554652	0.4972477	1.9460530
## [523]	{whole milk}	=> {butter}	0.027554652	0.1078392	1.9460530
## [524]	{domestic eggs}	=> {newspapers}	0.006914082	0.1089744	1.3653030
## [525]	{newspapers}	=> {fruit/vegetable juice}	0.008235892	0.1031847	1.4273160
## [526]	{fruit/vegetable juice}	=> {newspapers}	0.008235892	0.1139241	1.4273160
## [527]	{whipped/sour cream}	=> {newspapers}	0.007219115	0.1007092	1.2617518
## [528]	{newspapers}	=> {pastry}	0.008439248	0.1057325	1.1884331
## [529]	{newspapers}	=> {citrus fruit}	0.008337570	0.1044586	1.2621011
## [530]	{citrus fruit}	=> {newspapers}	0.008337570	0.1007371	1.2621011
## [531]	{newspapers}	=> {sausage}	0.008032537	0.1006369	1.0711735
## [532]	{newspapers}	=> {bottled water}	0.011286223	0.1414013	1.2793758
## [533]	{bottled water}	=> {newspapers}	0.011286223	0.1021159	1.2793758

## [534]	{newspapers}	=> {tropical fruit}	0.011794611	0.1477707	1.4082605	1
## [535]	{tropical fruit}	=> {newspapers}	0.011794611	0.1124031	1.4082605	1
## [536]	{newspapers}	=> {root vegetables}	0.011489578	0.1439490	1.3206519	1
## [537]	{root vegetables}	=> {newspapers}	0.011489578	0.1054104	1.3206519	1
## [538]	{newspapers}	=> {soda}	0.014641586	0.1834395	1.0519693	1
## [539]	{newspapers}	=> {yogurt}	0.015353330	0.1923567	1.3788834	1
## [540]	{yogurt}	=> {newspapers}	0.015353330	0.1100583	1.3788834	1
## [541]	{newspapers}	=> {rolls/buns}	0.019725470	0.2471338	1.3435934	1
## [542]	{rolls/buns}	=> {newspapers}	0.019725470	0.1072416	1.3435934	1
## [543]	{newspapers}	=> {other vegetables}	0.019318760	0.2420382	1.2508912	1
## [544]	{newspapers}	=> {whole milk}	0.027351296	0.3426752	1.3411103	2
## [545]	{whole milk}	=> {newspapers}	0.027351296	0.1070434	1.3411103	2
## [546]	{domestic eggs}	=> {fruit/vegetable juice}	0.008032537	0.1266026	1.7512464	1
## [547]	{fruit/vegetable juice}	=> {domestic eggs}	0.008032537	0.1111111	1.7512464	1
## [548]	{domestic eggs}	=> {whipped/sour cream}	0.009964413	0.1570513	2.1909211	9
## [549]	{whipped/sour cream}	=> {domestic eggs}	0.009964413	0.1390071	2.1909211	9
## [550]	{domestic eggs}	=> {pip fruit}	0.008642603	0.1362179	1.8006768	8
## [551]	{pip fruit}	=> {domestic eggs}	0.008642603	0.1142473	1.8006768	8
## [552]	{domestic eggs}	=> {pastry}	0.009049314	0.1426282	1.6031410	8
## [553]	{pastry}	=> {domestic eggs}	0.009049314	0.1017143	1.6031410	8
## [554]	{domestic eggs}	=> {citrus fruit}	0.010371124	0.1634615	1.9749929	10
## [555]	{citrus fruit}	=> {domestic eggs}	0.010371124	0.1253071	1.9749929	10
## [556]	{domestic eggs}	=> {shopping bags}	0.009049314	0.1426282	1.4476248	8
## [557]	{domestic eggs}	=> {sausage}	0.009557702	0.1506410	1.6034139	9
## [558]	{sausage}	=> {domestic eggs}	0.009557702	0.1017316	1.6034139	9
## [559]	{domestic eggs}	=> {bottled water}	0.009150991	0.1442308	1.3049766	9
## [560]	{domestic eggs}	=> {tropical fruit}	0.011387900	0.1794872	1.7105198	11
## [561]	{tropical fruit}	=> {domestic eggs}	0.011387900	0.1085271	1.7105198	11
## [562]	{domestic eggs}	=> {root vegetables}	0.014336553	0.2259615	2.0730706	14
## [563]	{root vegetables}	=> {domestic eggs}	0.014336553	0.1315299	2.0730706	14
## [564]	{domestic eggs}	=> {soda}	0.012404677	0.1955128	1.1212062	11
## [565]	{domestic eggs}	=> {yogurt}	0.014336553	0.2259615	1.6197753	14
## [566]	{yogurt}	=> {domestic eggs}	0.014336553	0.1027697	1.6197753	14
## [567]	{domestic eggs}	=> {rolls/buns}	0.015658363	0.2467949	1.3417510	11
## [568]	{domestic eggs}	=> {other vegetables}	0.022267412	0.3509615	1.8138238	21
## [569]	{other vegetables}	=> {domestic eggs}	0.022267412	0.1150815	1.8138238	21
## [570]	{domestic eggs}	=> {whole milk}	0.029994916	0.4727564	1.8502027	20
## [571]	{whole milk}	=> {domestic eggs}	0.029994916	0.1173896	1.8502027	20
## [572]	{fruit/vegetable juice}	=> {whipped/sour cream}	0.009049314	0.1251758	1.7462469	8
## [573]	{whipped/sour cream}	=> {fruit/vegetable juice}	0.009049314	0.1262411	1.7462469	8
## [574]	{fruit/vegetable juice}	=> {pip fruit}	0.009557702	0.1322082	1.7476710	9
## [575]	{pip fruit}	=> {fruit/vegetable juice}	0.009557702	0.1263441	1.7476710	9
## [576]	{fruit/vegetable juice}	=> {pastry}	0.008540925	0.1181435	1.3279325	8
## [577]	{fruit/vegetable juice}	=> {citrus fruit}	0.010371124	0.1434599	1.7333271	10
## [578]	{citrus fruit}	=> {fruit/vegetable juice}	0.010371124	0.1253071	1.7333271	10
## [579]	{fruit/vegetable juice}	=> {shopping bags}	0.010676157	0.1476793	1.4988918	10
## [580]	{shopping bags}	=> {fruit/vegetable juice}	0.010676157	0.1083591	1.4988918	10
## [581]	{fruit/vegetable juice}	=> {sausage}	0.010066090	0.1392405	1.4820675	9
## [582]	{sausage}	=> {fruit/vegetable juice}	0.010066090	0.1071429	1.4820675	9
## [583]	{fruit/vegetable juice}	=> {bottled water}	0.014234875	0.1969058	1.7815715	14
## [584]	{bottled water}	=> {fruit/vegetable juice}	0.014234875	0.1287948	1.7815715	14
## [585]	{fruit/vegetable juice}	=> {tropical fruit}	0.013726487	0.1898734	1.8095010	14
## [586]	{tropical fruit}	=> {fruit/vegetable juice}	0.013726487	0.1308140	1.8095010	14
## [587]	{fruit/vegetable juice}	=> {root vegetables}	0.011997966	0.1659634	1.5226216	14

## [588]	{root vegetables}	=> {fruit/vegetable juice}	0.011997966	0.1100746	1.5226216	1
## [589]	{fruit/vegetable juice}	=> {soda}	0.018403660	0.2545710	1.4598869	1
## [590]	{soda}	=> {fruit/vegetable juice}	0.018403660	0.1055394	1.4598869	1
## [591]	{fruit/vegetable juice}	=> {yogurt}	0.018708693	0.2587904	1.8551049	1
## [592]	{yogurt}	=> {fruit/vegetable juice}	0.018708693	0.1341108	1.8551049	1
## [593]	{fruit/vegetable juice}	=> {rolls/buns}	0.014539908	0.2011252	1.0934583	1
## [594]	{fruit/vegetable juice}	=> {other vegetables}	0.021047280	0.2911392	1.5046529	2
## [595]	{other vegetables}	=> {fruit/vegetable juice}	0.021047280	0.1087756	1.5046529	2
## [596]	{fruit/vegetable juice}	=> {whole milk}	0.026639553	0.3684951	1.4421604	2
## [597]	{whole milk}	=> {fruit/vegetable juice}	0.026639553	0.1042579	1.4421604	2
## [598]	{whipped/sour cream}	=> {pip fruit}	0.009252669	0.1290780	1.7062934	9
## [599]	{pip fruit}	=> {whipped/sour cream}	0.009252669	0.1223118	1.7062934	9
## [600]	{whipped/sour cream}	=> {pastry}	0.007524148	0.1049645	1.1798014	1
## [601]	{whipped/sour cream}	=> {citrus fruit}	0.010879512	0.1517730	1.8337690	1
## [602]	{citrus fruit}	=> {whipped/sour cream}	0.010879512	0.1314496	1.8337690	1
## [603]	{whipped/sour cream}	=> {shopping bags}	0.007930859	0.1106383	1.1229388	1
## [604]	{whipped/sour cream}	=> {sausage}	0.009049314	0.1262411	1.3437030	8
## [605]	{whipped/sour cream}	=> {bottled water}	0.008744281	0.1219858	1.1037079	8
## [606]	{whipped/sour cream}	=> {tropical fruit}	0.013828165	0.1929078	1.8384188	1
## [607]	{tropical fruit}	=> {whipped/sour cream}	0.013828165	0.1317829	1.8384188	1
## [608]	{whipped/sour cream}	=> {root vegetables}	0.017081851	0.2382979	2.1862496	1
## [609]	{root vegetables}	=> {whipped/sour cream}	0.017081851	0.1567164	2.1862496	1
## [610]	{whipped/sour cream}	=> {soda}	0.011591256	0.1617021	0.9273122	1
## [611]	{whipped/sour cream}	=> {yogurt}	0.020742247	0.2893617	2.0742510	2
## [612]	{yogurt}	=> {whipped/sour cream}	0.020742247	0.1486880	2.0742510	2
## [613]	{whipped/sour cream}	=> {rolls/buns}	0.014641586	0.2042553	1.1104760	14
## [614]	{whipped/sour cream}	=> {other vegetables}	0.028876462	0.4028369	2.0819237	28
## [615]	{other vegetables}	=> {whipped/sour cream}	0.028876462	0.1492380	2.0819237	28
## [616]	{whipped/sour cream}	=> {whole milk}	0.032231825	0.4496454	1.7597542	3
## [617]	{whole milk}	=> {whipped/sour cream}	0.032231825	0.1261441	1.7597542	3
## [618]	{pip fruit}	=> {pastry}	0.010676157	0.1411290	1.5862903	10
## [619]	{pastry}	=> {pip fruit}	0.010676157	0.1200000	1.5862903	10
## [620]	{pip fruit}	=> {citrus fruit}	0.013828165	0.1827957	2.2085942	11
## [621]	{citrus fruit}	=> {pip fruit}	0.013828165	0.1670762	2.2085942	11
## [622]	{pip fruit}	=> {shopping bags}	0.009354347	0.1236559	1.2550629	9
## [623]	{pip fruit}	=> {sausage}	0.010777834	0.1424731	1.5164752	10
## [624]	{sausage}	=> {pip fruit}	0.010777834	0.1147186	1.5164752	10
## [625]	{pip fruit}	=> {bottled water}	0.010574479	0.1397849	1.2647516	10
## [626]	{pip fruit}	=> {tropical fruit}	0.020437214	0.2701613	2.5746476	20
## [627]	{tropical fruit}	=> {pip fruit}	0.020437214	0.1947674	2.5746476	20
## [628]	{pip fruit}	=> {root vegetables}	0.015556685	0.2056452	1.8866793	1
## [629]	{root vegetables}	=> {pip fruit}	0.015556685	0.1427239	1.8866793	1
## [630]	{pip fruit}	=> {soda}	0.013319776	0.1760753	1.0097378	13
## [631]	{pip fruit}	=> {yogurt}	0.017996950	0.2379032	1.7053777	1
## [632]	{yogurt}	=> {pip fruit}	0.017996950	0.1290087	1.7053777	1
## [633]	{pip fruit}	=> {rolls/buns}	0.013929842	0.1841398	1.0011138	13
## [634]	{pip fruit}	=> {other vegetables}	0.026131164	0.3454301	1.7852365	2
## [635]	{other vegetables}	=> {pip fruit}	0.026131164	0.1350499	1.7852365	2
## [636]	{pip fruit}	=> {whole milk}	0.030096594	0.3978495	1.5570432	2
## [637]	{whole milk}	=> {pip fruit}	0.030096594	0.1177875	1.5570432	2
## [638]	{pastry}	=> {citrus fruit}	0.009761057	0.1097143	1.3256020	9
## [639]	{citrus fruit}	=> {pastry}	0.009761057	0.1179361	1.3256020	9
## [640]	{pastry}	=> {shopping bags}	0.011896289	0.1337143	1.3571517	1
## [641]	{shopping bags}	=> {pastry}	0.011896289	0.1207430	1.3571517	1

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## [642] {pastry}          => {sausage}          0.012506355 0.1405714 1.4962338
## [643] {sausage}         => {pastry}           0.012506355 0.1331169 1.4962338
## [644] {pastry}          => {bottled water}    0.008947636 0.1005714 0.9099540
## [645] {pastry}          => {tropical fruit}  0.013218099 0.1485714 1.4158915
## [646] {tropical fruit}  => {pastry}           0.013218099 0.1259690 1.4158915
## [647] {pastry}          => {root vegetables} 0.010981190 0.1234286 1.1323881
## [648] {root vegetables} => {pastry}           0.010981190 0.1007463 1.1323881
## [649] {pastry}          => {soda}              0.021047280 0.2365714 1.3566647
## [650] {soda}             => {pastry}           0.021047280 0.1206997 1.3566647
## [651] {pastry}          => {yogurt}            0.017691917 0.1988571 1.4254810
## [652] {yogurt}           => {pastry}           0.017691917 0.1268222 1.4254810
## [653] {pastry}          => {rolls/buns}      0.020945602 0.2354286 1.2799558
## [654] {rolls/buns}       => {pastry}           0.020945602 0.1138751 1.2799558
## [655] {pastry}          => {other vegetables} 0.022572445 0.2537143 1.3112349
## [656] {other vegetables}=> {pastry}           0.022572445 0.1166579 1.3112349
## [657] {pastry}          => {whole milk}       0.033248602 0.3737143 1.4625865
## [658] {whole milk}       => {pastry}           0.033248602 0.1301234 1.4625865
## [659] {citrus fruit}     => {shopping bags}   0.009761057 0.1179361 1.1970090
## [660] {citrus fruit}     => {sausage}          0.011286223 0.1363636 1.4514463
## [661] {sausage}          => {citrus fruit}     0.011286223 0.1201299 1.4514463
## [662] {citrus fruit}     => {bottled water}    0.013523132 0.1633907 1.4783323
## [663] {bottled water}    => {citrus fruit}     0.013523132 0.1223551 1.4783323
## [664] {citrus fruit}     => {tropical fruit}   0.019928826 0.2407862 2.2947022
## [665] {tropical fruit}  => {citrus fruit}     0.019928826 0.1899225 2.2947022
## [666] {citrus fruit}     => {root vegetables} 0.017691917 0.2137592 1.9611211
## [667] {root vegetables} => {citrus fruit}     0.017691917 0.1623134 1.9611211
## [668] {citrus fruit}     => {soda}              0.012811388 0.1547912 0.8876799
## [669] {citrus fruit}     => {yogurt}            0.021657346 0.2616708 1.8757521
## [670] {yogurt}           => {citrus fruit}     0.021657346 0.1552478 1.8757521
## [671] {citrus fruit}     => {rolls/buns}      0.016776817 0.2027027 1.1020349
## [672] {citrus fruit}     => {other vegetables} 0.028876462 0.3488943 1.8031403
## [673] {other vegetables}=> {citrus fruit}     0.028876462 0.1492380 1.8031403
## [674] {citrus fruit}     => {whole milk}       0.030503305 0.3685504 1.4423768
## [675] {whole milk}       => {citrus fruit}     0.030503305 0.1193792 1.4423768
## [676] {shopping bags}   => {sausage}          0.015658363 0.1589267 1.6916065
## [677] {sausage}          => {shopping bags}   0.015658363 0.1666667 1.6916065
## [678] {shopping bags}   => {bottled water}    0.010981190 0.1114551 1.0084278
## [679] {shopping bags}   => {tropical fruit}  0.013523132 0.1372549 1.3080445
## [680] {tropical fruit}  => {shopping bags}   0.013523132 0.1288760 1.3080445
## [681] {shopping bags}   => {root vegetables} 0.012811388 0.1300310 1.1929613
## [682] {root vegetables} => {shopping bags}   0.012811388 0.1175373 1.1929613
## [683] {shopping bags}   => {soda}              0.024605999 0.2497420 1.4321939
## [684] {soda}              => {shopping bags}   0.024605999 0.1411079 1.4321939
## [685] {shopping bags}   => {yogurt}            0.015251652 0.1547988 1.1096544
## [686] {yogurt}            => {shopping bags}   0.015251652 0.1093294 1.1096544
## [687] {shopping bags}   => {rolls/buns}      0.019522115 0.1981424 1.0772419
## [688] {rolls/buns}       => {shopping bags}   0.019522115 0.1061360 1.0772419
## [689] {shopping bags}   => {other vegetables} 0.023182511 0.2352941 1.2160366
## [690] {other vegetables}=> {shopping bags}   0.023182511 0.1198108 1.2160366
## [691] {shopping bags}   => {whole milk}       0.024504321 0.2487100 0.9733637
## [692] {sausage}          => {bottled water}    0.011997966 0.1277056 1.1554598
## [693] {bottled water}    => {sausage}          0.011997966 0.1085557 1.1554598
## [694] {sausage}          => {tropical fruit}  0.013929842 0.1482684 1.4130036
## [695] {tropical fruit}  => {sausage}          0.013929842 0.1327519 1.4130036

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## [750]	{soda}	=> {whole milk}	0.040061007	0.2297376	0.8991124	35
## [751]	{whole milk}	=> {soda}	0.040061007	0.1567847	0.8991124	35
## [752]	{yogurt}	=> {rolls/buns}	0.034367056	0.2463557	1.3393633	35
## [753]	{rolls/buns}	=> {yogurt}	0.034367056	0.1868436	1.3393633	35
## [754]	{yogurt}	=> {other vegetables}	0.043416370	0.3112245	1.6084566	41
## [755]	{other vegetables}	=> {yogurt}	0.043416370	0.2243826	1.6084566	41
## [756]	{yogurt}	=> {whole milk}	0.056024403	0.4016035	1.5717351	55
## [757]	{whole milk}	=> {yogurt}	0.056024403	0.2192598	1.5717351	55
## [758]	{rolls/buns}	=> {other vegetables}	0.042602949	0.2316197	1.1970465	41
## [759]	{other vegetables}	=> {rolls/buns}	0.042602949	0.2201787	1.1970465	41
## [760]	{rolls/buns}	=> {whole milk}	0.056634469	0.3079049	1.2050318	55
## [761]	{whole milk}	=> {rolls/buns}	0.056634469	0.2216474	1.2050318	55
## [762]	{other vegetables}	=> {whole milk}	0.074834774	0.3867578	1.5136341	73
## [763]	{whole milk}	=> {other vegetables}	0.074834774	0.2928770	1.5136341	73
## [764]	{oil,					
	other vegetables}	=> {whole milk}	0.005083884	0.5102041	1.9967597	55
## [765]	{oil,					
	whole milk}	=> {other vegetables}	0.005083884	0.4504505	2.3279980	55
## [766]	{onions,					
	root vegetables}	=> {other vegetables}	0.005693950	0.6021505	3.1120076	55
## [767]	{onions,					
	other vegetables}	=> {root vegetables}	0.005693950	0.4000000	3.6697761	55
## [768]	{other vegetables,					
	root vegetables}	=> {onions}	0.005693950	0.1201717	3.8750440	55
## [769]	{onions,					
	other vegetables}	=> {whole milk}	0.006609049	0.4642857	1.8170513	60
## [770]	{onions,					
	whole milk}	=> {other vegetables}	0.006609049	0.5462185	2.8229421	60
## [771]	{hamburger meat,					
	other vegetables}	=> {whole milk}	0.006304016	0.4558824	1.7841635	60
## [772]	{hamburger meat,					
	whole milk}	=> {other vegetables}	0.006304016	0.4275862	2.2098320	60
## [773]	{hygiene articles,					
	other vegetables}	=> {whole milk}	0.005185562	0.5425532	2.1233628	55
## [774]	{hygiene articles,					
	whole milk}	=> {other vegetables}	0.005185562	0.4047619	2.0918725	55
## [775]	{other vegetables,					
	sugar}	=> {whole milk}	0.006304016	0.5849057	2.2891155	60
## [776]	{sugar,					
	whole milk}	=> {other vegetables}	0.006304016	0.4189189	2.1650381	60
## [777]	{long life bakery product,					
	other vegetables}	=> {whole milk}	0.005693950	0.5333333	2.0872795	55
## [778]	{long life bakery product,					
	whole milk}	=> {other vegetables}	0.005693950	0.4210526	2.1760655	55
## [779]	{cream cheese ,					
	yogurt}	=> {other vegetables}	0.005287239	0.4262295	2.2028204	55
## [780]	{cream cheese ,					
	other vegetables}	=> {yogurt}	0.005287239	0.3851852	2.7611489	55
## [781]	{other vegetables,					
	yogurt}	=> {cream cheese }	0.005287239	0.1217799	3.0710383	55
## [782]	{cream cheese ,					
	yogurt}	=> {whole milk}	0.006609049	0.5327869	2.0851409	55
## [783]	{cream cheese ,					
	whole milk}	=> {yogurt}	0.006609049	0.4012346	2.8761968	55

## [784]	{whole milk, ## yogurt}	=> {cream cheese }	0.006609049	0.1179673	2.9748941
## [785]	{cream cheese , ## other vegetables}	=> {whole milk}	0.006710727	0.4888889	1.9133395
## [786]	{cream cheese , ## whole milk}	=> {other vegetables}	0.006710727	0.4074074	2.1055449
## [787]	{chicken, ## root vegetables}	=> {other vegetables}	0.005693950	0.5233645	2.7048291
## [788]	{chicken, ## other vegetables}	=> {root vegetables}	0.005693950	0.3181818	2.9191401
## [789]	{other vegetables, ## root vegetables}	=> {chicken}	0.005693950	0.1201717	2.8006834
## [790]	{chicken, ## root vegetables}	=> {whole milk}	0.005998983	0.5514019	2.1579934
## [791]	{chicken, ## whole milk}	=> {root vegetables}	0.005998983	0.3410405	3.1288554
## [792]	{root vegetables, ## whole milk}	=> {chicken}	0.005998983	0.1226611	2.8587018
## [793]	{chicken, ## rolls/buns}	=> {whole milk}	0.005287239	0.5473684	2.1422079
## [794]	{chicken, ## whole milk}	=> {rolls/buns}	0.005287239	0.3005780	1.6341542
## [795]	{chicken, ## other vegetables}	=> {whole milk}	0.008439248	0.4715909	1.8456413
## [796]	{chicken, ## whole milk}	=> {other vegetables}	0.008439248	0.4797688	2.4795197
## [797]	{other vegetables, ## whole milk}	=> {chicken}	0.008439248	0.1127717	2.6282229
## [798]	{other vegetables, ## white bread}	=> {whole milk}	0.005897306	0.4296296	1.6814196
## [799]	{white bread, ## whole milk}	=> {other vegetables}	0.005897306	0.3452381	1.7842442
## [800]	{chocolate, ## soda}	=> {whole milk}	0.005083884	0.3759398	1.4712966
## [801]	{chocolate, ## whole milk}	=> {soda}	0.005083884	0.3048780	1.7483823
## [802]	{soda, ## whole milk}	=> {chocolate}	0.005083884	0.1269036	2.5575747
## [803]	{chocolate, ## other vegetables}	=> {whole milk}	0.005490595	0.4320000	1.6906964
## [804]	{chocolate, ## whole milk}	=> {other vegetables}	0.005490595	0.3292683	1.7017098
## [805]	{coffee, ## yogurt}	=> {whole milk}	0.005083884	0.5208333	2.0383589
## [806]	{coffee, ## whole milk}	=> {yogurt}	0.005083884	0.2717391	1.9479259
## [807]	{coffee, ## other vegetables}	=> {whole milk}	0.006405694	0.4772727	1.8678779
## [808]	{coffee, ## whole milk}	=> {other vegetables}	0.006405694	0.3423913	1.7695315
## [809]	{frozen vegetables, ## root vegetables}	=> {other vegetables}	0.006100661	0.5263158	2.7200819
## [810]	{frozen vegetables, ## other vegetables}	=> {root vegetables}	0.006100661	0.3428571	3.1455224

```

## [811] {other vegetables,
##       root vegetables}      => {frozen vegetables}          0.006100661 0.1287554 2.6771861
## [812] {frozen vegetables,
##       root vegetables}      => {whole milk}                0.006202339 0.5350877 2.0941455
## [813] {frozen vegetables,
##       whole milk}           => {root vegetables}          0.006202339 0.3034826 2.7842829
## [814] {root vegetables,
##       whole milk}            => {frozen vegetables}          0.006202339 0.1268191 2.6369262
## [815] {frozen vegetables,
##       yogurt}                 => {other vegetables}          0.005287239 0.4262295 2.2028204
## [816] {frozen vegetables,
##       other vegetables}       => {yogurt}                  0.005287239 0.2971429 2.1300292
## [817] {other vegetables,
##       yogurt}                 => {frozen vegetables}          0.005287239 0.1217799 2.5321457
## [818] {frozen vegetables,
##       yogurt}                 => {whole milk}              0.006100661 0.4918033 1.9247454
## [819] {frozen vegetables,
##       whole milk}             => {yogurt}                  0.006100661 0.2985075 2.1398111
## [820] {whole milk,
##       yogurt}                 => {frozen vegetables}          0.006100661 0.1088929 2.2641900
## [821] {frozen vegetables,
##       rolls/buns}             => {whole milk}              0.005083884 0.5000000 1.9568245
## [822] {frozen vegetables,
##       whole milk}             => {rolls/buns}              0.005083884 0.2487562 1.3524143
## [823] {frozen vegetables,
##       other vegetables}        => {whole milk}              0.009659380 0.5428571 2.1245523
## [824] {frozen vegetables,
##       whole milk}             => {other vegetables}         0.009659380 0.4726368 2.4426606
## [825] {other vegetables,
##       whole milk}             => {frozen vegetables}          0.009659380 0.1290761 2.6838548
## [826] {beef,
##       root vegetables}        => {other vegetables}         0.007930859 0.4561404 2.3574043
## [827] {beef,
##       other vegetables}        => {root vegetables}          0.007930859 0.4020619 3.6886925
## [828] {other vegetables,
##       root vegetables}        => {beef}                   0.007930859 0.1673820 3.1903134
## [829] {beef,
##       root vegetables}        => {whole milk}              0.008032537 0.4619883 1.8080601
## [830] {beef,
##       whole milk}              => {root vegetables}          0.008032537 0.3779904 3.4678506
## [831] {root vegetables,
##       whole milk}              => {beef}                   0.008032537 0.1642412 3.1304493
## [832] {beef,
##       yogurt}                 => {other vegetables}         0.005185562 0.4434783 2.2919646
## [833] {beef,
##       other vegetables}        => {yogurt}                  0.005185562 0.2628866 1.8844677
## [834] {other vegetables,
##       yogurt}                 => {beef}                   0.005185562 0.1194379 2.2764964
## [835] {beef,
##       yogurt}                 => {whole milk}              0.006100661 0.5217391 2.0419038
## [836] {beef,
##       whole milk}              => {yogurt}                  0.006100661 0.2870813 2.0579045
## [837] {whole milk,
##       yogurt}                 => {beef}                   0.006100661 0.1088929 2.0755075

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## [838]	{beef, ##       rolls/buns}	=> {other vegetables}	0.005795628	0.4253731	2.1983945
## [839]	{beef, ##       other vegetables}	=> {rolls/buns}	0.005795628	0.2938144	1.5973825
## [840]	{other vegetables, ##       rolls/buns}	=> {beef}	0.005795628	0.1360382	2.5928984
## [841]	{beef, ##       rolls/buns}	=> {whole milk}	0.006812405	0.5000000	1.9568245
## [842]	{beef, ##       whole milk}	=> {rolls/buns}	0.006812405	0.3205742	1.7428673
## [843]	{rolls/buns, ##       whole milk}	=> {beef}	0.006812405	0.1202873	2.2926844
## [844]	{beef, ##       other vegetables}	=> {whole milk}	0.009252669	0.4690722	1.8357838
## [845]	{beef, ##       whole milk}	=> {other vegetables}	0.009252669	0.4354067	2.2502495
## [846]	{other vegetables, ##       whole milk}	=> {beef}	0.009252669	0.1236413	2.3566128
## [847]	{curd, ##       whipped/sour cream}	=> {whole milk}	0.005897306	0.5631068	2.2038024
## [848]	{curd, ##       whole milk}	=> {whipped/sour cream}	0.005897306	0.2256809	3.1483291
## [849]	{whipped/sour cream, ##       whole milk}	=> {curd}	0.005897306	0.1829653	3.4340911
## [850]	{curd, ##       tropical fruit}	=> {yogurt}	0.005287239	0.5148515	3.6906446
## [851]	{curd, ##       yogurt}	=> {tropical fruit}	0.005287239	0.3058824	2.9150707
## [852]	{tropical fruit, ##       yogurt}	=> {curd}	0.005287239	0.1805556	3.3888624
## [853]	{curd, ##       tropical fruit}	=> {other vegetables}	0.005287239	0.5148515	2.6608326
## [854]	{curd, ##       other vegetables}	=> {tropical fruit}	0.005287239	0.3076923	2.9323196
## [855]	{other vegetables, ##       tropical fruit}	=> {curd}	0.005287239	0.1473088	2.7648509
## [856]	{curd, ##       tropical fruit}	=> {whole milk}	0.006507372	0.6336634	2.4799360
## [857]	{curd, ##       whole milk}	=> {tropical fruit}	0.006507372	0.2490272	2.3732392
## [858]	{tropical fruit, ##       whole milk}	=> {curd}	0.006507372	0.1538462	2.8875514
## [859]	{curd, ##       root vegetables}	=> {other vegetables}	0.005490595	0.5046729	2.6082280
## [860]	{curd, ##       other vegetables}	=> {root vegetables}	0.005490595	0.3195266	2.9314780
## [861]	{other vegetables, ##       root vegetables}	=> {curd}	0.005490595	0.1158798	2.1749582
## [862]	{curd, ##       root vegetables}	=> {whole milk}	0.006202339	0.5700935	2.2311457
## [863]	{curd, ##       whole milk}	=> {root vegetables}	0.006202339	0.2373541	2.1775909
## [864]	{root vegetables, ##       whole milk}	=> {curd}	0.006202339	0.1268191	2.3802788

## [865]	{curd, ## yogurt}	=> {other vegetables}	0.006100661	0.3529412	1.8240549
## [866]	{curd, ## other vegetables}	=> {yogurt}	0.006100661	0.3550296	2.5449825
## [867]	{other vegetables, ## yogurt}	=> {curd}	0.006100661	0.1405152	2.6373420
## [868]	{curd, ## yogurt}	=> {whole milk}	0.010066090	0.5823529	2.2791250
## [869]	{curd, ## whole milk}	=> {yogurt}	0.010066090	0.3852140	2.7613555
## [870]	{whole milk, ## yogurt}	=> {curd}	0.010066090	0.1796733	3.3723037
## [871]	{curd, ## rolls/buns}	=> {whole milk}	0.005897306	0.5858586	2.2928449
## [872]	{curd, ## whole milk}	=> {rolls/buns}	0.005897306	0.2256809	1.2269607
## [873]	{rolls/buns, ## whole milk}	=> {curd}	0.005897306	0.1041293	1.9544109
## [874]	{curd, ## other vegetables}	=> {whole milk}	0.009862735	0.5739645	2.2462956
## [875]	{curd, ## whole milk}	=> {other vegetables}	0.009862735	0.3774319	1.9506268
## [876]	{other vegetables, ## whole milk}	=> {curd}	0.009862735	0.1317935	2.4736429
## [877]	{napkins, ## yogurt}	=> {whole milk}	0.006100661	0.4958678	1.9406524
## [878]	{napkins, ## whole milk}	=> {yogurt}	0.006100661	0.3092784	2.2170208
## [879]	{whole milk, ## yogurt}	=> {napkins}	0.006100661	0.1088929	2.0795376
## [880]	{napkins, ## rolls/buns}	=> {whole milk}	0.005287239	0.4521739	1.7696500
## [881]	{napkins, ## whole milk}	=> {rolls/buns}	0.005287239	0.2680412	1.4572612
## [882]	{napkins, ## other vegetables}	=> {whole milk}	0.006812405	0.4718310	1.8465809
## [883]	{napkins, ## whole milk}	=> {other vegetables}	0.006812405	0.3453608	1.7848785
## [884]	{pork, ## root vegetables}	=> {other vegetables}	0.007015760	0.5149254	2.6612144
## [885]	{other vegetables, ## pork}	=> {root vegetables}	0.007015760	0.3239437	2.9720018
## [886]	{other vegetables, ## root vegetables}	=> {pork}	0.007015760	0.1480687	2.5683516
## [887]	{pork, ## root vegetables}	=> {whole milk}	0.006812405	0.5000000	1.9568245
## [888]	{pork, ## whole milk}	=> {root vegetables}	0.006812405	0.3073394	2.8196674
## [889]	{root vegetables, ## whole milk}	=> {pork}	0.006812405	0.1392931	2.4161341
## [890]	{pork, ## rolls/buns}	=> {other vegetables}	0.005592272	0.4954955	2.5607978
## [891]	{other vegetables, ## pork}	=> {rolls/buns}	0.005592272	0.2582160	1.4038441

## [892]	{other vegetables, ## rolls/buns}	=> {pork}	0.005592272	0.1312649	2.2768791
## [893]	{pork, ## rolls/buns}	=> {whole milk}	0.006202339	0.5495495	2.1507441
## [894]	{pork, ## whole milk}	=> {rolls/buns}	0.006202339	0.2798165	1.5212799
## [895]	{rolls/buns, ## whole milk}	=> {pork}	0.006202339	0.1095153	1.8996166
## [896]	{other vegetables, ## pork}	=> {whole milk}	0.010167768	0.4694836	1.8373939
## [897]	{pork, ## whole milk}	=> {other vegetables}	0.010167768	0.4587156	2.3707136
## [898]	{other vegetables, ## whole milk}	=> {pork}	0.010167768	0.1358696	2.3567499
## [899]	{frankfurter, ## tropical fruit}	=> {whole milk}	0.005185562	0.5483871	2.1461946
## [900]	{frankfurter, ## whole milk}	=> {tropical fruit}	0.005185562	0.2524752	2.4060989
## [901]	{tropical fruit, ## whole milk}	=> {frankfurter}	0.005185562	0.1225962	2.0788503
## [902]	{frankfurter, ## root vegetables}	=> {whole milk}	0.005083884	0.5000000	1.9568245
## [903]	{frankfurter, ## whole milk}	=> {root vegetables}	0.005083884	0.2475248	2.2709011
## [904]	{root vegetables, ## whole milk}	=> {frankfurter}	0.005083884	0.1039501	1.7626712
## [905]	{frankfurter, ## yogurt}	=> {whole milk}	0.006202339	0.5545455	2.1702963
## [906]	{frankfurter, ## whole milk}	=> {yogurt}	0.006202339	0.3019802	2.1647050
## [907]	{whole milk, ## yogurt}	=> {frankfurter}	0.006202339	0.1107078	1.8772608
## [908]	{frankfurter, ## rolls/buns}	=> {other vegetables}	0.005592272	0.2910053	1.5039606
## [909]	{frankfurter, ## other vegetables}	=> {rolls/buns}	0.005592272	0.3395062	1.8457950
## [910]	{other vegetables, ## rolls/buns}	=> {frankfurter}	0.005592272	0.1312649	2.2258456
## [911]	{frankfurter, ## rolls/buns}	=> {whole milk}	0.005998983	0.3121693	1.2217211
## [912]	{frankfurter, ## whole milk}	=> {rolls/buns}	0.005998983	0.2920792	1.5879486
## [913]	{rolls/buns, ## whole milk}	=> {frankfurter}	0.005998983	0.1059246	1.7961524
## [914]	{frankfurter, ## other vegetables}	=> {whole milk}	0.007625826	0.4629630	1.8118745
## [915]	{frankfurter, ## whole milk}	=> {other vegetables}	0.007625826	0.3712871	1.9188696
## [916]	{other vegetables, ## whole milk}	=> {frankfurter}	0.007625826	0.1019022	1.7279446
## [917]	{bottled beer, ## bottled water}	=> {soda}	0.005083884	0.3225806	1.8499013
## [918]	{bottled beer, ## soda}	=> {bottled water}	0.005083884	0.2994012	2.7089336

## [919]	{bottled water, ## soda}	=> {bottled beer}	0.005083884	0.1754386	2.1785841
## [920]	{bottled beer, ## bottled water}	=> {whole milk}	0.006100661	0.3870968	1.5149609
## [921]	{bottled beer, ## whole milk}	=> {bottled water}	0.006100661	0.2985075	2.7008472
## [922]	{bottled water, ## whole milk}	=> {bottled beer}	0.006100661	0.1775148	2.2043661
## [923]	{bottled beer, ## yogurt}	=> {whole milk}	0.005185562	0.5604396	2.1933637
## [924]	{bottled beer, ## whole milk}	=> {yogurt}	0.005185562	0.2537313	1.8188395
## [925]	{bottled beer, ## rolls/buns}	=> {whole milk}	0.005388917	0.3955224	1.5479358
## [926]	{bottled beer, ## whole milk}	=> {rolls/buns}	0.005388917	0.2636816	1.4335591
## [927]	{bottled beer, ## other vegetables}	=> {whole milk}	0.007625826	0.4716981	1.8460609
## [928]	{bottled beer, ## whole milk}	=> {other vegetables}	0.007625826	0.3731343	1.9284162
## [929]	{other vegetables, ## whole milk}	=> {bottled beer}	0.007625826	0.1019022	1.2654140
## [930]	{brown bread, ## tropical fruit}	=> {whole milk}	0.005693950	0.5333333	2.0872795
## [931]	{brown bread, ## whole milk}	=> {tropical fruit}	0.005693950	0.2258065	2.1519442
## [932]	{tropical fruit, ## whole milk}	=> {brown bread}	0.005693950	0.1346154	2.0751447
## [933]	{brown bread, ## root vegetables}	=> {whole milk}	0.005693950	0.5600000	2.1916435
## [934]	{brown bread, ## whole milk}	=> {root vegetables}	0.005693950	0.2258065	2.0716478
## [935]	{root vegetables, ## whole milk}	=> {brown bread}	0.005693950	0.1164241	1.7947197
## [936]	{brown bread, ## soda}	=> {whole milk}	0.005083884	0.4032258	1.5780843
## [937]	{brown bread, ## whole milk}	=> {soda}	0.005083884	0.2016129	1.1561883
## [938]	{soda, ## whole milk}	=> {brown bread}	0.005083884	0.1269036	1.9562640
## [939]	{brown bread, ## yogurt}	=> {other vegetables}	0.005185562	0.3566434	1.8431883
## [940]	{brown bread, ## other vegetables}	=> {yogurt}	0.005185562	0.2771739	1.9868844
## [941]	{other vegetables, ## yogurt}	=> {brown bread}	0.005185562	0.1194379	1.8411789
## [942]	{brown bread, ## yogurt}	=> {whole milk}	0.007117438	0.4895105	1.9157723
## [943]	{brown bread, ## whole milk}	=> {yogurt}	0.007117438	0.2822581	2.0233295
## [944]	{whole milk, ## yogurt}	=> {brown bread}	0.007117438	0.1270417	1.9583943
## [945]	{brown bread, ## rolls/buns}	=> {whole milk}	0.005287239	0.4193548	1.6412077

## [946]	{brown bread, whole milk}	=> {rolls/buns}	0.005287239	0.2096774	1.1399544
## [947]	{brown bread, other vegetables}	=> {whole milk}	0.009354347	0.5000000	1.9568245
## [948]	{brown bread, whole milk}	=> {other vegetables}	0.009354347	0.3709677	1.9172190
## [949]	{other vegetables, whole milk}	=> {brown bread}	0.009354347	0.1250000	1.9269201
## [950]	{domestic eggs, margarine}	=> {whole milk}	0.005185562	0.6219512	2.4340988
## [951]	{margarine, whole milk}	=> {domestic eggs}	0.005185562	0.2142857	3.3774038
## [952]	{domestic eggs, whole milk}	=> {margarine}	0.005185562	0.1728814	2.9518891
## [953]	{margarine, root vegetables}	=> {other vegetables}	0.005897306	0.5321101	2.7500277
## [954]	{margarine, other vegetables}	=> {root vegetables}	0.005897306	0.2989691	2.7428739
## [955]	{other vegetables, root vegetables}	=> {margarine}	0.005897306	0.1244635	2.1251714
## [956]	{margarine, yogurt}	=> {other vegetables}	0.005693950	0.4000000	2.0672622
## [957]	{margarine, other vegetables}	=> {yogurt}	0.005693950	0.2886598	2.0692194
## [958]	{other vegetables, yogurt}	=> {margarine}	0.005693950	0.1311475	2.2392987
## [959]	{margarine, yogurt}	=> {whole milk}	0.007015760	0.4928571	1.9288699
## [960]	{margarine, whole milk}	=> {yogurt}	0.007015760	0.2899160	2.0782241
## [961]	{whole milk, yogurt}	=> {margarine}	0.007015760	0.1252269	2.1382052
## [962]	{margarine, rolls/buns}	=> {other vegetables}	0.005185562	0.3517241	1.8177651
## [963]	{margarine, other vegetables}	=> {rolls/buns}	0.005185562	0.2628866	1.4292370
## [964]	{other vegetables, rolls/buns}	=> {margarine}	0.005185562	0.1217184	2.0782990
## [965]	{margarine, rolls/buns}	=> {whole milk}	0.007930859	0.5379310	2.1052733
## [966]	{margarine, whole milk}	=> {rolls/buns}	0.007930859	0.3277311	1.7817774
## [967]	{rolls/buns, whole milk}	=> {margarine}	0.007930859	0.1400359	2.3910645
## [968]	{margarine, other vegetables}	=> {whole milk}	0.009252669	0.4690722	1.8357838
## [969]	{margarine, whole milk}	=> {other vegetables}	0.009252669	0.3823529	1.9760595
## [970]	{other vegetables, whole milk}	=> {margarine}	0.009252669	0.1236413	2.1111323
## [971]	{butter, domestic eggs}	=> {whole milk}	0.005998983	0.6210526	2.4305820
## [972]	{butter, whole milk}	=> {domestic eggs}	0.005998983	0.2177122	3.4314091

## [973]	{domestic eggs, ## whole milk}	=> {butter}	0.005998983	0.2000000	3.6091743
## [974]	{butter, ## whipped/sour cream}	=> {other vegetables}	0.005795628	0.5700000	2.9458487
## [975]	{butter, ## other vegetables}	=> {whipped/sour cream}	0.005795628	0.2893401	4.0363970
## [976]	{other vegetables, ## whipped/sour cream}	=> {butter}	0.005795628	0.2007042	3.6218827
## [977]	{butter, ## whipped/sour cream}	=> {whole milk}	0.006710727	0.6600000	2.5830084
## [978]	{butter, ## whole milk}	=> {whipped/sour cream}	0.006710727	0.2435424	3.3975033
## [979]	{whipped/sour cream, ## whole milk}	=> {butter}	0.006710727	0.2082019	3.7571846
## [980]	{butter, ## citrus fruit}	=> {whole milk}	0.005083884	0.5555556	2.1742495
## [981]	{butter, ## whole milk}	=> {citrus fruit}	0.005083884	0.1845018	2.2292084
## [982]	{citrus fruit, ## whole milk}	=> {butter}	0.005083884	0.1666667	3.0076453
## [983]	{bottled water, ## butter}	=> {whole milk}	0.005388917	0.6022727	2.3570841
## [984]	{butter, ## whole milk}	=> {bottled water}	0.005388917	0.1955720	1.7695034
## [985]	{bottled water, ## whole milk}	=> {butter}	0.005388917	0.1568047	2.8296781
## [986]	{butter, ## tropical fruit}	=> {other vegetables}	0.005490595	0.5510204	2.8477592
## [987]	{butter, ## other vegetables}	=> {tropical fruit}	0.005490595	0.2741117	2.6122949
## [988]	{other vegetables, ## tropical fruit}	=> {butter}	0.005490595	0.1529745	2.7605583
## [989]	{butter, ## tropical fruit}	=> {whole milk}	0.006202339	0.6224490	2.4360468
## [990]	{butter, ## whole milk}	=> {tropical fruit}	0.006202339	0.2250923	2.1451379
## [991]	{tropical fruit, ## whole milk}	=> {butter}	0.006202339	0.1466346	2.6461494
## [992]	{butter, ## root vegetables}	=> {other vegetables}	0.006609049	0.5118110	2.6451190
## [993]	{butter, ## other vegetables}	=> {root vegetables}	0.006609049	0.3299492	3.0270996
## [994]	{other vegetables, ## root vegetables}	=> {butter}	0.006609049	0.1394850	2.5171280
## [995]	{butter, ## root vegetables}	=> {whole milk}	0.008235892	0.6377953	2.4961069
## [996]	{butter, ## whole milk}	=> {root vegetables}	0.008235892	0.2988930	2.7421759
## [997]	{root vegetables, ## whole milk}	=> {butter}	0.008235892	0.1683992	3.0389098
## [998]	{butter, ## yogurt}	=> {other vegetables}	0.006405694	0.4375000	2.2610681
## [999]	{butter, ## other vegetables}	=> {yogurt}	0.006405694	0.3197970	2.2924220

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## [1000] {other vegetables,
##          yogurt}                => {butter}           0.006405694 0.1475410 2.6625056
## [1001] {butter,
##          yogurt}                => {whole milk}      0.009354347 0.6388889 2.5003869
## [1002] {butter,
##          whole milk}             => {yogurt}           0.009354347 0.3394834 2.4335417
## [1003] {whole milk,
##          yogurt}                => {butter}           0.009354347 0.1669691 3.0131038
## [1004] {butter,
##          rolls/buns}              => {other vegetables} 0.005693950 0.4242424 2.1925508
## [1005] {butter,
##          other vegetables}       => {rolls/buns}      0.005693950 0.2842640 1.5454594
## [1006] {other vegetables,
##          rolls/buns}              => {butter}           0.005693950 0.1336516 2.4118587
## [1007] {butter,
##          rolls/buns}              => {whole milk}      0.006609049 0.4924242 1.9271757
## [1008] {butter,
##          whole milk}              => {rolls/buns}      0.006609049 0.2398524 1.3040068
## [1009] {rolls/buns,
##          whole milk}              => {butter}           0.006609049 0.1166966 2.1058917
## [1010] {butter,
##          other vegetables}       => {whole milk}      0.011489578 0.5736041 2.2448850
## [1011] {butter,
##          whole milk}              => {other vegetables} 0.011489578 0.4169742 2.1549874
## [1012] {other vegetables,
##          whole milk}              => {butter}           0.011489578 0.1535326 2.7706297
## [1013] {newspapers,
##          tropical fruit}         => {whole milk}      0.005083884 0.4310345 1.6869177
## [1014] {newspapers,
##          whole milk}              => {tropical fruit} 0.005083884 0.1858736 1.7713827
## [1015] {tropical fruit,
##          whole milk}              => {newspapers}       0.005083884 0.1201923 1.5058488
## [1016] {newspapers,
##          root vegetables}        => {other vegetables} 0.005998983 0.5221239 2.6984175
## [1017] {newspapers,
##          other vegetables}       => {root vegetables} 0.005998983 0.3105263 2.8489051
## [1018] {other vegetables,
##          root vegetables}        => {newspapers}       0.005998983 0.1266094 1.5862470
## [1019] {newspapers,
##          root vegetables}        => {whole milk}      0.005795628 0.5044248 1.9741415
## [1020] {newspapers,
##          whole milk}              => {root vegetables} 0.005795628 0.2118959 1.9440264
## [1021] {root vegetables,
##          whole milk}              => {newspapers}       0.005795628 0.1185031 1.4846856
## [1022] {newspapers,
##          yogurt}                 => {rolls/buns}      0.005083884 0.3311258 1.8002336
## [1023] {newspapers,
##          rolls/buns}              => {yogurt}           0.005083884 0.2577320 1.8475174
## [1024] {rolls/buns,
##          yogurt}                 => {newspapers}       0.005083884 0.1479290 1.8533524
## [1025] {newspapers,
##          yogurt}                 => {other vegetables} 0.005592272 0.3642384 1.8824408
## [1026] {newspapers,
##          other vegetables}       => {yogurt}           0.005592272 0.2894737 2.0750537

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## [1027] {other vegetables,
##          yogurt}                => {newspapers}           0.005592272 0.1288056 1.6137621
## [1028] {newspapers,
##          yogurt}                => {whole milk}            0.006609049 0.4304636 1.6846834
## [1029] {newspapers,
##          whole milk}             => {yogurt}                 0.006609049 0.2416357 1.7321334
## [1030] {whole milk,
##          yogurt}                => {newspapers}           0.006609049 0.1179673 1.4779729
## [1031] {newspapers,
##          rolls/buns}              => {other vegetables}    0.005490595 0.2783505 1.4385588
## [1032] {newspapers,
##          other vegetables}       => {rolls/buns}            0.005490595 0.2842105 1.5451689
## [1033] {other vegetables,
##          rolls/buns}              => {newspapers}            0.005490595 0.1288783 1.6146725
## [1034] {newspapers,
##          rolls/buns}              => {whole milk}            0.007625826 0.3865979 1.5130086
## [1035] {newspapers,
##          whole milk}               => {rolls/buns}            0.007625826 0.2788104 1.5158100
## [1036] {rolls/buns,
##          whole milk}               => {newspapers}            0.007625826 0.1346499 1.6869833
## [1037] {newspapers,
##          other vegetables}        => {whole milk}            0.008337570 0.4315789 1.6890485
## [1038] {newspapers,
##          whole milk}               => {other vegetables}     0.008337570 0.3048327 1.5754229
## [1039] {other vegetables,
##          whole milk}               => {newspapers}            0.008337570 0.1114130 1.3958564
## [1040] {domestic eggs,
##          whipped/sour cream}      => {other vegetables}     0.005083884 0.5102041 2.6368141
## [1041] {domestic eggs,
##          other vegetables}        => {whipped/sour cream}   0.005083884 0.2283105 3.1850125
## [1042] {other vegetables,
##          whipped/sour cream}      => {domestic eggs}         0.005083884 0.1760563 2.7748623
## [1043] {domestic eggs,
##          whipped/sour cream}      => {whole milk}            0.005693950 0.5714286 2.2363709
## [1044] {domestic eggs,
##          whole milk}                => {whipped/sour cream}   0.005693950 0.1898305 2.6482029
## [1045] {whipped/sour cream,
##          whole milk}               => {domestic eggs}         0.005693950 0.1766562 2.7843161
## [1046] {domestic eggs,
##          pip fruit}                => {whole milk}            0.005388917 0.6235294 2.4402753
## [1047] {domestic eggs,
##          whole milk}               => {pip fruit}             0.005388917 0.1796610 2.3749544
## [1048] {pip fruit,
##          whole milk}               => {domestic eggs}         0.005388917 0.1790541 2.8221100
## [1049] {citrus fruit,
##          domestic eggs}             => {whole milk}            0.005693950 0.5490196 2.1486701
## [1050] {domestic eggs,
##          whole milk}               => {citrus fruit}           0.005693950 0.1898305 2.2935910
## [1051] {citrus fruit,
##          whole milk}               => {domestic eggs}         0.005693950 0.1866667 2.9420940
## [1052] {domestic eggs,
##          tropical fruit}            => {whole milk}            0.006914082 0.6071429 2.3761441
## [1053] {domestic eggs,
##          whole milk}               => {tropical fruit}        0.006914082 0.2305085 2.1967547

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## [1054] {tropical fruit, ## whole milk}	=> {domestic eggs}	0.006914082	0.1634615	2.5763529
## [1055] {domestic eggs, ## root vegetables}	=> {other vegetables}	0.007320793	0.5106383	2.6390582
## [1056] {domestic eggs, ## other vegetables}	=> {root vegetables}	0.007320793	0.3287671	3.0162543
## [1057] {other vegetables, ## root vegetables}	=> {domestic eggs}	0.007320793	0.1545064	2.4352096
## [1058] {domestic eggs, ## root vegetables}	=> {whole milk}	0.008540925	0.5957447	2.3315356
## [1059] {domestic eggs, ## whole milk}	=> {root vegetables}	0.008540925	0.2847458	2.6123830
## [1060] {root vegetables, ## whole milk}	=> {domestic eggs}	0.008540925	0.1746362	2.7524788
## [1061] {domestic eggs, ## soda}	=> {other vegetables}	0.005083884	0.4098361	2.1180965
## [1062] {domestic eggs, ## other vegetables}	=> {soda}	0.005083884	0.2283105	1.3092908
## [1063] {other vegetables, ## soda}	=> {domestic eggs}	0.005083884	0.1552795	2.4473941
## [1064] {domestic eggs, ## soda}	=> {whole milk}	0.005185562	0.4180328	1.6360336
## [1065] {domestic eggs, ## whole milk}	=> {soda}	0.005185562	0.1728814	0.9914217
## [1066] {soda, ## whole milk}	=> {domestic eggs}	0.005185562	0.1294416	2.0401577
## [1067] {domestic eggs, ## yogurt}	=> {other vegetables}	0.005795628	0.4042553	2.0892544
## [1068] {domestic eggs, ## other vegetables}	=> {yogurt}	0.005795628	0.2602740	1.8657394
## [1069] {other vegetables, ## yogurt}	=> {domestic eggs}	0.005795628	0.1334895	2.1039565
## [1070] {domestic eggs, ## yogurt}	=> {whole milk}	0.007727504	0.5390071	2.1094846
## [1071] {domestic eggs, ## whole milk}	=> {yogurt}	0.007727504	0.2576271	1.8467658
## [1072] {whole milk, ## yogurt}	=> {domestic eggs}	0.007727504	0.1379310	2.1739611
## [1073] {domestic eggs, ## rolls/buns}	=> {other vegetables}	0.005897306	0.3766234	1.9464482
## [1074] {domestic eggs, ## other vegetables}	=> {rolls/buns}	0.005897306	0.2648402	1.4398580
## [1075] {other vegetables, ## rolls/buns}	=> {domestic eggs}	0.005897306	0.1384248	2.1817438
## [1076] {domestic eggs, ## rolls/buns}	=> {whole milk}	0.006609049	0.4220779	1.6518648
## [1077] {domestic eggs, ## whole milk}	=> {rolls/buns}	0.006609049	0.2203390	1.1979181
## [1078] {rolls/buns, ## whole milk}	=> {domestic eggs}	0.006609049	0.1166966	1.8392804
## [1079] {domestic eggs, ## other vegetables}	=> {whole milk}	0.012302999	0.5525114	2.1623358
## [1080] {domestic eggs, ## whole milk}	=> {other vegetables}	0.012302999	0.4101695	2.1198197

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## [1081] {other vegetables,
##         whole milk}                => {domestic eggs}          0.012302999 0.1644022 2.5911785
## [1082] {bottled water,
##         fruit/vegetable juice}    => {soda}                  0.005185562 0.3642857 2.0890671
## [1083] {fruit/vegetable juice,
##         soda}                   => {bottled water}          0.005185562 0.2817680 2.5493908
## [1084] {bottled water,
##         soda}                   => {fruit/vegetable juice} 0.005185562 0.1789474 2.4753128
## [1085] {bottled water,
##         fruit/vegetable juice}   => {whole milk}            0.005795628 0.4071429 1.5934142
## [1086] {fruit/vegetable juice,
##         whole milk}              => {bottled water}          0.005795628 0.2175573 1.9684228
## [1087] {bottled water,
##         whole milk}              => {fruit/vegetable juice} 0.005795628 0.1686391 2.3327216
## [1088] {fruit/vegetable juice,
##         tropical fruit}         => {other vegetables}      0.006609049 0.4814815 2.4883712
## [1089] {fruit/vegetable juice,
##         other vegetables}       => {tropical fruit}        0.006609049 0.3140097 2.9925242
## [1090] {other vegetables,
##         tropical fruit}         => {fruit/vegetable juice} 0.006609049 0.1841360 2.5470849
## [1091] {fruit/vegetable juice,
##         tropical fruit}         => {whole milk}            0.005998983 0.4370370 1.7104096
## [1092] {fruit/vegetable juice,
##         whole milk}              => {tropical fruit}        0.005998983 0.2251908 2.1460774
## [1093] {tropical fruit,
##         whole milk}              => {fruit/vegetable juice} 0.005998983 0.1418269 1.9618394
## [1094] {fruit/vegetable juice,
##         root vegetables}        => {other vegetables}      0.006609049 0.5508475 2.8468653
## [1095] {fruit/vegetable juice,
##         other vegetables}       => {root vegetables}       0.006609049 0.3140097 2.8808629
## [1096] {other vegetables,
##         root vegetables}        => {fruit/vegetable juice} 0.006609049 0.1394850 1.9294441
## [1097] {fruit/vegetable juice,
##         root vegetables}        => {whole milk}            0.006507372 0.5423729 2.1226571
## [1098] {fruit/vegetable juice,
##         whole milk}              => {root vegetables}       0.006507372 0.2442748 2.2410847
## [1099] {root vegetables,
##         whole milk}              => {fruit/vegetable juice} 0.006507372 0.1330561 1.8405163
## [1100] {fruit/vegetable juice,
##         soda}                   => {yogurt}                0.005083884 0.2762431 1.9802120
## [1101] {fruit/vegetable juice,
##         yogurt}                 => {soda}                  0.005083884 0.2717391 1.5583407
## [1102] {soda,
##         yogurt}                 => {fruit/vegetable juice} 0.005083884 0.1858736 2.5711208
## [1103] {fruit/vegetable juice,
##         soda}                   => {whole milk}            0.006100661 0.3314917 1.2973422
## [1104] {fruit/vegetable juice,
##         whole milk}              => {soda}                  0.006100661 0.2290076 1.3132887
## [1105] {soda,
##         whole milk}              => {fruit/vegetable juice} 0.006100661 0.1522843 2.1064919
## [1106] {fruit/vegetable juice,
##         yogurt}                 => {other vegetables}     0.008235892 0.4402174 2.2751120
## [1107] {fruit/vegetable juice,
##         other vegetables}       => {yogurt}                0.008235892 0.3913043 2.8050133

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## [1108] {other vegetables,
##         yogurt}                => {fruit/vegetable juice} 0.008235892 0.1896956 2.6239884
## [1109] {fruit/vegetable juice,
##         yogurt}                => {whole milk}        0.009456024 0.5054348 1.9780943
## [1110] {fruit/vegetable juice,
##         whole milk}             => {yogurt}          0.009456024 0.3549618 2.5444968
## [1111] {whole milk,
##         yogurt}                => {fruit/vegetable juice} 0.009456024 0.1687840 2.3347270
## [1112] {fruit/vegetable juice,
##         rolls/buns}             => {whole milk}        0.005592272 0.3846154 1.5052496
## [1113] {fruit/vegetable juice,
##         whole milk}             => {rolls/buns}       0.005592272 0.2099237 1.1412931
## [1114] {fruit/vegetable juice,
##         other vegetables}      => {whole milk}        0.010472801 0.4975845 1.9473713
## [1115] {fruit/vegetable juice,
##         whole milk}             => {other vegetables} 0.010472801 0.3931298 2.0317558
## [1116] {other vegetables,
##         whole milk}             => {fruit/vegetable juice} 0.010472801 0.1399457 1.9358164
## [1117] {pip fruit,
##         whipped/sour cream}     => {other vegetables} 0.005592272 0.6043956 3.1236105
## [1118] {other vegetables,
##         whipped/sour cream}     => {pip fruit}        0.005592272 0.1936620 2.5600343
## [1119] {other vegetables,
##         pip fruit}              => {whipped/sour cream} 0.005592272 0.2140078 2.9854844
## [1120] {pip fruit,
##         whipped/sour cream}     => {whole milk}        0.005998983 0.6483516 2.5374208
## [1121] {whipped/sour cream,
##         whole milk}             => {pip fruit}        0.005998983 0.1861199 2.4603346
## [1122] {pip fruit,
##         whole milk}             => {whipped/sour cream} 0.005998983 0.1993243 2.7806450
## [1123] {citrus fruit,
##         whipped/sour cream}     => {other vegetables} 0.005693950 0.5233645 2.7048291
## [1124] {other vegetables,
##         whipped/sour cream}     => {citrus fruit}      0.005693950 0.1971831 2.3824272
## [1125] {citrus fruit,
##         other vegetables}      => {whipped/sour cream} 0.005693950 0.1971831 2.7507741
## [1126] {citrus fruit,
##         whipped/sour cream}     => {whole milk}        0.006304016 0.5794393 2.2677219
## [1127] {whipped/sour cream,
##         whole milk}             => {citrus fruit}      0.006304016 0.1955836 2.3631016
## [1128] {citrus fruit,
##         whole milk}             => {whipped/sour cream} 0.006304016 0.2066667 2.8830733
## [1129] {sausage,
##         whipped/sour cream}     => {whole milk}        0.005083884 0.5617978 2.1986792
## [1130] {whipped/sour cream,
##         whole milk}             => {sausage}          0.005083884 0.1577287 1.6788548
## [1131] {sausage,
##         whole milk}             => {whipped/sour cream} 0.005083884 0.1700680 2.3725093
## [1132] {tropical fruit,
##         whipped/sour cream}     => {yogurt}          0.006202339 0.4485294 3.2152236
## [1133] {whipped/sour cream,
##         yogurt}                => {tropical fruit} 0.006202339 0.2990196 2.8496685
## [1134] {tropical fruit,
##         yogurt}                => {whipped/sour cream} 0.006202339 0.2118056 2.9547626

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## [1135] {tropical fruit, ##       whipped/sour cream}	=> {other vegetables}	0.007829181	0.5661765	2.9260881
## [1136] {other vegetables, ##       whipped/sour cream}	=> {tropical fruit}	0.007829181	0.2711268	2.5838485
## [1137] {other vegetables, ##       tropical fruit}	=> {whipped/sour cream}	0.007829181	0.2181303	3.0429952
## [1138] {tropical fruit, ##       whipped/sour cream}	=> {whole milk}	0.007930859	0.5735294	2.2445928
## [1139] {whipped/sour cream, ##       whole milk}	=> {tropical fruit}	0.007930859	0.2460568	2.3449307
## [1140] {tropical fruit, ##       whole milk}	=> {whipped/sour cream}	0.007930859	0.1875000	2.6156915
## [1141] {root vegetables, ##       whipped/sour cream}	=> {yogurt}	0.006405694	0.3750000	2.6881378
## [1142] {whipped/sour cream, ##       yogurt}	=> {root vegetables}	0.006405694	0.3088235	2.8332830
## [1143] {root vegetables, ##       yogurt}	=> {whipped/sour cream}	0.006405694	0.2480315	3.4601273
## [1144] {root vegetables, ##       whipped/sour cream}	=> {other vegetables}	0.008540925	0.5000000	2.5840778
## [1145] {other vegetables, ##       whipped/sour cream}	=> {root vegetables}	0.008540925	0.2957746	2.7135668
## [1146] {other vegetables, ##       root vegetables}	=> {whipped/sour cream}	0.008540925	0.1802575	2.5146562
## [1147] {root vegetables, ##       whipped/sour cream}	=> {whole milk}	0.009456024	0.5535714	2.1664843
## [1148] {whipped/sour cream, ##       whole milk}	=> {root vegetables}	0.009456024	0.2933754	2.6915550
## [1149] {root vegetables, ##       whole milk}	=> {whipped/sour cream}	0.009456024	0.1933472	2.6972619
## [1150] {soda, ##       whipped/sour cream}	=> {whole milk}	0.005490595	0.4736842	1.8538337
## [1151] {whipped/sour cream, ##       whole milk}	=> {soda}	0.005490595	0.1703470	0.9768879
## [1152] {soda, ##       whole milk}	=> {whipped/sour cream}	0.005490595	0.1370558	1.9119775
## [1153] {whipped/sour cream, ##       yogurt}	=> {other vegetables}	0.010167768	0.4901961	2.5334096
## [1154] {other vegetables, ##       whipped/sour cream}	=> {yogurt}	0.010167768	0.3521127	2.5240730
## [1155] {other vegetables, ##       yogurt}	=> {whipped/sour cream}	0.010167768	0.2341920	3.2670620
## [1156] {whipped/sour cream, ##       yogurt}	=> {whole milk}	0.010879512	0.5245098	2.0527473
## [1157] {whipped/sour cream, ##       whole milk}	=> {yogurt}	0.010879512	0.3375394	2.4196066
## [1158] {whole milk, ##       yogurt}	=> {whipped/sour cream}	0.010879512	0.1941924	2.7090525
## [1159] {rolls/buns, ##       whipped/sour cream}	=> {other vegetables}	0.006710727	0.4583333	2.3687380
## [1160] {other vegetables, ##       whipped/sour cream}	=> {rolls/buns}	0.006710727	0.2323944	1.2634597
## [1161] {other vegetables, ##       rolls/buns}	=> {whipped/sour cream}	0.006710727	0.1575179	2.1974306

```

## [1162] {rolls/buns,
##          whipped/sour cream} => {whole milk} 0.007829181 0.5347222 2.0927151
## [1163] {whipped/sour cream,
##          whole milk} => {rolls/buns} 0.007829181 0.2429022 1.3205877
## [1164] {rolls/buns,
##          whole milk} => {whipped/sour cream} 0.007829181 0.1382406 1.9285050
## [1165] {other vegetables,
##          whipped/sour cream} => {whole milk} 0.014641586 0.5070423 1.9843854
## [1166] {whipped/sour cream,
##          whole milk} => {other vegetables} 0.014641586 0.4542587 2.3476795
## [1167] {other vegetables,
##          whole milk} => {whipped/sour cream} 0.014641586 0.1956522 2.7294172
## [1168] {pastry,
##          pip fruit} => {whole milk} 0.005083884 0.4761905 1.8636424
## [1169] {pip fruit,
##          whole milk} => {pastry} 0.005083884 0.1689189 1.8986486
## [1170] {pastry,
##          whole milk} => {pip fruit} 0.005083884 0.1529052 2.0212670
## [1171] {citrus fruit,
##          pip fruit} => {tropical fruit} 0.005592272 0.4044118 3.8540598
## [1172] {pip fruit,
##          tropical fruit} => {citrus fruit} 0.005592272 0.2736318 3.3061046
## [1173] {citrus fruit,
##          tropical fruit} => {pip fruit} 0.005592272 0.2806122 3.7094374
## [1174] {citrus fruit,
##          pip fruit} => {other vegetables} 0.005897306 0.4264706 2.2040663
## [1175] {other vegetables,
##          pip fruit} => {citrus fruit} 0.005897306 0.2256809 2.7267469
## [1176] {citrus fruit,
##          other vegetables} => {pip fruit} 0.005897306 0.2042254 2.6996725
## [1177] {citrus fruit,
##          pip fruit} => {whole milk} 0.005185562 0.3750000 1.4676184
## [1178] {pip fruit,
##          whole milk} => {citrus fruit} 0.005185562 0.1722973 2.0817493
## [1179] {citrus fruit,
##          whole milk} => {pip fruit} 0.005185562 0.1700000 2.2472446
## [1180] {pip fruit,
##          sausage} => {whole milk} 0.005592272 0.5188679 2.0306669
## [1181] {pip fruit,
##          whole milk} => {sausage} 0.005592272 0.1858108 1.9777590
## [1182] {sausage,
##          whole milk} => {pip fruit} 0.005592272 0.1870748 2.4729583
## [1183] {pip fruit,
##          tropical fruit} => {root vegetables} 0.005287239 0.2587065 2.3734870
## [1184] {pip fruit,
##          root vegetables} => {tropical fruit} 0.005287239 0.3398693 3.2389674
## [1185] {root vegetables,
##          tropical fruit} => {pip fruit} 0.005287239 0.2512077 3.3207366
## [1186] {pip fruit,
##          tropical fruit} => {yogurt} 0.006405694 0.3134328 2.2468017
## [1187] {pip fruit,
##          yogurt} => {tropical fruit} 0.006405694 0.3559322 3.3920477
## [1188] {tropical fruit,
##          yogurt} => {pip fruit} 0.006405694 0.2187500 2.8916751

```

## [1189] {pip fruit, ##       tropical fruit}	=> {other vegetables}	0.009456024	0.4626866	2.3912361
## [1190] {other vegetables, ##        pip fruit}	=> {tropical fruit}	0.009456024	0.3618677	3.4486132
## [1191] {other vegetables, ##        tropical fruit}	=> {pip fruit}	0.009456024	0.2634561	3.4826487
## [1192] {pip fruit, ##        tropical fruit}	=> {whole milk}	0.008439248	0.4129353	1.6160839
## [1193] {pip fruit, ##        whole milk}	=> {tropical fruit}	0.008439248	0.2804054	2.6722744
## [1194] {tropical fruit, ##        whole milk}	=> {pip fruit}	0.008439248	0.1995192	2.6374619
## [1195] {pip fruit, ##        root vegetables}	=> {yogurt}	0.005287239	0.3398693	2.4363079
## [1196] {pip fruit, ##        yogurt}	=> {root vegetables}	0.005287239	0.2937853	2.6953158
## [1197] {root vegetables, ##        yogurt}	=> {pip fruit}	0.005287239	0.2047244	2.7062696
## [1198] {pip fruit, ##        root vegetables}	=> {other vegetables}	0.008134215	0.5228758	2.7023036
## [1199] {other vegetables, ##        pip fruit}	=> {root vegetables}	0.008134215	0.3112840	2.8558569
## [1200] {other vegetables, ##        root vegetables}	=> {pip fruit}	0.008134215	0.1716738	2.2693710
## [1201] {pip fruit, ##        root vegetables}	=> {whole milk}	0.008947636	0.5751634	2.2509877
## [1202] {pip fruit, ##        whole milk}	=> {root vegetables}	0.008947636	0.2972973	2.7275363
## [1203] {root vegetables, ##        whole milk}	=> {pip fruit}	0.008947636	0.1829522	2.4184606
## [1204] {pip fruit, ##        yogurt}	=> {other vegetables}	0.008134215	0.4519774	2.3358895
## [1205] {other vegetables, ##        pip fruit}	=> {yogurt}	0.008134215	0.3112840	2.2313984
## [1206] {other vegetables, ##        yogurt}	=> {pip fruit}	0.008134215	0.1873536	2.4766438
## [1207] {pip fruit, ##        yogurt}	=> {whole milk}	0.009557702	0.5310734	2.0784351
## [1208] {pip fruit, ##        whole milk}	=> {yogurt}	0.009557702	0.3175676	2.2764410
## [1209] {whole milk, ##        yogurt}	=> {pip fruit}	0.009557702	0.1705989	2.2551617
## [1210] {pip fruit, ##        rolls/buns}	=> {other vegetables}	0.005083884	0.3649635	1.8861882
## [1211] {other vegetables, ##        pip fruit}	=> {rolls/buns}	0.005083884	0.1945525	1.0577248
## [1212] {other vegetables, ##        rolls/buns}	=> {pip fruit}	0.005083884	0.1193317	1.5774566
## [1213] {pip fruit, ##        rolls/buns}	=> {whole milk}	0.006202339	0.4452555	1.7425737
## [1214] {pip fruit, ##        whole milk}	=> {rolls/buns}	0.006202339	0.2060811	1.1204021
## [1215] {rolls/buns, ##        whole milk}	=> {pip fruit}	0.006202339	0.1095153	1.4476916

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## [1216] {other vegetables,
##          pip fruit}                => {whole milk}           0.013523132 0.5175097 2.0253514 1
## [1217] {pip fruit,
##          whole milk}               => {other vegetables} 0.013523132 0.4493243 2.3221780 1
## [1218] {other vegetables,
##          whole milk}               => {pip fruit}           0.013523132 0.1807065 2.3887751 1
## [1219] {pastry,
##          sausage}                  => {whole milk}           0.005693950 0.4552846 1.7818239 1
## [1220] {pastry,
##          whole milk}               => {sausage}             0.005693950 0.1712538 1.8228153 1
## [1221] {sausage,
##          whole milk}               => {pastry}              0.005693950 0.1904762 2.1409524 1
## [1222] {pastry,
##          tropical fruit}          => {other vegetables} 0.005083884 0.3846154 1.9877521 1
## [1223] {other vegetables,
##          pastry}                   => {tropical fruit}    0.005083884 0.2252252 2.1464051 1
## [1224] {other vegetables,
##          tropical fruit}          => {pastry}              0.005083884 0.1416431 1.5920680 1
## [1225] {pastry,
##          tropical fruit}          => {whole milk}           0.006710727 0.5076923 1.9869295 1
## [1226] {pastry,
##          whole milk}               => {tropical fruit}    0.006710727 0.2018349 1.9234941 1
## [1227] {tropical fruit,
##          whole milk}               => {pastry}              0.006710727 0.1586538 1.7832692 1
## [1228] {pastry,
##          root vegetables}         => {other vegetables} 0.005897306 0.5370370 2.7754909 1
## [1229] {other vegetables,
##          pastry}                  => {root vegetables}   0.005897306 0.2612613 2.3969258 1
## [1230] {other vegetables,
##          root vegetables}        => {pastry}              0.005897306 0.1244635 1.3989700 1
## [1231] {pastry,
##          root vegetables}        => {whole milk}           0.005693950 0.5185185 2.0292995 1
## [1232] {pastry,
##          whole milk}               => {root vegetables}   0.005693950 0.1712538 1.5711580 1
## [1233] {root vegetables,
##          whole milk}               => {pastry}              0.005693950 0.1164241 1.3086071 1
## [1234] {pastry,
##          soda}                     => {rolls/buns}         0.005388917 0.2560386 1.3920067 1
## [1235] {pastry,
##          rolls/buns}              => {soda}                0.005388917 0.2572816 1.4754309 1
## [1236] {rolls/buns,
##          soda}                     => {pastry}              0.005388917 0.1405836 1.5801592 1
## [1237] {pastry,
##          soda}                     => {other vegetables} 0.005490595 0.2608696 1.3482145 1
## [1238] {other vegetables,
##          pastry}                  => {soda}                0.005490595 0.2432432 1.3949255 1
## [1239] {other vegetables,
##          soda}                     => {pastry}              0.005490595 0.1677019 1.8849689 1
## [1240] {pastry,
##          soda}                     => {whole milk}           0.008235892 0.3913043 1.5314279 1
## [1241] {pastry,
##          whole milk}              => {soda}                0.008235892 0.2477064 1.4205205 1
## [1242] {soda,
##          whole milk}              => {pastry}              0.008235892 0.2055838 2.3107614 1

```

## [1243] {pastry, ## yogurt}	=> {rolls/buns}	0.005795628	0.3275862	1.7809897
## [1244] {pastry, ## rolls/buns}	=> {yogurt}	0.005795628	0.2766990	1.9834803
## [1245] {rolls/buns, ## yogurt}	=> {pastry}	0.005795628	0.1686391	1.8955030
## [1246] {pastry, ## yogurt}	=> {other vegetables}	0.006609049	0.3735632	1.9306328
## [1247] {other vegetables, ## pastry}	=> {yogurt}	0.006609049	0.2927928	2.0988463
## [1248] {other vegetables, ## yogurt}	=> {pastry}	0.006609049	0.1522248	1.7110070
## [1249] {pastry, ## yogurt}	=> {whole milk}	0.009150991	0.5172414	2.0243012
## [1250] {pastry, ## whole milk}	=> {yogurt}	0.009150991	0.2752294	1.9729451
## [1251] {whole milk, ## yogurt}	=> {pastry}	0.009150991	0.1633394	1.8359347
## [1252] {pastry, ## rolls/buns}	=> {other vegetables}	0.006100661	0.2912621	1.5052880
## [1253] {other vegetables, ## pastry}	=> {rolls/buns}	0.006100661	0.2702703	1.4693798
## [1254] {other vegetables, ## rolls/buns}	=> {pastry}	0.006100661	0.1431981	1.6095465
## [1255] {pastry, ## rolls/buns}	=> {whole milk}	0.008540925	0.4077670	1.5958569
## [1256] {pastry, ## whole milk}	=> {rolls/buns}	0.008540925	0.2568807	1.3965849
## [1257] {rolls/buns, ## whole milk}	=> {pastry}	0.008540925	0.1508079	1.6950808
## [1258] {other vegetables, ## pastry}	=> {whole milk}	0.010574479	0.4684685	1.8334212
## [1259] {pastry, ## whole milk}	=> {other vegetables}	0.010574479	0.3180428	1.6436947
## [1260] {other vegetables, ## whole milk}	=> {pastry}	0.010574479	0.1413043	1.5882609
## [1261] {bottled water, ## citrus fruit}	=> {other vegetables}	0.005083884	0.3759398	1.9429156
## [1262] {citrus fruit, ## other vegetables}	=> {bottled water}	0.005083884	0.1760563	1.5929292
## [1263] {bottled water, ## other vegetables}	=> {citrus fruit}	0.005083884	0.2049180	2.4758831
## [1264] {bottled water, ## citrus fruit}	=> {whole milk}	0.005897306	0.4360902	1.7067041
## [1265] {citrus fruit, ## whole milk}	=> {bottled water}	0.005897306	0.1933333	1.7492487
## [1266] {bottled water, ## whole milk}	=> {citrus fruit}	0.005897306	0.1715976	2.0732957
## [1267] {citrus fruit, ## tropical fruit}	=> {root vegetables}	0.005693950	0.2857143	2.6212687
## [1268] {citrus fruit, ## root vegetables}	=> {tropical fruit}	0.005693950	0.3218391	3.0671389
## [1269] {root vegetables, ## tropical fruit}	=> {citrus fruit}	0.005693950	0.2705314	3.2686441

## [1270] {citrus fruit, ##       tropical fruit}	=> {yogurt}	0.006304016	0.3163265	2.2675448
## [1271] {citrus fruit, ##       yogurt}	=> {tropical fruit}	0.006304016	0.2910798	2.7740019
## [1272] {tropical fruit, ##       yogurt}	=> {citrus fruit}	0.006304016	0.2152778	2.6010528
## [1273] {citrus fruit, ##       tropical fruit}	=> {other vegetables}	0.009049314	0.4540816	2.3467645
## [1274] {citrus fruit, ##       other vegetables}	=> {tropical fruit}	0.009049314	0.3133803	2.9865262
## [1275] {other vegetables, ##       tropical fruit}	=> {citrus fruit}	0.009049314	0.2521246	3.0462480
## [1276] {citrus fruit, ##       tropical fruit}	=> {whole milk}	0.009049314	0.4540816	1.7771161
## [1277] {citrus fruit, ##       whole milk}	=> {tropical fruit}	0.009049314	0.2966667	2.8272448
## [1278] {tropical fruit, ##       whole milk}	=> {citrus fruit}	0.009049314	0.2139423	2.5849172
## [1279] {citrus fruit, ##       root vegetables}	=> {other vegetables}	0.010371124	0.5862069	3.0296084
## [1280] {citrus fruit, ##       other vegetables}	=> {root vegetables}	0.010371124	0.3591549	3.2950455
## [1281] {other vegetables, ##       root vegetables}	=> {citrus fruit}	0.010371124	0.2188841	2.6446257
## [1282] {citrus fruit, ##       root vegetables}	=> {whole milk}	0.009150991	0.5172414	2.0243012
## [1283] {citrus fruit, ##       whole milk}	=> {root vegetables}	0.009150991	0.3000000	2.7523321
## [1284] {root vegetables, ##       whole milk}	=> {citrus fruit}	0.009150991	0.1871102	2.2607232
## [1285] {citrus fruit, ##       yogurt}	=> {rolls/buns}	0.005795628	0.2676056	1.4548930
## [1286] {citrus fruit, ##       rolls/buns}	=> {yogurt}	0.005795628	0.3454545	2.4763451
## [1287] {rolls/buns, ##       yogurt}	=> {citrus fruit}	0.005795628	0.1686391	2.0375492
## [1288] {citrus fruit, ##       yogurt}	=> {other vegetables}	0.007625826	0.3521127	1.8197731
## [1289] {citrus fruit, ##       other vegetables}	=> {yogurt}	0.007625826	0.2640845	1.8930548
## [1290] {other vegetables, ##       yogurt}	=> {citrus fruit}	0.007625826	0.1756440	2.1221855
## [1291] {citrus fruit, ##       yogurt}	=> {whole milk}	0.010269446	0.4741784	1.8557678
## [1292] {citrus fruit, ##       whole milk}	=> {yogurt}	0.010269446	0.3366667	2.4133503
## [1293] {whole milk, ##       yogurt}	=> {citrus fruit}	0.010269446	0.1833031	2.2147246
## [1294] {citrus fruit, ##       rolls/buns}	=> {other vegetables}	0.005998983	0.3575758	1.8480071
## [1295] {citrus fruit, ##       other vegetables}	=> {rolls/buns}	0.005998983	0.2077465	1.1294564
## [1296] {other vegetables, ##       rolls/buns}	=> {citrus fruit}	0.005998983	0.1408115	1.7013276

```

## [1297] {citrus fruit,
##         rolls/buns} => {whole milk} 0.007219115 0.4303030 1.6840550
## [1298] {citrus fruit,
##         whole milk} => {rolls/buns} 0.007219115 0.2366667 1.2866869
## [1299] {rolls/buns,
##         whole milk} => {citrus fruit} 0.007219115 0.1274686 1.5401149
## [1300] {citrus fruit,
##         other vegetables} => {whole milk} 0.013014743 0.4507042 1.7638982
## [1301] {citrus fruit,
##         whole milk} => {other vegetables} 0.013014743 0.4266667 2.2050797
## [1302] {other vegetables,
##         whole milk} => {citrus fruit} 0.013014743 0.1739130 2.1012712
## [1303] {sausage,
##         shopping bags} => {soda} 0.005693950 0.3636364 2.0853432
## [1304] {shopping bags,
##         soda} => {sausage} 0.005693950 0.2314050 2.4630604
## [1305] {sausage,
##         soda} => {shopping bags} 0.005693950 0.2343096 2.3781580
## [1306] {sausage,
##         shopping bags} => {rolls/buns} 0.005998983 0.3831169 2.0828936
## [1307] {rolls/buns,
##         shopping bags} => {sausage} 0.005998983 0.3072917 3.2707939
## [1308] {rolls/buns,
##         sausage} => {shopping bags} 0.005998983 0.1960133 1.9894641
## [1309] {sausage,
##         shopping bags} => {other vegetables} 0.005388917 0.3441558 1.7786509
## [1310] {other vegetables,
##         shopping bags} => {sausage} 0.005388917 0.2324561 2.4742491
## [1311] {other vegetables,
##         sausage} => {shopping bags} 0.005388917 0.2000000 2.0299278
## [1312] {root vegetables,
##         shopping bags} => {other vegetables} 0.006609049 0.5158730 2.6661120
## [1313] {other vegetables,
##         shopping bags} => {root vegetables} 0.006609049 0.2850877 2.6155203
## [1314] {other vegetables,
##         root vegetables} => {shopping bags} 0.006609049 0.1394850 1.4157222
## [1315] {root vegetables,
##         shopping bags} => {whole milk} 0.005287239 0.4126984 1.6151567
## [1316] {shopping bags,
##         whole milk} => {root vegetables} 0.005287239 0.2157676 1.9795473
## [1317] {root vegetables,
##         whole milk} => {shopping bags} 0.005287239 0.1081081 1.0972582
## [1318] {shopping bags,
##         soda} => {rolls/buns} 0.006304016 0.2561983 1.3928749
## [1319] {rolls/buns,
##         shopping bags} => {soda} 0.006304016 0.3229167 1.8518282
## [1320] {rolls/buns,
##         soda} => {shopping bags} 0.006304016 0.1644562 1.6691714
## [1321] {shopping bags,
##         soda} => {other vegetables} 0.005388917 0.2190083 1.1318688
## [1322] {other vegetables,
##         shopping bags} => {soda} 0.005388917 0.2324561 1.3330648
## [1323] {other vegetables,
##         soda} => {shopping bags} 0.005388917 0.1645963 1.6705927

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## [1324] {shopping bags, ## soda}	=> {whole milk}	0.006812405	0.2768595	1.0835309
## [1325] {shopping bags, ## whole milk}	=> {soda}	0.006812405	0.2780083	1.5942925
## [1326] {soda, ## whole milk}	=> {shopping bags}	0.006812405	0.1700508	1.7259538
## [1327] {shopping bags, ## yogurt}	=> {other vegetables}	0.005388917	0.3533333	1.8260816
## [1328] {other vegetables, ## shopping bags}	=> {yogurt}	0.005388917	0.2324561	1.6663310
## [1329] {other vegetables, ## yogurt}	=> {shopping bags}	0.005388917	0.1241218	1.2597912
## [1330] {shopping bags, ## yogurt}	=> {whole milk}	0.005287239	0.3466667	1.3567317
## [1331] {shopping bags, ## whole milk}	=> {yogurt}	0.005287239	0.2157676	1.5467017
## [1332] {rolls/buns, ## shopping bags}	=> {other vegetables}	0.005287239	0.2708333	1.3997088
## [1333] {other vegetables, ## shopping bags}	=> {rolls/buns}	0.005287239	0.2280702	1.2399503
## [1334] {other vegetables, ## rolls/buns}	=> {shopping bags}	0.005287239	0.1241050	1.2596210
## [1335] {rolls/buns, ## shopping bags}	=> {whole milk}	0.005287239	0.2708333	1.0599466
## [1336] {shopping bags, ## whole milk}	=> {rolls/buns}	0.005287239	0.2157676	1.1730651
## [1337] {other vegetables, ## shopping bags}	=> {whole milk}	0.007625826	0.3289474	1.2873845
## [1338] {shopping bags, ## whole milk}	=> {other vegetables}	0.007625826	0.3112033	1.6083472
## [1339] {other vegetables, ## whole milk}	=> {shopping bags}	0.007625826	0.1019022	1.0342703
## [1340] {bottled water, ## sausage}	=> {other vegetables}	0.005083884	0.4237288	2.1898964
## [1341] {other vegetables, ## sausage}	=> {bottled water}	0.005083884	0.1886792	1.7071393
## [1342] {bottled water, ## other vegetables}	=> {sausage}	0.005083884	0.2049180	2.1811351
## [1343] {sausage, ## tropical fruit}	=> {other vegetables}	0.005998983	0.4306569	2.2257020
## [1344] {other vegetables, ## sausage}	=> {tropical fruit}	0.005998983	0.2226415	2.1217822
## [1345] {other vegetables, ## tropical fruit}	=> {sausage}	0.005998983	0.1671388	1.7790154
## [1346] {sausage, ## tropical fruit}	=> {whole milk}	0.007219115	0.5182482	2.0282415
## [1347] {sausage, ## whole milk}	=> {tropical fruit}	0.007219115	0.2414966	2.3014719
## [1348] {tropical fruit, ## whole milk}	=> {sausage}	0.007219115	0.1706731	1.8166339
## [1349] {root vegetables, ## sausage}	=> {yogurt}	0.005185562	0.3469388	2.4869846
## [1350] {sausage, ## yogurt}	=> {root vegetables}	0.005185562	0.2642487	2.4243340

## [1351] {root vegetables, ## yogurt}	=> {sausage}	0.005185562	0.2007874	2.1371689
## [1352] {root vegetables, ## sausage}	=> {other vegetables}	0.006812405	0.4557823	2.3555539
## [1353] {other vegetables, ## sausage}	=> {root vegetables}	0.006812405	0.2528302	2.3195755
## [1354] {other vegetables, ## root vegetables}	=> {sausage}	0.006812405	0.1437768	1.5303518
## [1355] {root vegetables, ## sausage}	=> {whole milk}	0.007727504	0.5170068	2.0233832
## [1356] {sausage, ## whole milk}	=> {root vegetables}	0.007727504	0.2585034	2.3716240
## [1357] {root vegetables, ## whole milk}	=> {sausage}	0.007727504	0.1580042	1.6817867
## [1358] {sausage, ## soda}	=> {yogurt}	0.005592272	0.2301255	1.6496243
## [1359] {sausage, ## yogurt}	=> {soda}	0.005592272	0.2849741	1.6342392
## [1360] {soda, ## yogurt}	=> {sausage}	0.005592272	0.2044610	2.1762701
## [1361] {sausage, ## soda}	=> {rolls/buns}	0.009659380	0.3974895	2.1610335
## [1362] {rolls/buns, ## sausage}	=> {soda}	0.009659380	0.3156146	1.8099532
## [1363] {rolls/buns, ## soda}	=> {sausage}	0.009659380	0.2519894	2.6821598
## [1364] {sausage, ## soda}	=> {other vegetables}	0.007219115	0.2970711	1.5353098
## [1365] {other vegetables, ## sausage}	=> {soda}	0.007219115	0.2679245	1.5364652
## [1366] {other vegetables, ## soda}	=> {sausage}	0.007219115	0.2204969	2.3469556
## [1367] {sausage, ## soda}	=> {whole milk}	0.006710727	0.2761506	1.0807566
## [1368] {sausage, ## whole milk}	=> {soda}	0.006710727	0.2244898	1.2873803
## [1369] {soda, ## whole milk}	=> {sausage}	0.006710727	0.1675127	1.7829949
## [1370] {sausage, ## yogurt}	=> {rolls/buns}	0.005998983	0.3056995	1.6619980
## [1371] {rolls/buns, ## sausage}	=> {yogurt}	0.005998983	0.1960133	1.4050953
## [1372] {rolls/buns, ## yogurt}	=> {sausage}	0.005998983	0.1745562	1.8579658
## [1373] {sausage, ## yogurt}	=> {other vegetables}	0.008134215	0.4145078	2.1422406
## [1374] {other vegetables, ## sausage}	=> {yogurt}	0.008134215	0.3018868	2.1640354
## [1375] {other vegetables, ## yogurt}	=> {sausage}	0.008134215	0.1873536	1.9941807
## [1376] {sausage, ## yogurt}	=> {whole milk}	0.008744281	0.4455959	1.7439058
## [1377] {sausage, ## whole milk}	=> {yogurt}	0.008744281	0.2925170	2.0968694

```

## [1378] {whole milk,
##          yogurt}                => {sausage}           0.008744281 0.1560799 1.6613045
## [1379] {rolls/buns,
##          sausage}                => {other vegetables} 0.008845958 0.2890365 1.4937858
## [1380] {other vegetables,
##          sausage}                => {rolls/buns}         0.008845958 0.3283019 1.7848806
## [1381] {other vegetables,
##          rolls/buns}              => {sausage}           0.008845958 0.2076372 2.2100781
## [1382] {rolls/buns,
##          sausage}                => {whole milk}        0.009354347 0.3056478 1.1961984
## [1383] {sausage,
##          whole milk}              => {rolls/buns}         0.009354347 0.3129252 1.7012820
## [1384] {rolls/buns,
##          whole milk}              => {sausage}            0.009354347 0.1651706 1.7580654
## [1385] {other vegetables,
##          sausage}                => {whole milk}        0.010167768 0.3773585 1.4768487
## [1386] {sausage,
##          whole milk}              => {other vegetables} 0.010167768 0.3401361 1.7578760
## [1387] {other vegetables,
##          whole milk}              => {sausage}            0.010167768 0.1358696 1.4461874
## [1388] {bottled water,
##          tropical fruit}         => {soda}               0.005185562 0.2802198 1.6069747
## [1389] {bottled water,
##          soda}                   => {tropical fruit}   0.005185562 0.1789474 1.7053754
## [1390] {soda,
##          tropical fruit}         => {bottled water}     0.005185562 0.2487805 2.2509256
## [1391] {bottled water,
##          tropical fruit}         => {yogurt}             0.007117438 0.3846154 2.7570644
## [1392] {bottled water,
##          yogurt}                 => {tropical fruit}   0.007117438 0.3097345 2.9517819
## [1393] {tropical fruit,
##          yogurt}                 => {bottled water}     0.007117438 0.2430556 2.1991273
## [1394] {bottled water,
##          tropical fruit}         => {rolls/buns}        0.005388917 0.2912088 1.5832164
## [1395] {bottled water,
##          rolls/buns}              => {tropical fruit}   0.005388917 0.2226891 2.1222355
## [1396] {rolls/buns,
##          tropical fruit}         => {bottled water}     0.005388917 0.2190083 1.9815513
## [1397] {bottled water,
##          tropical fruit}         => {other vegetables} 0.006202339 0.3351648 1.7321840
## [1398] {bottled water,
##          other vegetables}       => {tropical fruit}   0.006202339 0.2500000 2.3825097
## [1399] {other vegetables,
##          tropical fruit}         => {bottled water}     0.006202339 0.1728045 1.5635074
## [1400] {bottled water,
##          tropical fruit}         => {whole milk}        0.008032537 0.4340659 1.6987817
## [1401] {bottled water,
##          whole milk}              => {tropical fruit}   0.008032537 0.2337278 2.2274351
## [1402] {tropical fruit,
##          whole milk}              => {bottled water}     0.008032537 0.1899038 1.7182193
## [1403] {bottled water,
##          root vegetables}        => {other vegetables} 0.007015760 0.4480519 2.3156022
## [1404] {bottled water,
##          other vegetables}       => {root vegetables} 0.007015760 0.2827869 2.5944114

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## [1405] {other vegetables, ##       root vegetables}	=> {bottled water}	0.007015760	0.1480687	1.3397013
## [1406] {bottled water, ##       root vegetables}	=> {whole milk}	0.007320793	0.4675325	1.8297580
## [1407] {bottled water, ##       whole milk}	=> {root vegetables}	0.007320793	0.2130178	1.9543186
## [1408] {root vegetables, ##       whole milk}	=> {bottled water}	0.007320793	0.1496881	1.3543541
## [1409] {bottled water, ##       soda}	=> {yogurt}	0.007422471	0.2561404	1.8361081
## [1410] {bottled water, ##       yogurt}	=> {soda}	0.007422471	0.3230088	1.8523569
## [1411] {soda, ##       yogurt}	=> {bottled water}	0.007422471	0.2713755	2.4553613
## [1412] {bottled water, ##       soda}	=> {rolls/buns}	0.006812405	0.2350877	1.2781027
## [1413] {bottled water, ##       rolls/buns}	=> {soda}	0.006812405	0.2815126	1.6143886
## [1414] {rolls/buns, ##       soda}	=> {bottled water}	0.006812405	0.1777188	1.6079712
## [1415] {bottled water, ##       soda}	=> {other vegetables}	0.005693950	0.1964912	1.0154972
## [1416] {bottled water, ##       other vegetables}	=> {soda}	0.005693950	0.2295082	1.3161593
## [1417] {other vegetables, ##       soda}	=> {bottled water}	0.005693950	0.1739130	1.5735371
## [1418] {bottled water, ##       soda}	=> {whole milk}	0.007524148	0.2596491	1.0161755
## [1419] {bottled water, ##       whole milk}	=> {soda}	0.007524148	0.2189349	1.2555247
## [1420] {soda, ##       whole milk}	=> {bottled water}	0.007524148	0.1878173	1.6993401
## [1421] {bottled water, ##       yogurt}	=> {rolls/buns}	0.007117438	0.3097345	1.6839353
## [1422] {bottled water, ##       rolls/buns}	=> {yogurt}	0.007117438	0.2941176	2.1083433
## [1423] {rolls/buns, ##       yogurt}	=> {bottled water}	0.007117438	0.2071006	1.8738126
## [1424] {bottled water, ##       yogurt}	=> {other vegetables}	0.008134215	0.3539823	1.8294356
## [1425] {bottled water, ##       other vegetables}	=> {yogurt}	0.008134215	0.3278689	2.3502844
## [1426] {other vegetables, ##       yogurt}	=> {bottled water}	0.008134215	0.1873536	1.6951453
## [1427] {bottled water, ##       yogurt}	=> {whole milk}	0.009659380	0.4203540	1.6451180
## [1428] {bottled water, ##       whole milk}	=> {yogurt}	0.009659380	0.2810651	2.0147778
## [1429] {whole milk, ##       yogurt}	=> {bottled water}	0.009659380	0.1724138	1.5599721
## [1430] {bottled water, ##       rolls/buns}	=> {other vegetables}	0.007320793	0.3025210	1.5634756
## [1431] {bottled water, ##       other vegetables}	=> {rolls/buns}	0.007320793	0.2950820	1.6042737

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## [1432] {other vegetables,
##          rolls/buns}          => {bottled water}           0.007320793 0.1718377 1.5547598
## [1433] {bottled water,
##          rolls/buns}          => {whole milk}            0.008744281 0.3613445 1.4141757
## [1434] {bottled water,
##          whole milk}          => {rolls/buns}            0.008744281 0.2544379 1.3833037
## [1435] {rolls/buns,
##          whole milk}          => {bottled water}           0.008744281 0.1543986 1.3969732
## [1436] {bottled water,
##          other vegetables}    => {whole milk}            0.010777834 0.4344262 1.7001918
## [1437] {bottled water,
##          whole milk}          => {other vegetables}     0.010777834 0.3136095 1.6207825
## [1438] {other vegetables,
##          whole milk}          => {bottled water}           0.010777834 0.1440217 1.3030854
## [1439] {root vegetables,
##          tropical fruit}      => {yogurt}                0.008134215 0.3864734 2.7703835
## [1440] {tropical fruit,
##          yogurt}              => {root vegetables}      0.008134215 0.2777778 2.5484556
## [1441] {root vegetables,
##          yogurt}              => {tropical fruit}       0.008134215 0.3149606 3.0015870
## [1442] {root vegetables,
##          tropical fruit}      => {rolls/buns}            0.005897306 0.2801932 1.5233281
## [1443] {rolls/buns,
##          tropical fruit}      => {root vegetables}      0.005897306 0.2396694 2.1988328
## [1444] {rolls/buns,
##          root vegetables}     => {tropical fruit}       0.005897306 0.2426778 2.3127291
## [1445] {root vegetables,
##          tropical fruit}      => {other vegetables}     0.012302999 0.5845411 3.0209991
## [1446] {other vegetables,
##          tropical fruit}      => {root vegetables}      0.012302999 0.3427762 3.1447798
## [1447] {other vegetables,
##          root vegetables}     => {tropical fruit}       0.012302999 0.2596567 2.4745380
## [1448] {root vegetables,
##          tropical fruit}      => {whole milk}            0.011997966 0.5700483 2.2309690
## [1449] {tropical fruit,
##          whole milk}          => {root vegetables}      0.011997966 0.2836538 2.6023653
## [1450] {root vegetables,
##          whole milk}          => {tropical fruit}       0.011997966 0.2453222 2.3379305
## [1451] {soda,
##          tropical fruit}      => {yogurt}                0.006609049 0.3170732 2.2728970
## [1452] {tropical fruit,
##          yogurt}              => {soda}                  0.006609049 0.2256944 1.2942885
## [1453] {soda,
##          yogurt}              => {tropical fruit}       0.006609049 0.2416357 2.3027975
## [1454] {soda,
##          tropical fruit}      => {rolls/buns}            0.005388917 0.2585366 1.4055872
## [1455] {rolls/buns,
##          tropical fruit}      => {soda}                  0.005388917 0.2190083 1.2559454
## [1456] {rolls/buns,
##          soda}                 => {tropical fruit}       0.005388917 0.1405836 1.3397667
## [1457] {soda,
##          tropical fruit}      => {other vegetables}     0.007219115 0.3463415 1.7899466
## [1458] {other vegetables,
##          tropical fruit}      => {soda}                  0.007219115 0.2011331 1.1534370

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## [1459] {other vegetables, ## soda}	=> {tropical fruit}	0.007219115	0.2204969	2.1013440
## [1460] {soda, ## tropical fruit}	=> {whole milk}	0.007829181	0.3756098	1.4700048
## [1461] {tropical fruit, ## whole milk}	=> {soda}	0.007829181	0.1850962	1.0614698
## [1462] {soda, ## whole milk}	=> {tropical fruit}	0.007829181	0.1954315	1.8624695
## [1463] {tropical fruit, ## yogurt}	=> {rolls/buns}	0.008744281	0.2986111	1.6234606
## [1464] {rolls/buns, ## tropical fruit}	=> {yogurt}	0.008744281	0.3553719	2.5474363
## [1465] {rolls/buns, ## yogurt}	=> {tropical fruit}	0.008744281	0.2544379	2.4248028
## [1466] {tropical fruit, ## yogurt}	=> {other vegetables}	0.012302999	0.4201389	2.1713431
## [1467] {other vegetables, ## tropical fruit}	=> {yogurt}	0.012302999	0.3427762	2.4571457
## [1468] {other vegetables, ## yogurt}	=> {tropical fruit}	0.012302999	0.2833724	2.7005496
## [1469] {tropical fruit, ## yogurt}	=> {whole milk}	0.015149975	0.5173611	2.0247698
## [1470] {tropical fruit, ## whole milk}	=> {yogurt}	0.015149975	0.3581731	2.5675162
## [1471] {whole milk, ## yogurt}	=> {tropical fruit}	0.015149975	0.2704174	2.5770885
## [1472] {rolls/buns, ## tropical fruit}	=> {other vegetables}	0.007829181	0.3181818	1.6444131
## [1473] {other vegetables, ## tropical fruit}	=> {rolls/buns}	0.007829181	0.2181303	1.1859102
## [1474] {other vegetables, ## rolls/buns}	=> {tropical fruit}	0.007829181	0.1837709	1.7513436
## [1475] {rolls/buns, ## tropical fruit}	=> {whole milk}	0.010981190	0.4462810	1.7465872
## [1476] {tropical fruit, ## whole milk}	=> {rolls/buns}	0.010981190	0.2596154	1.4114524
## [1477] {rolls/buns, ## whole milk}	=> {tropical fruit}	0.010981190	0.1938959	1.8478352
## [1478] {other vegetables, ## tropical fruit}	=> {whole milk}	0.017081851	0.4759207	1.8625865
## [1479] {tropical fruit, ## whole milk}	=> {other vegetables}	0.017081851	0.4038462	2.0871397
## [1480] {other vegetables, ## whole milk}	=> {tropical fruit}	0.017081851	0.2282609	2.1753349
## [1481] {root vegetables, ## soda}	=> {other vegetables}	0.008235892	0.4426230	2.2875443
## [1482] {other vegetables, ## root vegetables}	=> {soda}	0.008235892	0.1738197	0.9968030
## [1483] {other vegetables, ## soda}	=> {root vegetables}	0.008235892	0.2515528	2.3078561
## [1484] {root vegetables, ## soda}	=> {whole milk}	0.008134215	0.4371585	1.7108848
## [1485] {root vegetables, ## whole milk}	=> {soda}	0.008134215	0.1663202	0.9537952

## [1486] {soda,	=> {root vegetables}	0.008134215	0.2030457	1.8628305
## whole milk}				
## [1487] {root vegetables,	=> {rolls/buns}	0.007219115	0.2795276	1.5197090
## yogurt}				
## [1488] {rolls/buns,	=> {yogurt}	0.007219115	0.2970711	2.1295150
## root vegetables}				
## [1489] {rolls/buns,	=> {root vegetables}	0.007219115	0.2100592	1.9271753
## yogurt}				
## [1490] {root vegetables,	=> {other vegetables}	0.012913066	0.5000000	2.5840778
## yogurt}				
## [1491] {other vegetables,	=> {yogurt}	0.012913066	0.2725322	1.9536108
## root vegetables}				
## [1492] {other vegetables,	=> {root vegetables}	0.012913066	0.2974239	2.7286977
## yogurt}				
## [1493] {root vegetables,	=> {whole milk}	0.014539908	0.5629921	2.2033536
## yogurt}				
## [1494] {root vegetables,	=> {yogurt}	0.014539908	0.2972973	2.1311362
## whole milk}				
## [1495] {whole milk,	=> {root vegetables}	0.014539908	0.2595281	2.3810253
## yogurt}				
## [1496] {rolls/buns,	=> {other vegetables}	0.012201322	0.5020921	2.5948898
## root vegetables}				
## [1497] {other vegetables,	=> {rolls/buns}	0.012201322	0.2575107	1.4000100
## root vegetables}				
## [1498] {other vegetables,	=> {root vegetables}	0.012201322	0.2863962	2.6275247
## rolls/buns}				
## [1499] {rolls/buns,	=> {whole milk}	0.012709710	0.5230126	2.0468876
## root vegetables}				
## [1500] {root vegetables,	=> {rolls/buns}	0.012709710	0.2598753	1.4128652
## whole milk}				
## [1501] {rolls/buns,	=> {root vegetables}	0.012709710	0.2244165	2.0588959
## whole milk}				
## [1502] {other vegetables,	=> {whole milk}	0.023182511	0.4892704	1.9148326
## root vegetables}				
## [1503] {root vegetables,	=> {other vegetables}	0.023182511	0.4740125	2.4497702
## whole milk}				
## [1504] {other vegetables,	=> {root vegetables}	0.023182511	0.3097826	2.8420820
## whole milk}				
## [1505] {soda,	=> {rolls/buns}	0.008642603	0.3159851	1.7179181
## yogurt}				
## [1506] {rolls/buns,	=> {yogurt}	0.008642603	0.2254642	1.6162101
## soda}				
## [1507] {rolls/buns,	=> {soda}	0.008642603	0.2514793	1.4421567
## yogurt}				
## [1508] {soda,	=> {other vegetables}	0.008337570	0.3048327	1.5754229
## yogurt}				
## [1509] {other vegetables,	=> {yogurt}	0.008337570	0.2546584	1.8254849
## soda}				
## [1510] {other vegetables,	=> {soda}	0.008337570	0.1920375	1.1012761
## yogurt}				
## [1511] {soda,	=> {whole milk}	0.010472801	0.3828996	1.4985348
## yogurt}				
## [1512] {soda,	=> {yogurt}	0.010472801	0.2614213	1.8739641
## whole milk}				

## [1513] {whole milk, ## yogurt}	=> {soda}	0.010472801	0.1869328	1.0720027	10
## [1514] {rolls/buns, ## soda}	=> {other vegetables}	0.009862735	0.2572944	1.3297376	9
## [1515] {other vegetables, ## soda}	=> {rolls/buns}	0.009862735	0.3012422	1.6377653	9
## [1516] {other vegetables, ## rolls/buns}	=> {soda}	0.009862735	0.2315036	1.3276022	9
## [1517] {rolls/buns, ## soda}	=> {whole milk}	0.008845958	0.2307692	0.9031498	8
## [1518] {soda, ## whole milk}	=> {rolls/buns}	0.008845958	0.2208122	1.2004908	8
## [1519] {rolls/buns, ## whole milk}	=> {soda}	0.008845958	0.1561939	0.8957242	8
## [1520] {other vegetables, ## soda}	=> {whole milk}	0.013929842	0.4254658	1.6651240	13
## [1521] {soda, ## whole milk}	=> {other vegetables}	0.013929842	0.3477157	1.7970490	13
## [1522] {other vegetables, ## whole milk}	=> {soda}	0.013929842	0.1861413	1.0674634	13
## [1523] {rolls/buns, ## yogurt}	=> {other vegetables}	0.011489578	0.3343195	1.7278153	11
## [1524] {other vegetables, ## yogurt}	=> {rolls/buns}	0.011489578	0.2646370	1.4387534	11
## [1525] {other vegetables, ## rolls/buns}	=> {yogurt}	0.011489578	0.2696897	1.9332351	11
## [1526] {rolls/buns, ## yogurt}	=> {whole milk}	0.015556685	0.4526627	1.7715630	13
## [1527] {whole milk, ## yogurt}	=> {rolls/buns}	0.015556685	0.2776770	1.5096478	13
## [1528] {rolls/buns, ## whole milk}	=> {yogurt}	0.015556685	0.2746858	1.9690488	13
## [1529] {other vegetables, ## yogurt}	=> {whole milk}	0.022267412	0.5128806	2.0072345	20
## [1530] {whole milk, ## yogurt}	=> {other vegetables}	0.022267412	0.3974592	2.0541308	20
## [1531] {other vegetables, ## whole milk}	=> {yogurt}	0.022267412	0.2975543	2.1329789	20
## [1532] {other vegetables, ## rolls/buns}	=> {whole milk}	0.017895272	0.4200477	1.6439194	11
## [1533] {rolls/buns, ## whole milk}	=> {other vegetables}	0.017895272	0.3159785	1.6330258	11
## [1534] {other vegetables, ## whole milk}	=> {rolls/buns}	0.017895272	0.2391304	1.3000817	11
## [1535] {fruit/vegetable juice, ## other vegetables, ## yogurt}	=> {whole milk}	0.005083884	0.6172840	2.4158327	9
## [1536] {fruit/vegetable juice, ## whole milk, ## yogurt}	=> {other vegetables}	0.005083884	0.5376344	2.7785782	9
## [1537] {fruit/vegetable juice, ## other vegetables, ## whole milk}	=> {yogurt}	0.005083884	0.4854369	3.4797900	9
## [1538] {other vegetables,					

```

##      whole milk,
##      yogurt}          => {fruit/vegetable juice} 0.005083884 0.2283105 3.1581347
## [1539] {other vegetables,
##         root vegetables,
##         whipped/sour cream} => {whole milk}          0.005185562 0.6071429 2.3761441
## [1540] {root vegetables,
##         whipped/sour cream,
##         whole milk}        => {other vegetables} 0.005185562 0.5483871 2.8341498
## [1541] {other vegetables,
##         whipped/sour cream,
##         whole milk}        => {root vegetables} 0.005185562 0.3541667 3.2492809
## [1542] {other vegetables,
##         root vegetables,
##         whole milk}        => {whipped/sour cream} 0.005185562 0.2236842 3.1204741
## [1543] {other vegetables,
##         whipped/sour cream,
##         yogurt}            => {whole milk}          0.005592272 0.5500000 2.1525070
## [1544] {whipped/sour cream,
##         whole milk,
##         yogurt}            => {other vegetables} 0.005592272 0.5140187 2.6565286
## [1545] {other vegetables,
##         whipped/sour cream,
##         whole milk}        => {yogurt}              0.005592272 0.3819444 2.7379181
## [1546] {other vegetables,
##         whole milk,
##         yogurt}            => {whipped/sour cream} 0.005592272 0.2511416 3.5035137
## [1547] {other vegetables,
##         pip fruit,
##         root vegetables}   => {whole milk}          0.005490595 0.6750000 2.6417131
## [1548] {pip fruit,
##         root vegetables,
##         whole milk}        => {other vegetables} 0.005490595 0.6136364 3.1713682
## [1549] {other vegetables,
##         pip fruit,
##         whole milk}        => {root vegetables} 0.005490595 0.4060150 3.7249607
## [1550] {other vegetables,
##         root vegetables,
##         whole milk}        => {pip fruit}           0.005490595 0.2368421 3.1308362
## [1551] {other vegetables,
##         pip fruit,
##         yogurt}            => {whole milk}          0.005083884 0.6250000 2.4460306
## [1552] {pip fruit,
##         whole milk,
##         yogurt}            => {other vegetables} 0.005083884 0.5319149 2.7490189
## [1553] {other vegetables,
##         pip fruit,
##         whole milk}        => {yogurt}              0.005083884 0.3759398 2.6948749
## [1554] {other vegetables,
##         whole milk,
##         yogurt}            => {pip fruit}           0.005083884 0.2283105 3.0180562
## [1555] {citrus fruit,
##         other vegetables,
##         root vegetables}   => {whole milk}          0.005795628 0.5588235 2.1870392
## [1556] {citrus fruit,

```

```

##      root vegetables,
##      whole milk}          => {other vegetables}    0.005795628  0.6333333 3.2731652
## [1557] {citrus fruit,
##      other vegetables,
##      whole milk}          => {root vegetables}    0.005795628  0.4453125 4.0854929
## [1558] {other vegetables,
##      root vegetables,
##      whole milk}          => {citrus fruit}      0.005795628  0.2500000 3.0205774
## [1559] {root vegetables,
##      tropical fruit,
##      yogurt}              => {whole milk}       0.005693950  0.7000000 2.7395543
## [1560] {root vegetables,
##      tropical fruit,
##      whole milk}          => {yogurt}          0.005693950  0.4745763 3.4019370
## [1561] {tropical fruit,
##      whole milk,
##      yogurt}              => {root vegetables} 0.005693950  0.3758389 3.4481118
## [1562] {root vegetables,
##      whole milk,
##      yogurt}              => {tropical fruit} 0.005693950  0.3916084 3.7320432
## [1563] {other vegetables,
##      root vegetables,
##      tropical fruit}      => {whole milk}       0.007015760  0.5702479 2.2317503
## [1564] {root vegetables,
##      tropical fruit,
##      whole milk}          => {other vegetables} 0.007015760  0.5847458 3.0220571
## [1565] {other vegetables,
##      tropical fruit,
##      whole milk}          => {root vegetables} 0.007015760  0.4107143 3.7680737
## [1566] {other vegetables,
##      root vegetables,
##      whole milk}          => {tropical fruit} 0.007015760  0.3026316 2.8840907
## [1567] {other vegetables,
##      tropical fruit,
##      yogurt}              => {whole milk}       0.007625826  0.6198347 2.4258155
## [1568] {tropical fruit,
##      whole milk,
##      yogurt}              => {other vegetables} 0.007625826  0.5033557 2.6014206
## [1569] {other vegetables,
##      tropical fruit,
##      whole milk}          => {yogurt}          0.007625826  0.4464286 3.2001640
## [1570] {other vegetables,
##      whole milk,
##      yogurt}              => {tropical fruit} 0.007625826  0.3424658 3.2637119
## [1571] {other vegetables,
##      root vegetables,
##      yogurt}              => {whole milk}       0.007829181  0.6062992 2.3728423
## [1572] {root vegetables,
##      whole milk,
##      yogurt}              => {other vegetables} 0.007829181  0.5384615 2.7828530
## [1573] {other vegetables,
##      root vegetables,
##      whole milk}          => {yogurt}          0.007829181  0.3377193 2.4208960
## [1574] {other vegetables,

```

```

##      whole milk,
##      yogurt}          => {root vegetables}    0.007829181 0.3515982 3.2257165
## [1575] {other vegetables,
##         rolls/buns,
##         root vegetables} => {whole milk}        0.006202339 0.5083333 1.9894383
## [1576] {rolls/buns,
##         root vegetables,
##         whole milk}       => {other vegetables} 0.006202339 0.4880000 2.5220599
## [1577] {other vegetables,
##         root vegetables,
##         whole milk}       => {rolls/buns}        0.006202339 0.2675439 1.4545571
## [1578] {other vegetables,
##         rolls/buns,
##         whole milk}       => {root vegetables} 0.006202339 0.3465909 3.1797776
## [1579] {other vegetables,
##         rolls/buns,
##         yogurt}           => {whole milk}        0.005998983 0.5221239 2.0434097
## [1580] {rolls/buns,
##         whole milk,
##         yogurt}           => {other vegetables} 0.005998983 0.3856209 1.9929489
## [1581] {other vegetables,
##         whole milk,
##         yogurt}           => {rolls/buns}        0.005998983 0.2694064 1.4646832
## [1582] {other vegetables,
##         rolls/buns,
##         whole milk}        => {yogurt}          0.005998983 0.3352273 2.4030322

inspect(subset(rules, subset=lift > 3))

##   lhs                  rhs          support confidence lift count
## [1] {herbs}             => {root vegetables} 0.007015760 0.4312500 3.956477 69
## [2] {ham}               => {white bread}     0.005083884 0.1953125 4.639851 50
## [3] {white bread}       => {ham}            0.005083884 0.1207729 4.639851 50
## [4] {sliced cheese}     => {sausage}        0.007015760 0.2863071 3.047435 69
## [5] {berries}           => {whipped/sour cream} 0.009049314 0.2721713 3.796886 89
## [6] {whipped/sour cream}=> {berries}        0.009049314 0.1262411 3.796886 89
## [7] {hygiene articles} => {napkins}         0.006100661 0.1851852 3.536498 60
## [8] {napkins}           => {hygiene articles} 0.006100661 0.1165049 3.536498 60
## [9] {waffles}           => {chocolate}       0.005795628 0.1507937 3.039048 57
## [10] {chocolate}        => {waffles}         0.005795628 0.1168033 3.039048 57
## [11] {chicken}          => {frozen vegetables} 0.006710727 0.1563981 3.251956 66
## [12] {frozen vegetables}=> {chicken}         0.006710727 0.1395349 3.251956 66
## [13] {beef}              => {root vegetables} 0.017386884 0.3313953 3.040367 171
## [14] {root vegetables}  => {beef}            0.017386884 0.1595149 3.040367 171
## [15] {onions,
##       root vegetables}  => {other vegetables} 0.005693950 0.6021505 3.112008 56
## [16] {onions,
##       other vegetables} => {root vegetables} 0.005693950 0.4000000 3.669776 56
## [17] {other vegetables,
##       root vegetables}  => {onions}          0.005693950 0.1201717 3.875044 56
## [18] {other vegetables,
##       yogurt}           => {cream cheese } 0.005287239 0.1217799 3.071038 52
## [19] {chicken,
##       whole milk}        => {root vegetables} 0.005998983 0.3410405 3.128855 59

```

## [20] {frozen vegetables, ## other vegetables}	=> {root vegetables}	0.006100661	0.3428571	3.145522	60
## [21] {beef, ## other vegetables}	=> {root vegetables}	0.007930859	0.4020619	3.688692	78
## [22] {other vegetables, ## root vegetables}	=> {beef}	0.007930859	0.1673820	3.190313	78
## [23] {beef, ## whole milk}	=> {root vegetables}	0.008032537	0.3779904	3.467851	79
## [24] {root vegetables, ## whole milk}	=> {beef}	0.008032537	0.1642412	3.130449	79
## [25] {curd, ## whole milk}	=> {whipped/sour cream}	0.005897306	0.2256809	3.148329	58
## [26] {whipped/sour cream, ## whole milk}	=> {curd}	0.005897306	0.1829653	3.434091	58
## [27] {curd, ## tropical fruit}	=> {yogurt}	0.005287239	0.5148515	3.690645	52
## [28] {tropical fruit, ## yogurt}	=> {curd}	0.005287239	0.1805556	3.388862	52
## [29] {whole milk, ## yogurt}	=> {curd}	0.010066090	0.1796733	3.372304	99
## [30] {margarine, ## whole milk}	=> {domestic eggs}	0.005185562	0.2142857	3.377404	51
## [31] {butter, ## whole milk}	=> {domestic eggs}	0.005998983	0.2177122	3.431409	59
## [32] {domestic eggs, ## whole milk}	=> {butter}	0.005998983	0.2000000	3.609174	59
## [33] {butter, ## other vegetables}	=> {whipped/sour cream}	0.005795628	0.2893401	4.036397	57
## [34] {other vegetables, ## whipped/sour cream}	=> {butter}	0.005795628	0.2007042	3.621883	57
## [35] {butter, ## whole milk}	=> {whipped/sour cream}	0.006710727	0.2435424	3.397503	66
## [36] {whipped/sour cream, ## whole milk}	=> {butter}	0.006710727	0.2082019	3.757185	66
## [37] {citrus fruit, ## whole milk}	=> {butter}	0.005083884	0.1666667	3.007645	50
## [38] {butter, ## other vegetables}	=> {root vegetables}	0.006609049	0.3299492	3.027100	65
## [39] {root vegetables, ## whole milk}	=> {butter}	0.008235892	0.1683992	3.038910	81
## [40] {whole milk, ## yogurt}	=> {butter}	0.009354347	0.1669691	3.013104	92
## [41] {domestic eggs, ## other vegetables}	=> {whipped/sour cream}	0.005083884	0.2283105	3.185012	50
## [42] {domestic eggs, ## other vegetables}	=> {root vegetables}	0.007320793	0.3287671	3.016254	72
## [43] {pip fruit, ## whipped/sour cream}	=> {other vegetables}	0.005592272	0.6043956	3.123610	55
## [44] {tropical fruit, ## whipped/sour cream}	=> {yogurt}	0.006202339	0.4485294	3.215224	61
## [45] {other vegetables, ## tropical fruit}	=> {whipped/sour cream}	0.007829181	0.2181303	3.042995	77
## [46] {root vegetables, ## yogurt}	=> {whipped/sour cream}	0.006405694	0.2480315	3.460127	63

## [47] {other vegetables, ## yogurt}	=> {whipped/sour cream}	0.010167768	0.2341920	3.267062	100
## [48] {citrus fruit, ## pip fruit}	=> {tropical fruit}	0.005592272	0.4044118	3.854060	55
## [49] {pip fruit, ## tropical fruit}	=> {citrus fruit}	0.005592272	0.2736318	3.306105	55
## [50] {citrus fruit, ## tropical fruit}	=> {pip fruit}	0.005592272	0.2806122	3.709437	55
## [51] {pip fruit, ## root vegetables}	=> {tropical fruit}	0.005287239	0.3398693	3.238967	52
## [52] {root vegetables, ## tropical fruit}	=> {pip fruit}	0.005287239	0.2512077	3.320737	52
## [53] {pip fruit, ## yogurt}	=> {tropical fruit}	0.006405694	0.3559322	3.392048	63
## [54] {other vegetables, ## pip fruit}	=> {tropical fruit}	0.009456024	0.3618677	3.448613	93
## [55] {other vegetables, ## tropical fruit}	=> {pip fruit}	0.009456024	0.2634561	3.482649	93
## [56] {citrus fruit, ## root vegetables}	=> {tropical fruit}	0.005693950	0.3218391	3.067139	56
## [57] {root vegetables, ## tropical fruit}	=> {citrus fruit}	0.005693950	0.2705314	3.268644	56
## [58] {other vegetables, ## tropical fruit}	=> {citrus fruit}	0.009049314	0.2521246	3.046248	89
## [59] {citrus fruit, ## root vegetables}	=> {other vegetables}	0.010371124	0.5862069	3.029608	102
## [60] {citrus fruit, ## other vegetables}	=> {root vegetables}	0.010371124	0.3591549	3.295045	102
## [61] {rolls/buns, ## shopping bags}	=> {sausage}	0.005998983	0.3072917	3.270794	59
## [62] {root vegetables, ## yogurt}	=> {tropical fruit}	0.008134215	0.3149606	3.001587	80
## [63] {root vegetables, ## tropical fruit}	=> {other vegetables}	0.012302999	0.5845411	3.020999	121
## [64] {other vegetables, ## tropical fruit}	=> {root vegetables}	0.012302999	0.3427762	3.144780	121
## [65] {fruit/vegetable juice, ## other vegetables, ## whole milk}	=> {yogurt}	0.005083884	0.4854369	3.479790	50
## [66] {other vegetables, ## whole milk, ## yogurt}	=> {fruit/vegetable juice}	0.005083884	0.2283105	3.158135	50
## [67] {other vegetables, ## whipped/sour cream, ## whole milk}	=> {root vegetables}	0.005185562	0.3541667	3.249281	51
## [68] {other vegetables, ## root vegetables, ## whole milk}	=> {whipped/sour cream}	0.005185562	0.2236842	3.120474	51
## [69] {other vegetables, ## whole milk, ## yogurt}	=> {whipped/sour cream}	0.005592272	0.2511416	3.503514	55
## [70] {pip fruit, ## root vegetables, ## whole milk}	=> {other vegetables}	0.005490595	0.6136364	3.171368	54

```

## [71] {other vegetables,
##       pip fruit,
##       whole milk}      => {root vegetables}    0.005490595  0.4060150 3.724961   54
## [72] {other vegetables,
##       root vegetables,
##       whole milk}      => {pip fruit}        0.005490595  0.2368421 3.130836   54
## [73] {other vegetables,
##       whole milk,
##       yogurt}         => {pip fruit}        0.005083884  0.2283105 3.018056   50
## [74] {citrus fruit,
##       root vegetables,
##       whole milk}      => {other vegetables} 0.005795628  0.6333333 3.273165   57
## [75] {citrus fruit,
##       other vegetables,
##       whole milk}      => {root vegetables} 0.005795628  0.4453125 4.085493   57
## [76] {other vegetables,
##       root vegetables,
##       whole milk}      => {citrus fruit}     0.005795628  0.2500000 3.020577   57
## [77] {root vegetables,
##       tropical fruit,
##       whole milk}      => {yogurt}          0.005693950  0.4745763 3.401937   56
## [78] {tropical fruit,
##       whole milk,
##       yogurt}         => {root vegetables} 0.005693950  0.3758389 3.448112   56
## [79] {root vegetables,
##       whole milk,
##       yogurt}         => {tropical fruit} 0.005693950  0.3916084 3.732043   56
## [80] {root vegetables,
##       tropical fruit,
##       whole milk}      => {other vegetables} 0.007015760  0.5847458 3.022057   69
## [81] {other vegetables,
##       tropical fruit,
##       whole milk}      => {root vegetables} 0.007015760  0.4107143 3.768074   69
## [82] {other vegetables,
##       tropical fruit,
##       whole milk}      => {yogurt}          0.007625826  0.4464286 3.200164   75
## [83] {other vegetables,
##       whole milk,
##       yogurt}         => {tropical fruit} 0.007625826  0.3424658 3.263712   75
## [84] {other vegetables,
##       whole milk,
##       yogurt}         => {root vegetables} 0.007829181  0.3515982 3.225716   77
## [85] {other vegetables,
##       rolls/buns,
##       whole milk}      => {root vegetables} 0.006202339  0.3465909 3.179778   61

inspect(subset(rules, subset=confidence > 0.6))

```

##	lhs	rhs	support	confidence	lift	count
[1]	{onions, root vegetables}	=> {other vegetables}	0.005693950	0.6021505	3.112008	56
[2]	{curd, tropical fruit}	=> {whole milk}	0.006507372	0.6336634	2.479936	64
[3]	{domestic eggs,					

```

##      margarine}          => {whole milk}      0.005185562  0.6219512 2.434099  51
## [4] {butter,
##      domestic eggs}      => {whole milk}      0.005998983  0.6210526 2.430582  59
## [5] {butter,
##      whipped/sour cream} => {whole milk}      0.006710727  0.6600000 2.583008  66
## [6] {bottled water,
##      butter}              => {whole milk}      0.005388917  0.6022727 2.357084  53
## [7] {butter,
##      tropical fruit}     => {whole milk}      0.006202339  0.6224490 2.436047  61
## [8] {butter,
##      root vegetables}    => {whole milk}      0.008235892  0.6377953 2.496107  81
## [9] {butter,
##      yogurt}              => {whole milk}      0.009354347  0.6388889 2.500387  92
## [10] {domestic eggs,
##       pip fruit}          => {whole milk}      0.005388917  0.6235294 2.440275  53
## [11] {domestic eggs,
##       tropical fruit}    => {whole milk}      0.006914082  0.6071429 2.376144  68
## [12] {pip fruit,
##       whipped/sour cream} => {other vegetables} 0.005592272  0.6043956 3.123610  55
## [13] {pip fruit,
##       whipped/sour cream} => {whole milk}      0.005998983  0.6483516 2.537421  59
## [14] {fruit/vegetable juice,
##       other vegetables,
##       yogurt}              => {whole milk}      0.005083884  0.6172840 2.415833  50
## [15] {other vegetables,
##       root vegetables,
##       whipped/sour cream} => {whole milk}      0.005185562  0.6071429 2.376144  51
## [16] {other vegetables,
##       pip fruit,
##       root vegetables}    => {whole milk}      0.005490595  0.6750000 2.641713  54
## [17] {pip fruit,
##       root vegetables,
##       whole milk}          => {other vegetables} 0.005490595  0.6136364 3.171368  54
## [18] {other vegetables,
##       pip fruit,
##       yogurt}              => {whole milk}      0.005083884  0.6250000 2.446031  50
## [19] {citrus fruit,
##       root vegetables,
##       whole milk}          => {other vegetables} 0.005795628  0.6333333 3.273165  57
## [20] {root vegetables,
##       tropical fruit,
##       yogurt}              => {whole milk}      0.005693950  0.7000000 2.739554  56
## [21] {other vegetables,
##       tropical fruit,
##       yogurt}              => {whole milk}      0.007625826  0.6198347 2.425816  75
## [22] {other vegetables,
##       root vegetables,
##       yogurt}              => {whole milk}      0.007829181  0.6062992 2.372842  77

inspect(subset(rules, subset=lift > 3 & confidence > 0.5))

##      lhs                  rhs                  support  confidence      lift  count
## [1] {onions,
##      root vegetables}    => {other vegetables} 0.005693950  0.6021505 3.112008      56

```

```

## [2] {curd,
##      tropical fruit}    => {yogurt}          0.005287239  0.5148515 3.690645   52
## [3] {pip fruit,
##      whipped/sour cream} => {other vegetables} 0.005592272  0.6043956 3.123610   55
## [4] {citrus fruit,
##      root vegetables}   => {other vegetables} 0.010371124  0.5862069 3.029608   102
## [5] {root vegetables,
##      tropical fruit}    => {other vegetables} 0.012302999  0.5845411 3.020999  121
## [6] {pip fruit,
##      root vegetables,
##      whole milk}        => {other vegetables} 0.005490595  0.6136364 3.171368   54
## [7] {citrus fruit,
##      root vegetables,
##      whole milk}        => {other vegetables} 0.005795628  0.6333333 3.273165   57
## [8] {root vegetables,
##      tropical fruit,
##      whole milk}        => {other vegetables} 0.007015760  0.5847458 3.022057   69

```

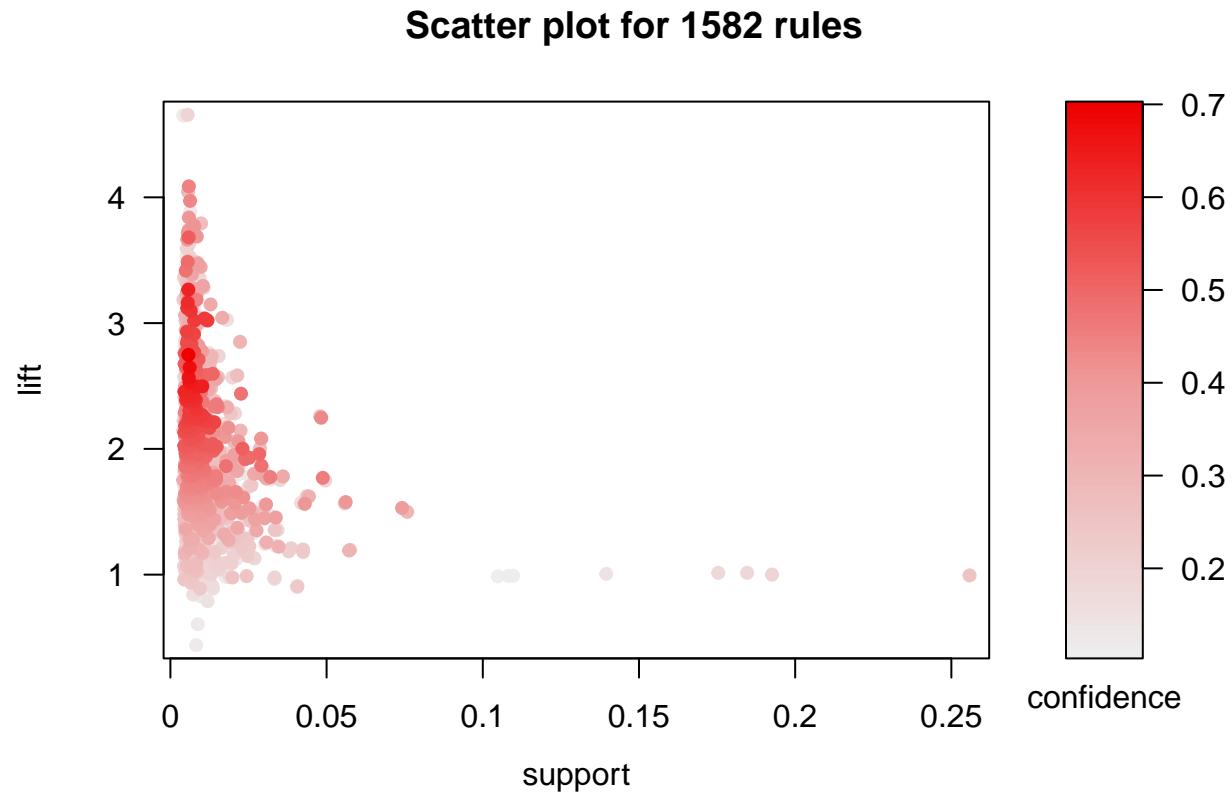
Created rules using apriori. We chose maxlen= 4 since all of the baskets were max 4. We then looked at subsets with lift 3 or greater to narrow down the options a bit. The most concise subset is a subset with lift 3 and confidence of .5

```

# can swap the axes and color scales
plot(rules, measure = c("support", "lift"), shading = "confidence")

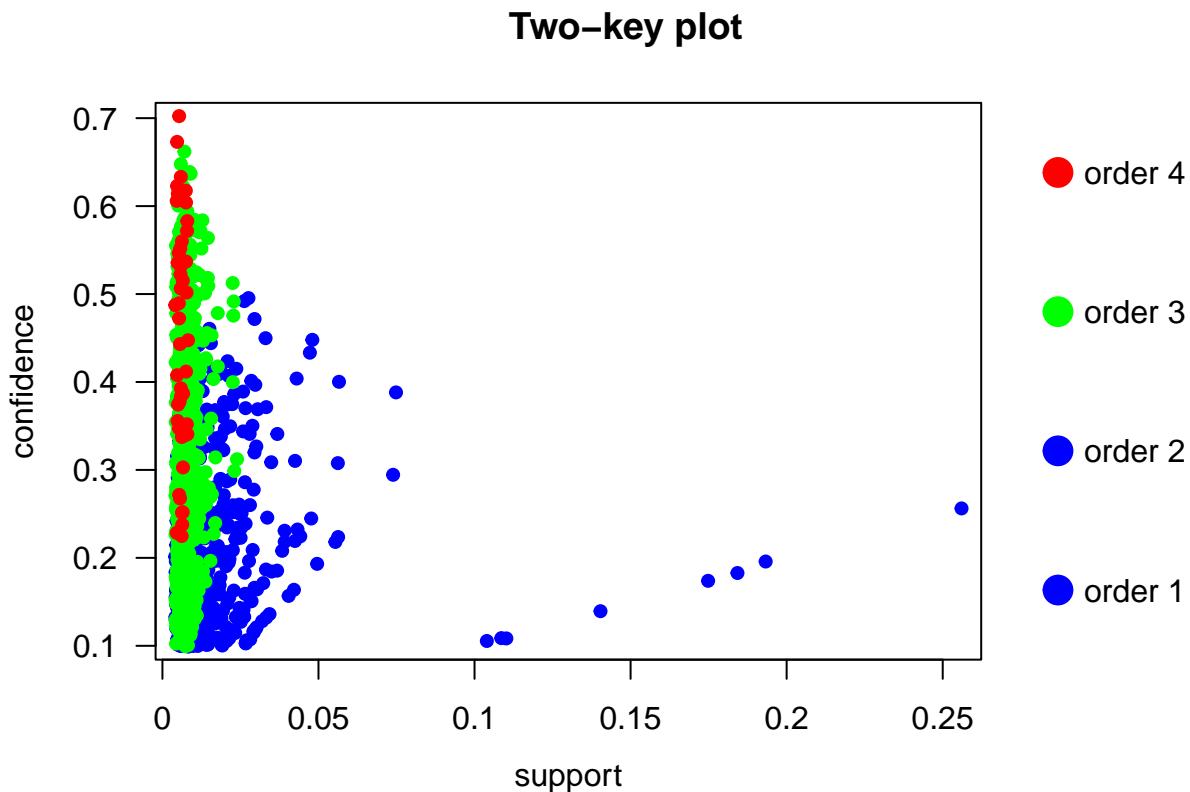
```

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



```
# "two key" plot: coloring is by size (order) of item set
plot(rules, method='two-key plot')
```

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



If we look at the above graphs we can see that as support grows confidence goes down. But as lift increases so does confidence.

```
saveAsGraph(head(rules, n = 1000, by = "lift"), file = "rules.graphml")
```

While nearly impossible to see in the above network graph (it can bee seen in the gephi file) the major nodes with lots of connections are large food staples such as whole milk, sour cream, fruit, vegetables, and juice. This makes sense since they are in many of the baskets. The smaller light blue nodes are combinations of things like {beef, vegetables}. When in this combined order the nodes become more unique and have less connectors. Among all of these connections are some unique ones like root vegetables and yogurt, or sausage and dessert. With these we have to think less about the content, but rather who we think would buy these things together. Perhaps a mom bought sausage and dessert together for her kids because sausage is easy to cook for kids and also children love dessert. Creating a graph like this can help us see connections that we might not normally infer, along for a broader understanding and allowing us to try and come up with creative ideas to, in this case lets say, increase sales by marketing or placing different items together.

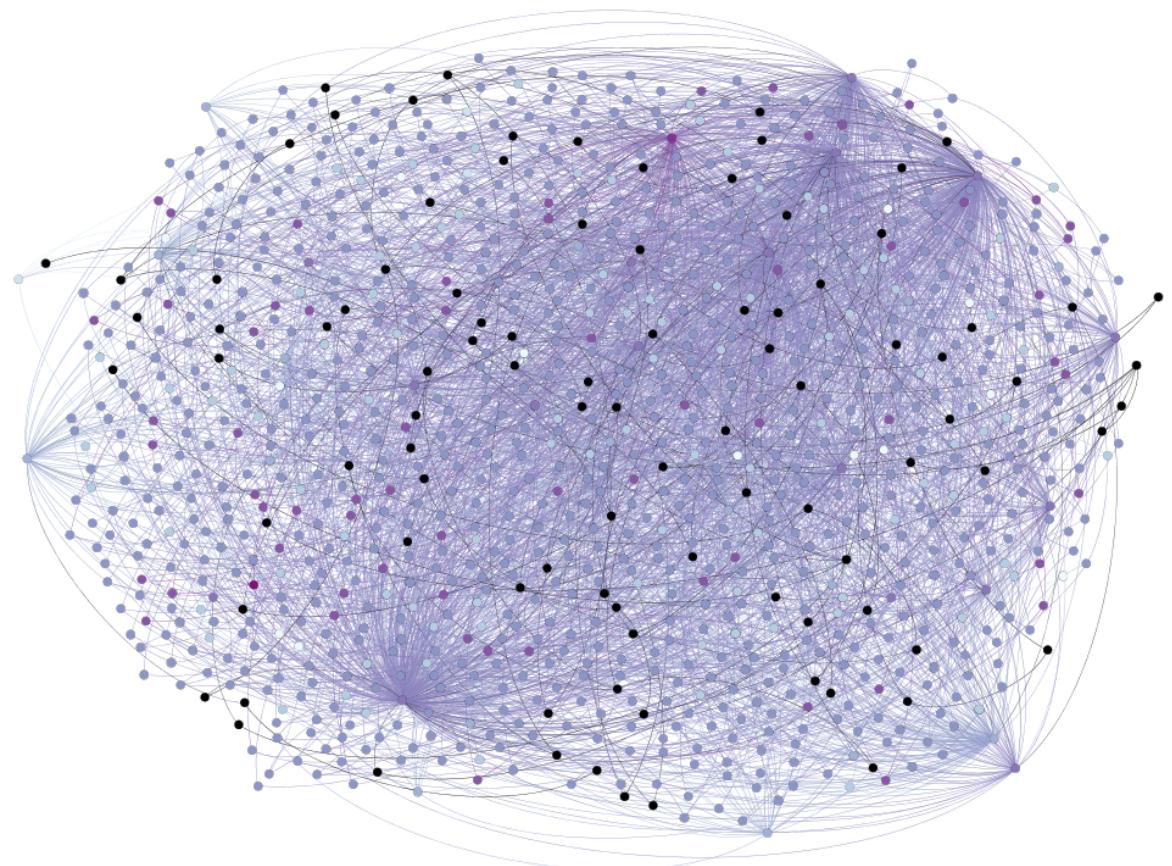


Figure 1: A caption