Association Between Products

Code

THe purpose of this analysis to identify purchasing patterns for Blackwell Electronics, a fictitious company that is considering purchasing another fictitious company, Electronidex's clientele. Our data is a CSV file that contains online transactions for one month of Electronixes sales, and a file containing all the electronics that the company sells. Due to their lack of funding, Electronidex is only able to pull data on the items that customers purchased per their transactions.

We will use R to conduct a market basket analysis to discover interesting relationships (or associations) between customer's transactions and the item(s) they've purchased. These associations can then be used to drive sales-oriented initiatives such as recommender systems like the ones used by Amazon and other eCommerce sites.

Questions: Are there any interesting patterns or item relationships within Electronidex's transactions? Would Blackwell benefit from selling any of Electronidex's items? In your opinion, should Blackwell acquire Electronidex? If Blackwell does acquire Electronidex, do you have any recommendations for Blackwell? (Ex: cross-selling items, sale promotions, should they remove items, etc.)

Once we've completed your market basket analysis, please put together a formal business report in Word.

Install and Load Libraries

Hide

```
install.packages("arules")
```

```
Error in install.packages : Updating loaded packages
```

Hide

```
library(arules)

install.packages("arulesViz")
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/el-capitan/contrib/3.6/arulesViz_1.3-3.t
gz'
Content type 'application/x-gzip' length 767032 bytes (749 KB)
==================================================
downloaded 749 KB
```

```


The downloaded binary packages are in
    /var/folders/hm/2md7sccd0479bw81zsh0yyq80000gn/T//Rtmpp4nUa6/downloaded_packages
```

Hide

```
library(arulesViz)
```

```
Loading required package: grid
Registered S3 method overwritten by 'dplyr':
  method           from
  print.rowwise_df
Registered S3 method overwritten by 'seriation':
  method         from
  reorder.hclust gclus
Registered S3 methods overwritten by 'htmltools':
  method               from
  print.html           tools:rstudio
  print.shiny.tag      tools:rstudio
  print.shiny.tag.list tools:rstudio
Registered S3 method overwritten by 'htmlwidgets':
  method           from
  print.htmlwidget tools:rstudio
Registered S3 method overwritten by 'data.table':
  method           from
  print.data.table
```

Import Data

Hide

```
transactions <- read.transactions("ElectronidexTransactions2017.csv", format = "basket",
rm.duplicates=TRUE, sep=",")
```

```
incomplete final line found on 'ElectronidexTransactions2017.csv'
```

```
distribution of transactions with duplicates:
items
  1   2
191  10
```

Hide

```
#productList <- read.transactions("ProductList.csv")
```

Hide

```
str(transactions)
```

```
Formal class 'transactions' [package "arules"] with 3 slots
  ..@ data       :Formal class 'ngCMatrix' [package "Matrix"] with 5 slots
  .. .. ..@ i       : int [1:43104] 5 25 28 120 18 36 79 69 6 70 ...
  .. .. ..@ p       : int [1:9836] 0 4 7 8 12 16 21 22 27 28 ...
  .. .. ..@ Dim     : int [1:2] 125 9835
  .. .. ..@ Dimnames:List of 2
  .. .. .. ..$ : NULL
  .. .. .. ..$ : NULL
  .. .. ..@ factors : list()
  ..@ itemInfo   :'data.frame': 125 obs. of  1 variable:
  .. ..$ labels: chr [1:125] "1TB Portable External Hard Drive" "2TB Portable External H
ard Drive" "3-Button Mouse" "3TB Portable External Hard Drive" ...
  ..@ itemsetInfo:'data.frame': 0 obs. of  0 variables
```

Get to know your transactional data.

View first 10 transactions

Hide

```
inspect(head(transactions,10))
```

```
     items
[1]  {Acer Aspire,
      Belkin Mouse Pad,
      Brother Printer Toner,
      VGA Monitor Cable}
[2]  {Apple Wireless Keyboard,
      Dell Desktop,
      Lenovo Desktop Computer}
[3]  {iMac}
[4]  {Acer Desktop,
      Intel Desktop,
      Lenovo Desktop Computer,
      XIBERIA Gaming Headset}
[5]  {ASUS Desktop,
      Epson Black Ink,
      HP Laptop,
      iMac}
[6]  {ASUS Monitor,
      Gaming Mouse Professional,
      iMac,
      Lenovo Desktop Computer,
      Mackie CR Speakers}
[7]  {CYBERPOWER Gamer Desktop}
[8]  {Apple MacBook Air,
      Bose Companion Speakers,
      CYBERPOWER Gamer Desktop,
      HP Laptop,
      Large Mouse Pad}
[9]  {Logitech Keyboard}
[10] {Generic Black 3-Button,
      iMac}
```

Number of transactions

Hide

```
length(transactions)
```

```
[1] 9835
```

Items per transactions

Hide

```
sort(size(transactions),decreasing=TRUE)
```

```
  [1] 30 29 27 27 27 26 25 23 23 23 22 22 22 22 22 21 21 21 21 21 21 21 21 21 21 20 20
20 20 20 20 20 20
 [34] 20 20 19 19 19 19 19 19 19 19 19 19 18 18 18 18 18 18 18 18 18 18 18 18 18 18 18
18 18 18 18 18 17
 [67] 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 17 16 16
16 16 16 16 16 16
[100] 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16 16
16 16 16 16 16 16
[133] 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15
15 15 15 15 15 15
[166] 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 14 14 14 14
14 14 14 14 14 14
[199] 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14
14 14 14 14 14 14
[232] 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14 14
14 14 13 13 13 13
[265] 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13
13 13 13 13 13 13
[298] 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13 13
13 13 13 13 13 13
[331] 13 13 13 13 13 13 13 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12
12 12 12 12 12 12
[364] 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12
12 12 12 12 12 12
[397] 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12
12 12 12 12 12 12
[430] 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12 12
11 11 11 11 11 11
[463] 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11
11 11 11 11 11 11
[496] 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11
11 11 11 11 11 11
[529] 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11
11 11 11 11 11 11
[562] 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11
11 11 11 11 11 11
[595] 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11 11
11 11 11 11 11 11
[628] 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10
10 10 10 10 10 10
[661] 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10
10 10 10 10 10 10
[694] 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10
10 10 10 10 10 10
[727] 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10
10 10 10 10 10 10
[760] 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10
10 10 10 10 10 10
[793] 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10
10 10 10 10 10 10
[826] 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10
10 10 10 10 10 10
[859] 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10  9  9  9  9  9  9  9  9  9  9  9
```

```
9  9  9  9  9  9
 [892]  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9
9  9  9  9  9  9
 [925]  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9
9  9  9  9  9  9
 [958]  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9  9
9  9  9  9  9  9
 [991]  9  9  9  9  9  9  9  9  9  9
 [ reached getOption("max.print") -- omitted 8835 entries ]
```

Lists the transactions by conversion

LIST() creates a list representation from objects based on itemMatrix (e.g., transactions, tidLists, or itemsets). These methods can be used for the coercion to a list.

Hide

```
as_list_transactions <- LIST(transactions)
```

Item Labels

Hide

```
itemLabels(transactions)
```

```
 [1] "1TB Portable External Hard Drive"
 [2] "2TB Portable External Hard Drive"
 [3] "3-Button Mouse"
 [4] "3TB Portable External Hard Drive"
 [5] "5TB Desktop Hard Drive"
 [6] "Acer Aspire"
 [7] "Acer Desktop"
 [8] "Acer Monitor"
 [9] "Ailihen Stereo Headphones"
[10] "Alienware Laptop"
[11] "AOC Monitor"
[12] "APIE Bluetooth Headphone"
[13] "Apple Earpods"
[14] "Apple MacBook Air"
[15] "Apple MacBook Pro"
[16] "Apple Magic Keyboard"
[17] "Apple TV"
[18] "Apple Wired Keyboard"
[19] "Apple Wireless Keyboard"
[20] "ASUS 2 Monitor"
[21] "ASUS Chromebook"
[22] "ASUS Desktop"
[23] "ASUS Monitor"
[24] "Audio Cable"
[25] "Backlit LED Gaming Keyboard"
[26] "Belkin Mouse Pad"
[27] "Bose Companion Speakers"
[28] "Brother Printer"
[29] "Brother Printer Toner"
[30] "Cambridge Bluetooth Speaker"
[31] "Canon Ink"
[32] "Canon Office Printer"
[33] "Computer Game"
[34] "Cyber Acoustics"
[35] "CYBERPOWER Gamer Desktop"
[36] "Dell 2 Desktop"
[37] "Dell Desktop"
[38] "Dell KM117 Wireless Keyboard & Mouse"
[39] "Dell Laptop"
[40] "Dell Monitor"
[41] "Dell Wired Keyboard"
[42] "DOSS Touch Wireless Bluetooth"
[43] "DYMO Label Manker"
[44] "DYMO Labeling Tape"
[45] "EagleTec Wireless Combo Keyboard and Mouse"
[46] "Eluktronics Pro Gaming Laptop"
[47] "Epson Black Ink"
[48] "Epson Printer"
[49] "Etekcity Power Extension Cord Cable"
[50] "Ethernet Cable"
[51] "Fire HD Tablet"
[52] "Fire TV Stick"
[53] "Full Motion Monitor Mount"
```

```
 [54] "Gaming Mouse Professional"
 [55] "Generic Black 3-Button"
 [56] "Google Home"
 [57] "Halter Acrylic Monitor Stand"
 [58] "Halter Mesh Metal Monitor Stand"
 [59] "HDMI Adapter"
 [60] "HDMI Cable 6ft"
 [61] "Height-Adjustable Standing Desk"
 [62] "HP Black & Tri-color Ink"
 [63] "HP Desktop"
 [64] "HP Laptop"
 [65] "HP Monitor"
 [66] "HP Notebook Touchscreen Laptop PC"
 [67] "HP USB Keyboard"
 [68] "HP Wireless Mouse"
 [69] "HP Wireless Printer"
 [70] "iMac"
 [71] "Intel Desktop"
 [72] "iPad"
 [73] "iPad Pro"
 [74] "iPhone Charger Cable"
 [75] "JBL Splashproof Portable Bluetooth Speaker"
 [76] "Kensington Headphones"
 [77] "Kindle"
 [78] "Koss Home Headphones"
 [79] "Large Mouse Pad"
 [80] "Lenovo Desktop Computer"
 [81] "LG Monitor"
 [82] "LG Touchscreen Laptop"
 [83] "Logitech 3-button Mouse"
 [84] "Logitech ClearChat Headset"
 [85] "Logitech Desktop MK120 Mouse and keyboard Combo"
 [86] "Logitech Keyboard"
 [87] "Logitech MK270 Wireless Keyboard and Mouse Combo"
 [88] "Logitech MK360 Wireless Keyboard and Mouse Combo"
 [89] "Logitech MK550 Wireless Wave Keyboard and Mouse Combo"
 [90] "Logitech Multimedia Speakers"
 [91] "Logitech Stereo Headset"
 [92] "Logitech Wireless Keyboard"
 [93] "Logitech Wireless Mouse"
 [94] "Mackie CR Speakers"
 [95] "Microsoft Basic Optical Mouse"
 [96] "Microsoft Headset"
 [97] "Microsoft Office Home and Student 2016"
 [98] "Microsoft Wireless Comfort Keyboard and Mouse"
 [99] "Microsoft Wireless Desktop Keyboard and Mouse"
[100] "Monster Beats By Dr Dre"
[101] "Multi Media Stand"
[102] "Otium Wireless Sports Bluetooth Headphone"
[103] "Panasonic In-Ear Headphone"
[104] "Panasonic On-Ear Stereo Headphones"
[105] "PC Gaming Headset"
[106] "Philips Flexible Earhook Headphone"
[107] "Redragon Gaming Mouse"
```

```
[108] "Rii LED Gaming Keyboard & Mouse Combo"
[109] "Rii LED Keyboard"
[110] "Rokono Mini Speaker"
[111] "Roku Express"
[112] "Samsung Charging Cable"
[113] "Samsung Galaxy Tablet"
[114] "Samsung Monitor"
[115] "Sceptre Monitor"
[116] "Slim 2TB Portable External Hard Drive"
[117] "Slim Wireless Mouse"
[118] "Smart Light Bulb"
[119] "Sonos"
[120] "USB Cable"
[121] "VGA Monitor Cable"
[122] "ViewSonic Monitor"
[123] "Wireless Portable Mouse"
[124] "XIBERIA Gaming Headset"
[125] "Zombie Gaming Headset"
```

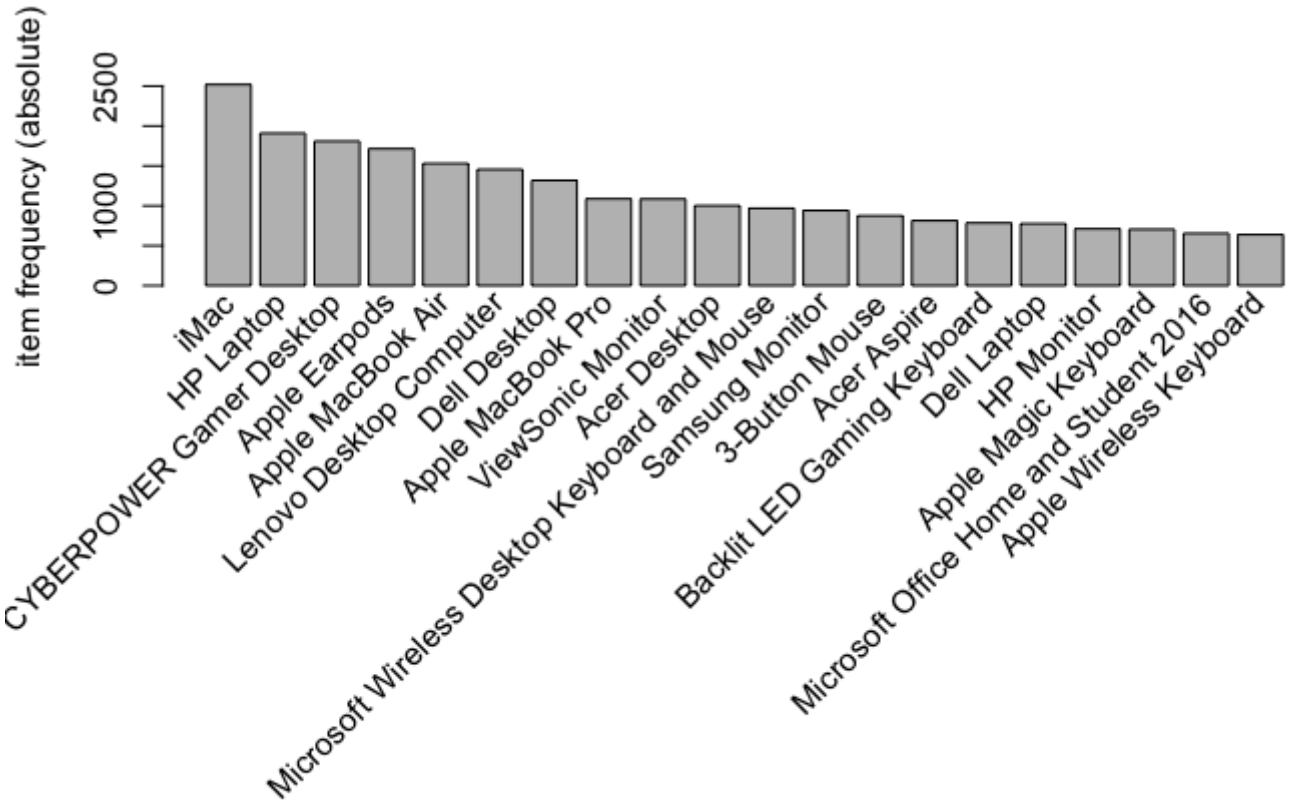
https://cran.r-project.org/web/packages/arules/arules.pdf (https://cran.r-project.org/web/packages/arules/arules.pdf) :

- itemLabels signature(object = “itemMatrix”); – returns the item labels used for encoding as a character vector. – returns the item labels used to encode the rules – returns the item labels as a character vector. The index for each label is the column index of the item in the binary matrix.

What are the most frequent items?

Hide

```
itemFrequencyPlot(transactions,topN=20,type="absolute")
```



Least Frequent Selling Items

Hide

```
sort(itemFrequency(transactions))
```

Logitech Wireless Keyboard
0.002236909
VGA Monitor Cable
0.002236909
Panasonic On-Ear Stereo Headphones
0.002338587
1TB Portable External Hard Drive
0.002745297
Canon Ink
0.002745297
Logitech Stereo Headset
0.003050330
Ethernet Cable
0.003253686
Canon Office Printer
0.003558719
Gaming Mouse Professional
0.003558719
Audio Cable
0.003660397
Logitech Multimedia Speakers
0.003863752
5TB Desktop Hard Drive
0.004168785
Roku Express
0.004168785
XIBERIA Gaming Headset
0.004270463
Philips Flexible Earhook Headphone
0.004473818
Samsung Galaxy Tablet
0.004575496
HP Notebook Touchscreen Laptop PC
0.005185562
Kindle
0.005287239
HDMI Adapter
0.005388917
EagleTec Wireless Combo Keyboard and Mouse
0.005592272
Generic Black 3-Button
0.005693950
DYMO Label Manker
0.005795628
Multi Media Stand
0.005998983
2TB Portable External Hard Drive
0.006100661
USB Cable
0.006304016
DOSS Touch Wireless Bluetooth
0.006507372
Kensington Headphones

0.006507372
3TB Portable External Hard Drive
0.006914082
Microsoft Wireless Comfort Keyboard and Mouse
0.007219115
Mackie CR Speakers
0.007625826
Samsung Charging Cable
0.007727504
Large Mouse Pad
0.007930859
Logitech MK360 Wireless Keyboard and Mouse Combo
0.008032537
Logitech Desktop MK120 Mouse and keyboard Combo
0.008134215
Dell Monitor
0.008439248
Google Home
0.008540925
HP USB Keyboard
0.008540925
Sceptre Monitor
0.008947636
Fire TV Stick
0.009049314
Logitech ClearChat Headset
0.009049314
Height-Adjustable Standing Desk
0.009150991
Rokono Mini Speaker
0.009252669
APIE Bluetooth Headphone
0.009456024
Halter Mesh Metal Monitor Stand
0.010371124
Full Motion Monitor Mount
0.010777834
Apple Wired Keyboard
0.011184545
DYMO Labeling Tape
0.011387900
Fire HD Tablet
0.011997966
Logitech Wireless Mouse
0.013014743
Rii LED Keyboard
0.013218099
Monster Beats By Dr Dre
0.013421454
PC Gaming Headset
0.014234875
Ailihen Stereo Headphones
0.014641586
Cyber Acoustics

0.015048297
Halter Acrylic Monitor Stand
0.015048297
Apple TV
0.015353330
HP Black & Tri-color Ink
0.016268429
Dell Wired Keyboard
0.016573462
Koss Home Headphones
0.017081851
Rii LED Gaming Keyboard & Mouse Combo
0.017386884
JBL Splashproof Portable Bluetooth Speaker
0.017590239
Brother Printer Toner
0.017691917
Smart Light Bulb
0.017691917
Microsoft Basic Optical Mouse
0.017895272
Epson Black Ink
0.018403660
iPhone Charger Cable
0.019013726
LG Touchscreen Laptop
0.019013726
Dell KM117 Wireless Keyboard & Mouse
0.019217082
Microsoft Headset
0.021047280
Logitech MK270 Wireless Keyboard and Mouse Combo
0.022369090
Zombie Gaming Headset
0.022369090
Redragon Gaming Mouse
0.023284189
Logitech MK550 Wireless Wave Keyboard and Mouse Combo
0.024504321
Panasonic In-Ear Headphone
0.024911032
Sonos
0.025012710
Otium Wireless Sports Bluetooth Headphone
0.025826131
HDMI Cable 6ft
0.026029487
Slim 2TB Portable External Hard Drive
0.026029487
HP Desktop
0.027351296
Logitech Keyboard
0.027656329
Alienware Laptop

0.027961362
Cambridge Bluetooth Speaker
0.028368073
Etekcity Power Extension Cord Cable
0.030706660
Brother Printer
0.032943569
Dell 2 Desktop
0.033248602
Bose Companion Speakers
0.033451957
iPad
0.034163701
Eluktronics Pro Gaming Laptop
0.035688866
HP Wireless Printer
0.037112354
ASUS Desktop
0.037417387
Slim Wireless Mouse
0.037824098
Wireless Portable Mouse
0.038434164
Intel Desktop
0.039654296
Computer Game
0.041992883
AOC Monitor
0.042094560
HP Wireless Mouse
0.043518048
Epson Printer
0.048093543
iPad Pro
0.052364006
ASUS Chromebook
0.052465684
ASUS Monitor
0.055414337
ASUS 2 Monitor
0.057651246
LG Monitor
0.057651246
Belkin Mouse Pad
0.058566345
Acer Monitor
0.058973055
Apple Wireless Keyboard
0.064870361
Logitech 3-button Mouse
0.064870361
Microsoft Office Home and Student 2016
0.066497204
Apple Magic Keyboard

```
                                    0.071682766
                                     HP Monitor
                                    0.072292832
                                    Dell Laptop
                                    0.078901881
                  Backlit LED Gaming Keyboard
                                    0.079816980
                                    Acer Aspire
                                    0.082765633
                                3-Button Mouse
                                    0.088967972
                               Samsung Monitor
                                    0.095678699
Microsoft Wireless Desktop Keyboard and Mouse
                                    0.098525674
                                   Acer Desktop
                                    0.101881037
                              ViewSonic Monitor
                                    0.110320285
                              Apple MacBook Pro
                                    0.110523640
                                   Dell Desktop
                                    0.134011185
                 Lenovo Desktop Computer
                                    0.148042705
                              Apple MacBook Air
                                    0.155566853
                                  Apple Earpods
                                    0.174377224
                 CYBERPOWER Gamer Desktop
                                    0.183934926
                                    HP Laptop
                                    0.194102694
                                           iMac
                                    0.256126080
```

How many items do customers purchase the most? Least?

Hide

```
summary(transactions)
```

```
transactions as itemMatrix in sparse format with
 9835 rows (elements/itemsets/transactions) and
 125 columns (items) and a density of 0.03506172

most frequent items:
                   iMac                 HP Laptop CYBERPOWER Gamer Desktop            Ap
ple Earpods
                   2519                      1909                      1809
1715
       Apple MacBook Air                   (Other)
                   1530                     33622

element (itemset/transaction) length distribution:
sizes
   0    1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16   1
7   18   19   20
   2 2163 1647 1294 1021  856  646  540  439  353  247  171  119   77   72   56   41   2
6   20   10   10
  21   22   23   25   26   27   29   30
  10    5    3    1    1    3    1    1

   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  0.000   2.000   3.000   4.383   6.000  30.000

includes extended item information - examples:
```

	labels <chr>
1	1TB Portable External Hard Drive
2	2TB Portable External Hard Drive
3	3-Button Mouse

3 rows

Customers purchase most often purchase 1 item at a time. The least often purchase 25 to 30 items at a time.

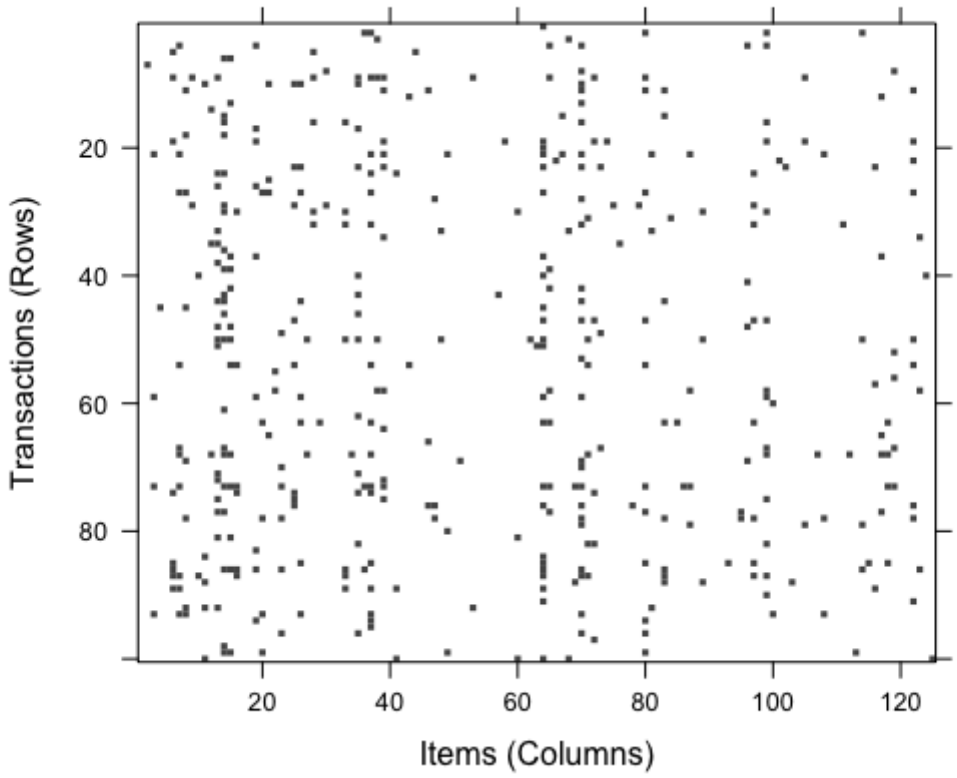
It's interesting that there are 2 transactions that have 0 items. Those shouldn't be in the dataset at all.

It looks like computers are the main categories of items purchased followed by keyboards.

Visualize all transactions within dataset

Hide

```
image(sample(transactions, 100))
```



This looks pretty random If anything, the first 40 items are purchased more.

apriori algorithm

Support gives an idea of how frequent an itemset is in all the transactions. Value of support helps us identify the rules worth considering for further analysis. If an itemset happens to have a very low support, we do not have enough information on the relationship between its items and hence no conclusions can be drawn from such a rule.

minlen is the minimum number of items required in the rule. A minlen of 3 returns rules with at least 2 items in the itemset. After tuning the minimum support and confidence values, it already seems like there are not a lot of items that have strong associations.

Hide

```
rulesTransactions<- apriori (transactions, parameter = list(supp = 0.01, conf = 0.5, min
len=2))
```

```
Apriori

Parameter specification:
```

confidence <dbl>	minval <dbl>	s… <dbl>	ar… <fctr>	aval <lgl>	originalSupport <lgl>	maxtime <dbl>	support <dbl>	minlen <int>
0.5	0.1	1	none	FALSE	TRUE	5	0.01	2

1 row | 1-10 of 12 columns

```
Algorithmic control:
```

filter	tree	heap	memopt	load	sort	verbose
<dbl>	<lgl>	<lgl>	<lgl>	<lgl>	<int>	<lgl>
0.1	TRUE	TRUE	FALSE	TRUE	2	TRUE

1 row

```
Absolute minimum support count: 98

set item appearances ...[0 item(s)] done [0.00s].
set transactions ...[125 item(s), 9835 transaction(s)] done [0.01s].
sorting and recoding items ... [82 item(s)] done [0.00s].
creating transaction tree ... done [0.01s].
checking subsets of size 1 2 3 4 done [0.01s].
writing ... [19 rule(s)] done [0.00s].
creating S4 object  ... done [0.00s].
```

Hide

```
inspect(rulesTransactions)
```

	lhs		rhs	suppor
	<fctr>	<fctr>	<fctr>	<dbl>
[1]	{ASUS 2 Monitor,Lenovo Desktop Computer}	=>	{iMac}	0.0108795
[2]	{ASUS 2 Monitor,HP Laptop}	=>	{iMac}	0.0110828
[3]	{ASUS Monitor,HP Laptop}	=>	{iMac}	0.0117946
[4]	{HP Laptop,Microsoft Office Home and Student 2016}	=>	{iMac}	0.0129130
[5]	{HP Laptop,HP Monitor}	=>	{iMac}	0.0105744
[6]	{Apple Magic Keyboard,Dell Desktop}	=>	{iMac}	0.0101677
[7]	{Apple Magic Keyboard,Lenovo Desktop Computer}	=>	{iMac}	0.0113879
[8]	{Apple Magic Keyboard,HP Laptop}	=>	{iMac}	0.0147432
[9]	{Acer Aspire,ViewSonic Monitor}	=>	{HP Laptop}	0.0107778
[10]	{Acer Desktop,ViewSonic Monitor}	=>	{iMac}	0.0100660

1-10 of 19 rows | 1-6 of 7 columns Previous **1** 2 Next

Evalaute model

Hide

```
summary(rulesTransactions)
```

```
set of 19 rules

rule length distribution (lhs + rhs):sizes
 3
19

   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
      3       3       3       3       3       3

summary of quality measures:
    support          confidence          lift           count
 Min.   :0.01007   Min.   :0.5000   Min.   :1.952   Min.   : 99.0
 1st Qu.:0.01098   1st Qu.:0.5110   1st Qu.:2.006   1st Qu.:108.0
 Median :0.01230   Median :0.5440   Median :2.156   Median :121.0
 Mean   :0.01343   Mean   :0.5439   Mean   :2.234   Mean   :132.1
 3rd Qu.:0.01500   3rd Qu.:0.5788   3rd Qu.:2.280   3rd Qu.:147.5
 Max.   :0.02308   Max.   :0.6023   Max.   :3.103   Max.   :227.0

mining info:
```

	data	ntransactions	support	confidence
	<fctr>	<int>	<dbl>	<dbl>
	transactions	9835	0.01	0.5

1 row

Lift measures the importance of a rule. In cases where {X} actually leads to {Y} on the cart, value of lift will be greater than 1. A value of lift less than 1 shows that having the second item on the cart does not increase the chances of occurrence of the first item in spite of the rule showing a high confidence value.

https://towardsdatascience.com/association-rules-2-aa9a77241654
(https://towardsdatascience.com/association-rules-2-aa9a77241654)

In our case, the lift is higher than 1 for all of our rules.

Sort rules by their measurements

Hide

```
inspect(sort( rulesTransactions, by = "lift"))
```

	lhs		rhs	suppor
	<fctr>	<fctr>	<fctr>	<dbl>
[1]	{Acer Aspire,ViewSonic Monitor}	=>	{HP Laptop}	0.0107783
[2]	{Dell Desktop,ViewSonic Monitor}	=>	{HP Laptop}	0.0152516

	lhs <fctr>		rhs <fctr>	suppor <dbl>
[3]	{CYBERPOWER Gamer Desktop,ViewSonic Monitor}	=>	{HP Laptop}	0.01220132
[4]	{ASUS 2 Monitor,Lenovo Desktop Computer}	=>	{iMac}	0.0108795
[5]	{Apple Magic Keyboard,Dell Desktop}	=>	{iMac}	0.0101677
[6]	{ASUS Monitor,HP Laptop}	=>	{iMac}	0.0117946
[7]	{ASUS 2 Monitor,HP Laptop}	=>	{iMac}	0.0110828
[8]	{Dell Desktop,ViewSonic Monitor}	=>	{iMac}	0.0147432
[9]	{Lenovo Desktop Computer,ViewSonic Monitor}	=>	{iMac}	0.0157600
[10]	{HP Laptop,Microsoft Office Home and Student 2016}	=>	{iMac}	0.0129130

1-10 of 19 rows | 1-6 of 7 columns Previous **1** 2 Next

I chose to sort by lift, because really, support and confidence are already low.

Let's look at rules with a lift higher than 2.5, or the first 3 rules.

Hide

```
inspect(head(sort( rulesTransactions, by = "lift"),3))
```

	lhs <fctr>		rhs <fctr>	support <dbl>	confid <dbl>
[1]	{Acer Aspire,ViewSonic Monitor}	=>	{HP Laptop}	0.01077783	0.602
[2]	{Dell Desktop,ViewSonic Monitor}	=>	{HP Laptop}	0.01525165	0.574
[3]	{CYBERPOWER Gamer Desktop,ViewSonic Monitor}	=>	{HP Laptop}	0.01220132	0.502

3 rows | 1-7 of 7 columns

Hide

```
NA
```

View rules for "View Sonic Monitor"

Hide

```
ViewSonicMonitorRules <- subset(rulesTransactions, items %in% "ViewSonic Monitor")
inspect(ViewSonicMonitorRules)
```

	lhs <fctr>		rhs <fctr>	support <dbl>	confid <dbl>

	lhs		rhs	support	confid
	<fctr>		<fctr>	<dbl>	<
[1]	{Acer Aspire,ViewSonic Monitor}	=>	{HP Laptop}	0.01077783	0.602
[2]	{Acer Desktop,ViewSonic Monitor}	=>	{iMac}	0.01006609	0.543
[3]	{Dell Desktop,ViewSonic Monitor}	=>	{HP Laptop}	0.01525165	0.574
[4]	{Dell Desktop,ViewSonic Monitor}	=>	{iMac}	0.01474326	0.555
[5]	{CYBERPOWER Gamer Desktop,ViewSonic Monitor}	=>	{HP Laptop}	0.01220132	0.502
[6]	{CYBERPOWER Gamer Desktop,ViewSonic Monitor}	=>	{iMac}	0.01281139	0.527
[7]	{Lenovo Desktop Computer,ViewSonic Monitor}	=>	{iMac}	0.01576004	0.555

7 rows | 1-7 of 7 columns

Remove redundant rules

Hide

```
is.redundant(rulesTransactions)
```

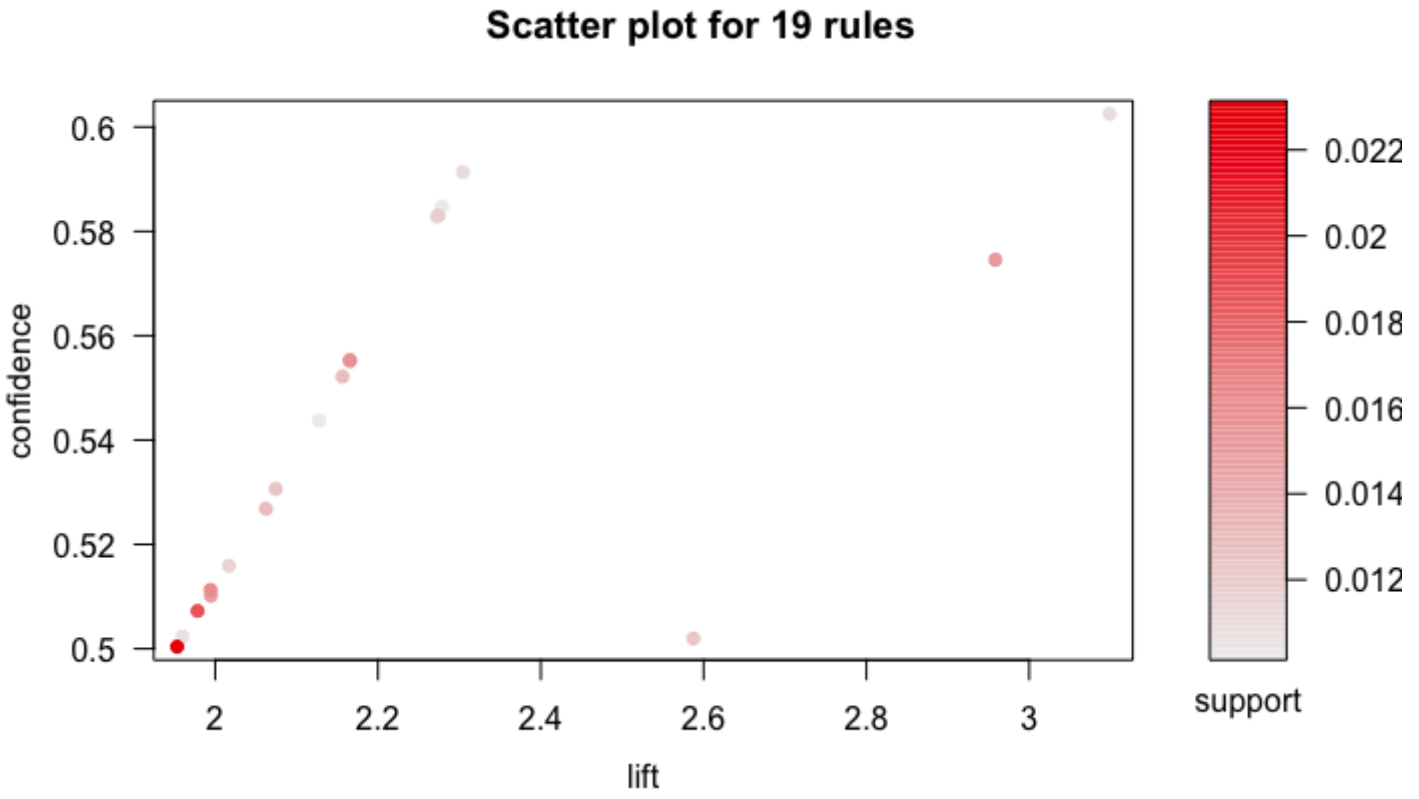
```
 [1] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
FALSE FALSE FALSE
[18] FALSE FALSE
```

None of are rules are redundant.

Visualize Rules

Hide

```
plot(rulesTransactions, measure="lift",shading="support")
```



Hide

```
html_plot <- plot(rulesTransactions, method="graph",engine="htmlwidget")
install.packages("arules")
```

```
trying URL 'https://cran.rstudio.com/bin/macosx/el-capitan/contrib/3.6/arules_1.6-4.tgz'
Content type 'application/x-gzip' length 2713455 bytes (2.6 MB)
==================================================
downloaded 2.6 MB
```

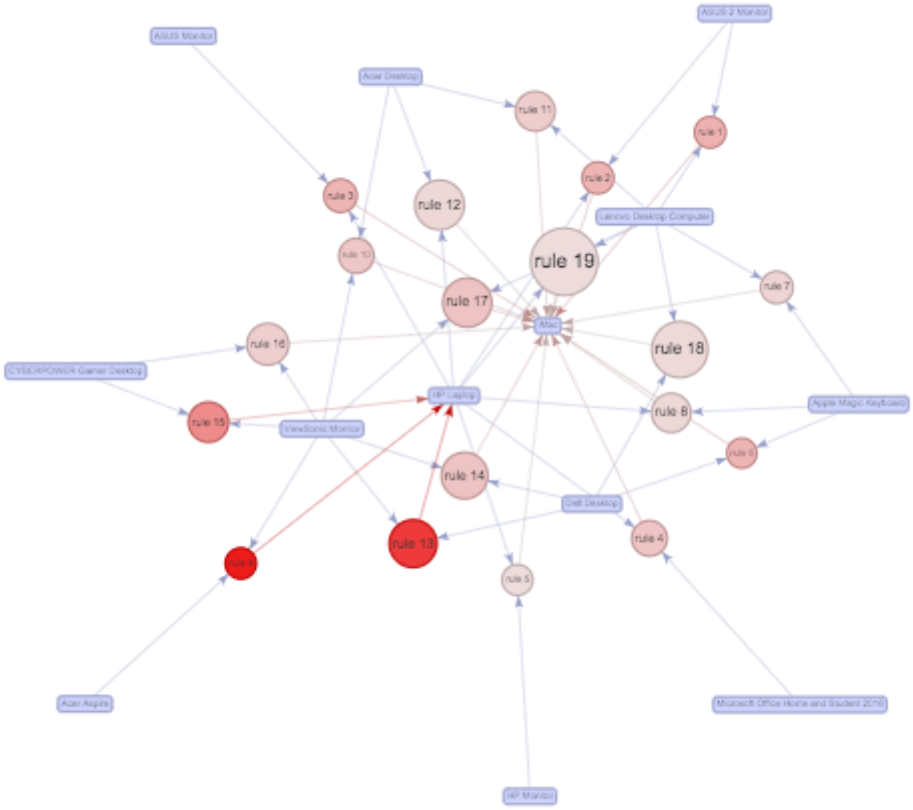
```


The downloaded binary packages are in
    /var/folders/hm/2md7sccd0479bw81zsh0yyq80000gn/T//Rtmpp4nUa6/downloaded_packages
```

Hide

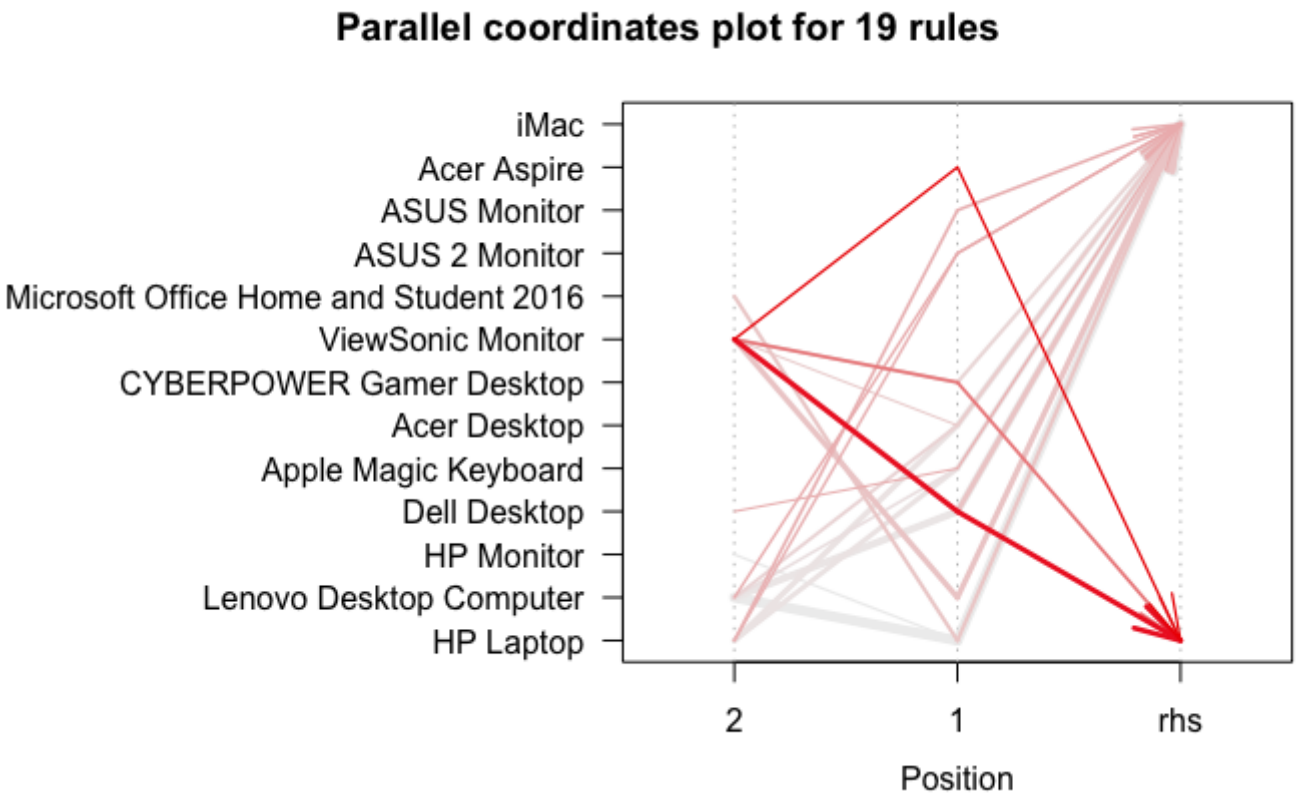
```
html_plot
```

Select by id



Hide

```
plot(rulesTransactions, method="paracoord")
```



Hide

```
plot(rulesTransactions, method="grouped")
```