Lab3

Grupo:

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Regras de Associação

Pacotes Utilizados

```
Loading required package: Matrix


Attaching package: 'arules'

The following objects are masked from 'package:base':

    abbreviate, write

── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──
✔ dplyr     1.1.0     ✔ readr     2.1.4
✔ forcats   1.0.0     ✔ stringr   1.5.0
✔ ggplot2   3.4.1     ✔ tibble    3.2.0
✔ lubridate 1.9.2     ✔ tidyr     1.3.0
✔ purrr     1.0.1
── Conflicts ────────────────────────────────────────── tidyverse_conflicts() ──
✖ tidyr::expand() masks Matrix::expand()
✖ dplyr::filter() masks stats::filter()
✖ dplyr::lag()    masks stats::lag()
✖ tidyr::pack()   masks Matrix::pack()
✖ dplyr::recode() masks arules::recode()
✖ tidyr::unpack() masks Matrix::unpack()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to
become errors
------------------------------------------------------------------------------

You have loaded plyr after dplyr - this is likely to cause problems.
If you need functions from both plyr and dplyr, please load plyr first, then dplyr:
library(plyr); library(dplyr)

------------------------------------------------------------------------------


Attaching package: 'plyr'


The following objects are masked from 'package:dplyr':

    arrange, count, desc, failwith, id, mutate, rename, summarise,
    summarize


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

    compact
```

Dados

Dados

```
retail <- read_excel('Online Retail.xlsx')
retail <- retail[complete.cases(retail), ]
retail <- retail |>
  mutate(
    Description = as.factor(Description),
    Country = as.factor(Country),
    Date = as.Date(InvoiceDate),
    TransTime = format(InvoiceDate,"%H:%M:%S"),
    InvoiceNo = as.numeric(as.character(InvoiceNo)))
```

```
Warning in eval(cols[[col]], .data, parent.frame()): NAs introduced by coercion
```

```
glimpse(retail)
```

```
Rows: 406,829
Columns: 10
$ InvoiceNo   <dbl> 536365, 536365, 536365, 536365, 536365, 536365, 536365, 53…
$ StockCode   <chr> "85123A", "71053", "84406B", "84029G", "84029E", "22752", …
$ Description <fct> "WHITE HANGING HEART T-LIGHT HOLDER", "WHITE METAL LANTERN…
$ Quantity    <dbl> 6, 6, 8, 6, 6, 2, 6, 6, 6, 32, 6, 6, 8, 6, 6, 3, 2, 3, 3, …
$ InvoiceDate <dttm> 2010-12-01 08:26:00, 2010-12-01 08:26:00, 2010-12-01 08:2…
$ UnitPrice   <dbl> 2.55, 3.39, 2.75, 3.39, 3.39, 7.65, 4.25, 1.85, 1.85, 1.69…
$ CustomerID  <dbl> 17850, 17850, 17850, 17850, 17850, 17850, 17850, 17850, 17…
$ Country     <fct> United Kingdom, United Kingdom, United Kingdom, United Kin…
$ Date        <date> 2010-12-01, 2010-12-01, 2010-12-01, 2010-12-01, 2010-12-0…
$ TransTime   <chr> "08:26:00", "08:26:00", "08:26:00", "08:26:00", "08:26:00"…
```

```
#retail |> glimpse()
transactionData <- ddply(retail,c("InvoiceNo","Date"),function(df1)paste(df1$Description, c
transactionData$InvoiceNo <- NULL
transactionData$Date <- NULL
colnames(transactionData) <- c("items")


transactionData |> write.csv("market_basket_transactions.csv", quote = FALSE,row.names = FA
```

Transações

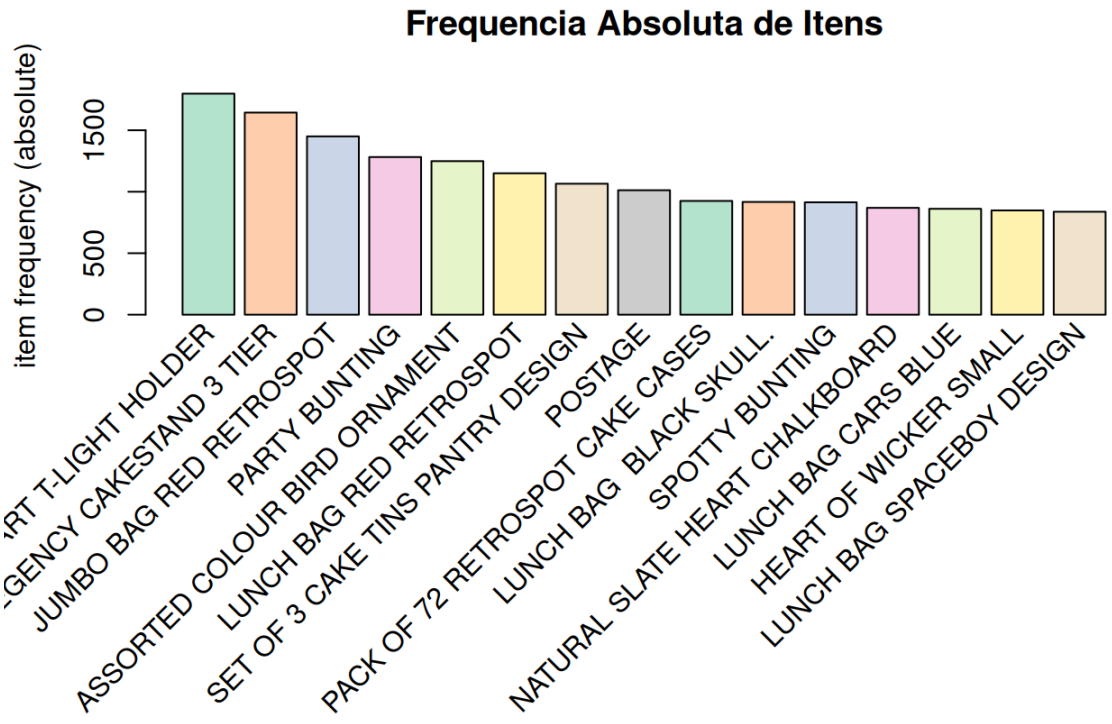
COMENTÁRIOS: Nesta etapa o número de transações e item difere do que foi apresentado no documento. Obtivemos um número menor de transações e um número bem menor de items. Isso faz com que os próximos resultados sejam um pouco diferentes. Deixamos os códigos para mostrar que o pré-processamento foi igual

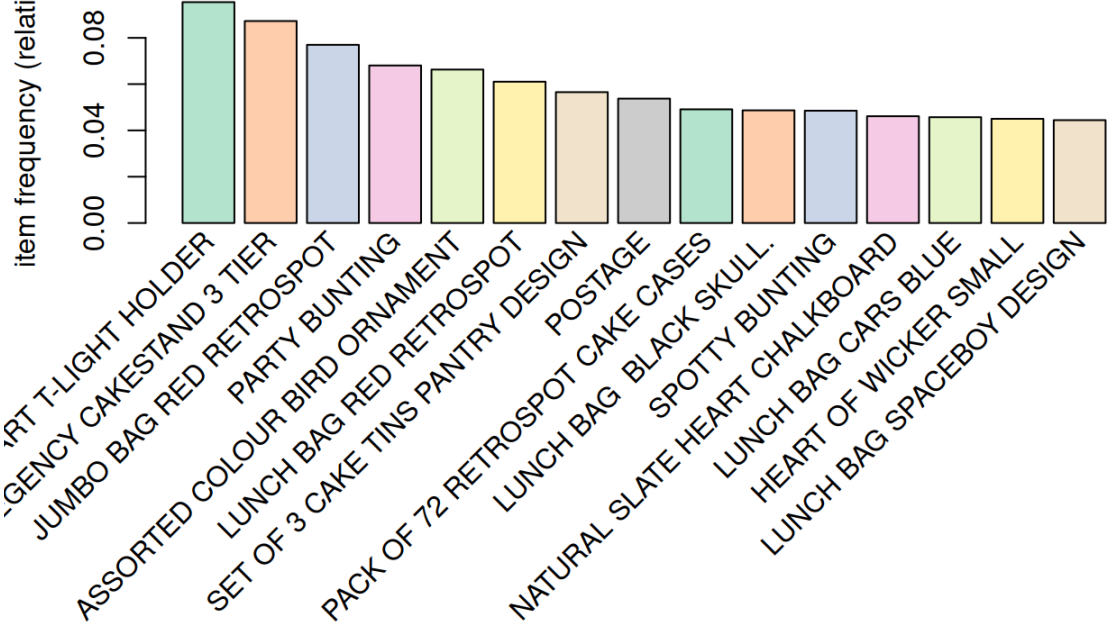
```
transactions in sparse format with
 18839 transactions (rows) and
 7887 items (columns)
```

COMENTÁRIOS: A densidade foi um pocuo maior da apresentada no documento do laboratório. Mas os demais resultados são praticamente iguais

```
transactions as itemMatrix in sparse format with
 18839 rows (elements/itemsets/transactions) and
 7887 columns (items) and a density of 0.002260834

most frequent items:
WHITE HANGING HEART T-LIGHT HOLDER           REGENCY CAKESTAND 3 TIER
                              1798                               1644
           JUMBO BAG RED RETROSPOT                      PARTY BUNTING
                              1450                               1282
     ASSORTED COLOUR BIRD ORNAMENT                            (Other)
                              1249                             328499
```

```
element (itemset/transaction) length distribution:
sizes
   1    2    3    4    5    6    7    8    9   10   11   12   13   14   15   16
1578  867  762  773  768  721  660  652  648  586  621  532  510  532  555  525
  17   18   19   20   21   22   23   24   25   26   27   28   29   30   31   32
 470  442  483  425  396  319  310  276  241  255  230  218  223  215  173  163
  33   34   35   36   37   38   39   40   41   42   43   44   45   46   47   48
 143  146  139  112  118   89  117   96   97   89   93   67   66   68   65   61
  49   50   51   52   53   54   55   56   57   58   59   60   61   62   63   64
  64   53   67   43   42   50   43   37   31   40   30   27   28   18   26   25
  65   66   67   68   69   70   71   72   73   74   75   76   77   78   79   80
  20   27   25   25   15   20   20   13   16   16   12   16   12    7    9   14
  81   82   83   84   85   86   87   88   89   90   91   92   93   94   95   96
  15   12    8    9   11   11   14    8    6    5    6   12    6    4    4    3
  97   98   99  100  101  102  103  104  105  106  107  108  109  110  111  112
   6    5    2    4    2    5    4    3    2    2    6    3    4    3    2    1
 113  114  116  117  118  120  121  122  123  125  126  127  131  132  133  134
   3    1    4    3    3    1    2    2    1    3    2    2    1    1    2    1
 140  141  142  143  145  146  147  150  154  157  168  171  177  178  180  202
   1    2    2    1    1    2    1    1    3    2    2    2    1    1    1    1
 204  228  236  249  250  285  320  400  419
   1    1    1    1    1    1    1    1    1

   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   1.00    5.00   13.00   17.83   23.00  419.00

includes extended item information - examples:
                      labels
1                   1 HANGER
2     10 COLOUR SPACEBOY PEN
3 12 COLOURED PARTY BALLOONS

Loading required package: RColorBrewer
```





COMENTÁRIOS: Itens mais frequentes devem ser observados com maior cuidado pelo varejista. No entando , é importante ressaltar que o varejista pode querer observar essas informações em uma janela mais recente das vendas. Pressupõe-se que o padrão de compras não mudou ao longo do 1 ano que se tem registro na base

```
[1] "Data mínima: "

[1] "2010-12-01"

[1] "Data máxima: "

[1] "2011-12-09"

# A tibble: 305 × 2
   Date           n
   <date>     <int>
 1 2010-12-01  1968
 2 2010-12-02  2044
 3 2010-12-03  1117
 4 2010-12-05  2724
 5 2010-12-06  1974
 6 2010-12-07  1133
 7 2010-12-08  2021
 8 2010-12-09  1822
 9 2010-12-10  1449
10 2010-12-12  1448
# i 295 more rows
```

Gerando Regras

COMENTÁRIOS: Aumentamos o suporte para 0.002, isso alterou bastante o número de regras criadas. Enquanto para um suporte de 0.001 temos 116493 , enquanto para um suporte de 0.002 temos bem menos regras (8280)

```
summary(apriori(tr, parameter = list(supp=0.001, conf=0.8,maxlen=10)))
```

```
Apriori

Parameter specification:
 confidence minval smax arem  aval originalSupport maxtime support minlen
        0.8    0.1    1 none FALSE            TRUE       5   0.001      1
 maxlen target  ext
```

```
     10  rules TRUE

Algorithmic control:
 filter tree heap memopt load sort verbose
    0.1 TRUE TRUE  FALSE TRUE    2    TRUE

Absolute minimum support count: 18

set item appearances ...[0 item(s)] done [0.00s].
set transactions ...[7887 item(s), 18839 transaction(s)] done [0.07s].
sorting and recoding items ... [2455 item(s)] done [0.01s].
creating transaction tree ... done [0.00s].
checking subsets of size 1 2 3 4 5 6 7 8 9 10

Warning in apriori(tr, parameter = list(supp = 0.001, conf = 0.8, maxlen =
10)): Mining stopped (maxlen reached). Only patterns up to a length of 10
returned!

 done [0.22s].
writing ... [116493 rule(s)] done [0.03s].
creating S4 object  ... done [0.02s].

set of 116493 rules

rule length distribution (lhs + rhs):sizes
    2     3     4     5     6     7     8     9    10
  111  3378 10947 29980 39875 23872  6860  1249   221

   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  2.000   5.000   6.000   5.826   7.000  10.000

summary of quality measures:
    support           confidence        coverage             lift
 Min.   :0.001009   Min.   :0.8000   Min.   :0.001009   Min.   :  8.382
 1st Qu.:0.001062   1st Qu.:0.8333   1st Qu.:0.001168   1st Qu.: 18.897
 Median :0.001168   Median :0.8750   Median :0.001327   Median : 23.917
 Mean   :0.001323   Mean   :0.8870   Mean   :0.001499   Mean   : 48.813
 3rd Qu.:0.001380   3rd Qu.:0.9310   3rd Qu.:0.001592   3rd Qu.: 39.552
 Max.   :0.022453   Max.   :1.0000   Max.   :0.027921   Max.   :607.710
     count
 Min.   : 19.00
 1st Qu.: 20.00
 Median : 22.00
 Mean   : 24.92
 3rd Qu.: 26.00
 Max.   :423.00

mining info:
 data ntransactions support confidence
   tr         18839   0.001        0.8
                                                                        call
 apriori(data = tr, parameter = list(supp = 0.001, conf = 0.8, maxlen = 10))
```

```r
association.rules <- apriori(tr, parameter = list(supp=0.002, conf=0.8,maxlen=10))
```

```
Apriori

Parameter specification:
 confidence minval smax arem  aval originalSupport maxtime support minlen
        0.8    0.1    1 none FALSE            TRUE       5   0.002      1
 maxlen target  ext
     10  rules TRUE

Algorithmic control:
 filter tree heap memopt load sort verbose
```

```
 filter tree heap memopt load sort verbose
    0.1 TRUE TRUE  FALSE TRUE    2    TRUE

Absolute minimum support count: 37

set item appearances ...[0 item(s)] done [0.00s].
set transactions ...[7887 item(s), 18839 transaction(s)] done [0.07s].
sorting and recoding items ... [1920 item(s)] done [0.01s].
creating transaction tree ... done [0.00s].
checking subsets of size 1 2 3 4 5 6 7 8 9 done [0.07s].
writing ... [8280 rule(s)] done [0.01s].
creating S4 object  ... done [0.00s].
```

```
summary(association.rules)
```

```
set of 8280 rules

rule length distribution (lhs + rhs):sizes
   2    3    4    5    6    7    8    9
  95  688 1810 2261 2000 1161  256    9

   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
    2.0     4.0     5.0     5.2     6.0     9.0

summary of quality measures:
    support           confidence        coverage             lift
 Min.   :0.002017   Min.   :0.8000   Min.   :0.002017   Min.   :  8.456
 1st Qu.:0.002123   1st Qu.:0.8333   1st Qu.:0.002442   1st Qu.: 18.907
 Median :0.002389   Median :0.8711   Median :0.002707   Median : 22.586
 Mean   :0.002706   Mean   :0.8774   Mean   :0.003094   Mean   : 43.382
 3rd Qu.:0.002813   3rd Qu.:0.9130   3rd Qu.:0.003291   3rd Qu.: 60.085
 Max.   :0.022453   Max.   :1.0000   Max.   :0.027921   Max.   :495.763
     count
 Min.   : 38.00
 1st Qu.: 40.00
 Median : 45.00
 Mean   : 50.98
 3rd Qu.: 53.00
 Max.   :423.00

mining info:
 data ntransactions support confidence
   tr         18839   0.002        0.8
                                                                          call
 apriori(data = tr, parameter = list(supp = 0.002, conf = 0.8, maxlen = 10))
```

```
     lhs                                    rhs
support confidence    coverage      lift count
[1]  {ART LIGHTS}                        => {FUNK MONKEY}
0.002017092  1.0000000 0.002017092 495.76316    38
[2]  {FUNK MONKEY}                       => {ART LIGHTS}
0.002017092  1.0000000 0.002017092 495.76316    38
[3]  {CHOCOLATE  SPOTS}                  => {SWISS ROLL TOWEL}
0.002282499  1.0000000 0.002282499 392.47917    43
[4]  {SWISS ROLL TOWEL}                  => {CHOCOLATE  SPOTS}
0.002282499  0.8958333 0.002547906 392.47917    43
[5]  {BLACK TEA}                         => {SUGAR JARS}
0.002441743  1.0000000 0.002441743 204.77174    46
[6]  {BLACK TEA}                         => {COFFEE}
0.002441743  1.0000000 0.002441743  59.42902    46
[7]  {FRENCH BLUE METAL DOOR SIGN 0}     => {FRENCH BLUE METAL DOOR SIGN 2}
0.002707150  0.8225806 0.003291045 154.96597    51
[8]  {FRENCH BLUE METAL DOOR SIGN 0}     => {FRENCH BLUE METAL DOOR SIGN 1}
0.002813313  0.8548387 0.003291045 135.33031    53
[9]  {GREEN 3 PIECE POLKADOT CUTLERY SET} => {RED 3 PIECE RETROSPOT CUTLERY SET}
```

```
0.002494825  0.8103448 0.003078720 177.51263    47
[10] {NURSERY A}                          => {B}
0.002919476  1.0000000 0.002919476 342.52727    55
```

Limitar o número e o tamanho das regras

COMENTÁRIOS: Aqui fomos ainda mais agressivos , queremos apenas aqueles que possuem 95% de confiança . Para compensar aumentamos o max len para 5

```
shorter.association.rules <- apriori(tr, parameter = list(supp=0.001,
conf=0.95,maxlen=5))
```

```
Apriori

Parameter specification:
 confidence minval smax arem  aval originalSupport maxtime support minlen
       0.95    0.1    1 none FALSE            TRUE       5   0.001      1
 maxlen target  ext
      5  rules TRUE

Algorithmic control:
 filter tree heap memopt load sort verbose
    0.1 TRUE TRUE  FALSE TRUE    2    TRUE

Absolute minimum support count: 18

set item appearances ...[0 item(s)] done [0.00s].
set transactions ...[7887 item(s), 18839 transaction(s)] done [0.06s].
sorting and recoding items ... [2455 item(s)] done [0.01s].
creating transaction tree ... done [0.00s].
checking subsets of size 1 2 3 4 5

Warning in apriori(tr, parameter = list(supp = 0.001, conf = 0.95, maxlen =
5)): Mining stopped (maxlen reached). Only patterns up to a length of 5
returned!

 done [0.17s].
writing ... [6163 rule(s)] done [0.02s].
creating S4 object  ... done [0.01s].
```

```
inspect(shorter.association.rules[1:10])
```

```
     lhs                          rhs                 support     confidence
[1]  {WOBBLY CHICKEN}          => {METAL}             0.001486278 1
[2]  {WOBBLY CHICKEN}          => {DECORATION}        0.001486278 1
[3]  {DECOUPAGE}               => {GREETING CARD}     0.001220872 1
[4]  {BILLBOARD FONTS DESIGN}  => {WRAP}              0.001539360 1
[5]  {WOBBLY RABBIT}           => {METAL}             0.001804767 1
[6]  {WOBBLY RABBIT}           => {DECORATION}        0.001804767 1
[7]  {ART LIGHTS}              => {FUNK MONKEY}       0.002017092 1
[8]  {FUNK MONKEY}             => {ART LIGHTS}        0.002017092 1
[9]  {CHOCOLATE  SPOTS}        => {SWISS ROLL TOWEL}  0.002282499 1
[10] {BLACK TEA}               => {SUGAR JARS}        0.002441743 1
     coverage    lift     count
[1]  0.001486278 376.7800 28
[2]  0.001486278 376.7800 28
[3]  0.001220872 330.5088 23
[4]  0.001539360 607.7097 29
[5]  0.001804767 376.7800 34
[6]  0.001804767 376.7800 34
[7]  0.002017092 495.7632 38
[8]  0.002017092 495.7632 38
[9]  0.002282499 392.4792 43
[10] 0.002441743 204.7717 46
```

Removendo Regras Redundantes

```
[1] 7159

[1] 1121

[1] 6163

[1] 2482
```

10 Regras (após subset e remover redundâncias) de tamanho igual a 3

```
     lhs                                     rhs
support confidence    coverage      lift count
[1]  {CHILDS GARDEN RAKE BLUE,
      CHILDS GARDEN SPADE PINK}           => {CHILDS GARDEN SPADE BLUE}
0.001327034          1 0.001327034 265.33803    25
[2]  {SWISS CHALET TREE DECORATION,
      WOODEN STAR CHRISTMAS SCANDINAVIAN} => {WOODEN HEART CHRISTMAS SCANDINAVIAN}
0.001061627          1 0.001061627  49.83862    20
[3]  {CHILDS GARDEN BRUSH BLUE,
      CHILDS GARDEN SPADE PINK}           => {CHILDS GARDEN SPADE BLUE}
0.001167790          1 0.001167790 265.33803    22
[4]  {REGENCY CAKE FORK,
      REGENCY TEA PLATE GREEN}            => {REGENCY TEA PLATE ROSES}
0.001114709          1 0.001114709  62.58804    21
[5]  {DOLLY GIRL CHILDRENS CUP,
      POSTAGE}                            => {DOLLY GIRL CHILDRENS BOWL}
0.001008546          1 0.001008546 172.83486    19
[6]  {CHRISTMAS GINGHAM TREE,
      CHRISTMAS RETROSPOT STAR WOOD}      => {CHRISTMAS GINGHAM STAR}
0.001008546          1 0.001008546 174.43519    19
[7]  {GLITTER HEART DECORATION,
      WOODEN TREE CHRISTMAS SCANDINAVIAN} => {WOODEN STAR CHRISTMAS SCANDINAVIAN}
0.001008546          1 0.001008546  54.76453    19
[8]  {GLITTER HEART DECORATION,
      WOODEN TREE CHRISTMAS SCANDINAVIAN} => {WOODEN HEART CHRISTMAS SCANDINAVIAN}
0.001008546          1 0.001008546  49.83862    19
[9]  {LUNCH BAG DOILEY PATTERN,
      PINK VINTAGE SPOT BEAKER}           => {BLUE VINTAGE SPOT BEAKER}
0.001008546          1 0.001008546 131.74126    19
[10] {BLUE GIANT GARDEN THERMOMETER,
      HERB MARKER ROSEMARY}               => {HERB MARKER BASIL}
0.001008546          1 0.001008546 112.80838    19
```

10 Regras (após subset e remover redundâncias) de tamanho igual a 3

```
     lhs                                     rhs                                      support
confidence    coverage      lift count
[1]  {PARTY PIZZA DISH BLUE POLKADOT,
      PARTY PIZZA DISH GREEN POLKADOT} => {PARTY PIZZA DISH PINK POLKADOT}  0.001114709
0.9545455 0.001167790 438.60200    21
[2]  {DRAWER KNOB CERAMIC RED,
      RED STRIPE CERAMIC DRAWER KNOB}  => {BLUE STRIPE CERAMIC DRAWER KNOB} 0.001167790
0.9565217 0.001220872  55.96246    22
[3]  {FRENCH BLUE METAL DOOR SIGN 0,
      FRENCH BLUE METAL DOOR SIGN 9}   => {FRENCH BLUE METAL DOOR SIGN 7}   0.001857848
0.9722222 0.001910929 257.96753    35
[4]  {FRENCH BLUE METAL DOOR SIGN 0,
      FRENCH BLUE METAL DOOR SIGN 9}   => {FRENCH BLUE METAL DOOR SIGN 2}   0.001857848
0.9722222 0.001910929 183.15694    35
```

```
[5]  {FRENCH BLUE METAL DOOR SIGN 6,
      FRENCH BLUE METAL DOOR SIGN 9}   => {FRENCH BLUE METAL DOOR SIGN 7}   0.001857848
0.9722222 0.001910929 257.96753    35
[6]  {FRENCH BLUE METAL DOOR SIGN 5,
      FRENCH BLUE METAL DOOR SIGN 9}   => {FRENCH BLUE METAL DOOR SIGN 7}   0.002070174
0.9750000 0.002123255 258.70458    39
[7]  {FRENCH BLUE METAL DOOR SIGN 3,
      FRENCH BLUE METAL DOOR SIGN 9}   => {FRENCH BLUE METAL DOOR SIGN 1}   0.002017092
0.9743590 0.002070174 154.25167    38
[8]  {FRENCH BLUE METAL DOOR SIGN 0,
      FRENCH BLUE METAL DOOR SIGN 7}   => {FRENCH BLUE METAL DOOR SIGN 2}   0.002070174
0.9750000 0.002123255 183.68025    39
[9]  {FRENCH BLUE METAL DOOR SIGN 0,
      FRENCH BLUE METAL DOOR SIGN 7}   => {FRENCH BLUE METAL DOOR SIGN 1}   0.002070174
0.9750000 0.002123255 154.35315    39
[10] {FRENCH BLUE METAL DOOR SIGN 0,
      FRENCH BLUE METAL DOOR SIGN 5}   => {FRENCH BLUE METAL DOOR SIGN 2}   0.002123255
0.9523810 0.002229418 179.41905    40
```

Regras (após subset e remover redundâncias) que possuem o item de maior frequência

```
    lhs                                       rhs
support confidence    coverage      lift count
[1] {GLASS STAR FROSTED T-LIGHT HOLDER,
     KNITTED UNION FLAG HOT WATER BOTTLE}  => {WHITE HANGING HEART T-LIGHT HOLDER}
0.001008546       0.95 0.001061627  9.953865    19
[2] {KNITTED UNION FLAG HOT WATER BOTTLE,
     SET 7 BABUSHKA NESTING BOXES}         => {WHITE HANGING HEART T-LIGHT HOLDER}
0.001008546       1.00 0.001008546 10.477753    19
[3] {CANDLEHOLDER PINK HANGING HEART,
     HEART IVORY TRELLIS LARGE}            => {WHITE HANGING HEART T-LIGHT HOLDER}
0.001008546       0.95 0.001061627  9.953865    19
```

Encontrando Regras Relacionadas a Itens Fornecidos

- Metal

```
Apriori

Parameter specification:
 confidence minval smax arem  aval originalSupport maxtime support minlen
        0.8    0.1    1 none FALSE            TRUE       5   0.001      1
 maxlen target  ext
     10  rules TRUE

Algorithmic control:
 filter tree heap memopt load sort verbose
    0.1 TRUE TRUE  FALSE TRUE    2    TRUE

Absolute minimum support count: 18

set item appearances ...[1 item(s)] done [0.00s].
set transactions ...[7887 item(s), 18839 transaction(s)] done [0.06s].
sorting and recoding items ... [2455 item(s)] done [0.01s].
creating transaction tree ... done [0.00s].
checking subsets of size 1 2 3 4 5 6 7 8 9 10

Warning in apriori(tr, parameter = list(supp = 0.001, conf = 0.8), appearance =
list(default = "lhs", : Mining stopped (maxlen reached). Only patterns up to a
length of 10 returned!

 done [0.21s].
writing ... [5 rule(s)] done [0.04s].
creating S4 object  ... done [0.01s].
```

```
creating S4 object  ... done [0.01s].

    lhs                              rhs     support     confidence coverage
[1] {WOBBLY CHICKEN}             => {METAL} 0.001486278 1          0.001486278
[2] {WOBBLY RABBIT}              => {METAL} 0.001804767 1          0.001804767
[3] {DECORATION}                 => {METAL} 0.002654069 1          0.002654069
[4] {DECORATION, WOBBLY CHICKEN} => {METAL} 0.001486278 1          0.001486278
[5] {DECORATION, WOBBLY RABBIT}  => {METAL} 0.001804767 1          0.001804767
    lift   count
[1] 376.78 28
[2] 376.78 34
[3] 376.78 50
[4] 376.78 28
[5] 376.78 34
```

- Sugar

```
Apriori

Parameter specification:
 confidence minval smax arem  aval originalSupport maxtime support minlen
       0.95    0.1    1 none FALSE            TRUE       5   0.001      1
 maxlen target  ext
     10  rules TRUE

Algorithmic control:
 filter tree heap memopt load sort verbose
    0.1 TRUE TRUE  FALSE TRUE    2    TRUE

Absolute minimum support count: 18

set item appearances ...[1 item(s)] done [0.00s].
set transactions ...[7887 item(s), 18839 transaction(s)] done [0.06s].
sorting and recoding items ... [2455 item(s)] done [0.01s].
creating transaction tree ... done [0.00s].
checking subsets of size 1 2 3 4 5 6 7 8 9 10

Warning in apriori(tr, parameter = list(supp = 0.001, conf = 0.95), appearance
= list(default = "lhs", : Mining stopped (maxlen reached). Only patterns up to
a length of 10 returned!

 done [0.21s].
writing ... [97 rule(s)] done [0.04s].
creating S4 object  ... done [0.01s].

    lhs                                rhs         support confidence    coverage     lift
count
[1] {SET 3 RETROSPOT TEA}           => {SUGAR} 0.012261797          1 0.012261797 81.55411
231
[2] {RED RETROSPOT MUG,
     SET 3 RETROSPOT TEA}           => {SUGAR} 0.001061627          1 0.001061627 81.55411
20
[3] {RED RETROSPOT SUGAR JAM BOWL,
     SET 3 RETROSPOT TEA}           => {SUGAR} 0.001751685          1 0.001751685 81.55411
33
[4] {RED RETROSPOT BUTTER DISH,
     SET 3 RETROSPOT TEA}           => {SUGAR} 0.002017092          1 0.002017092 81.55411
38
[5] {BREAD BIN DINER STYLE RED,
     SET 3 RETROSPOT TEA}           => {SUGAR} 0.001061627          1 0.001061627 81.55411
20
[6] {RED SPOTTY BISCUIT TIN,
     SET 3 RETROSPOT TEA}           => {SUGAR} 0.003609533          1 0.003609533 81.55411
68
```

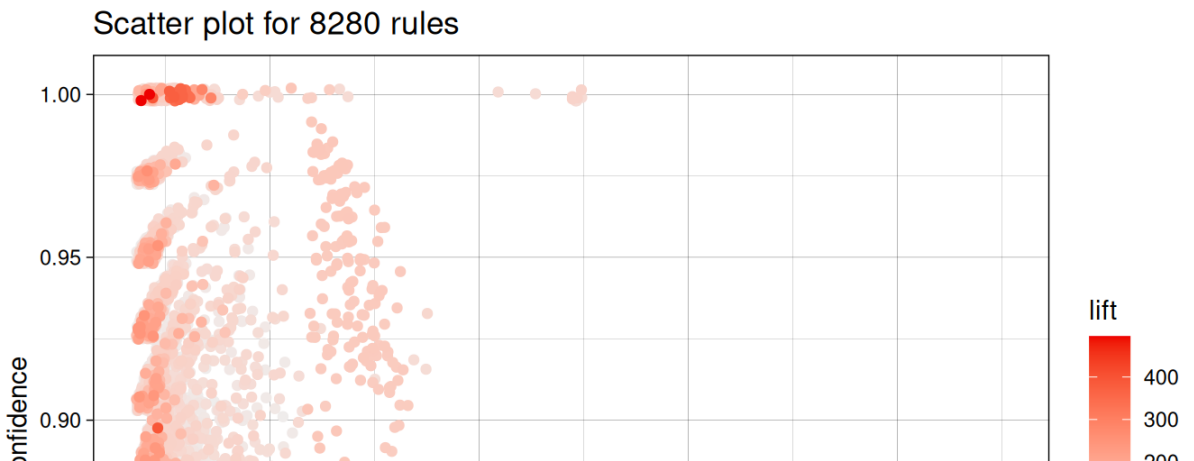
- Coffe

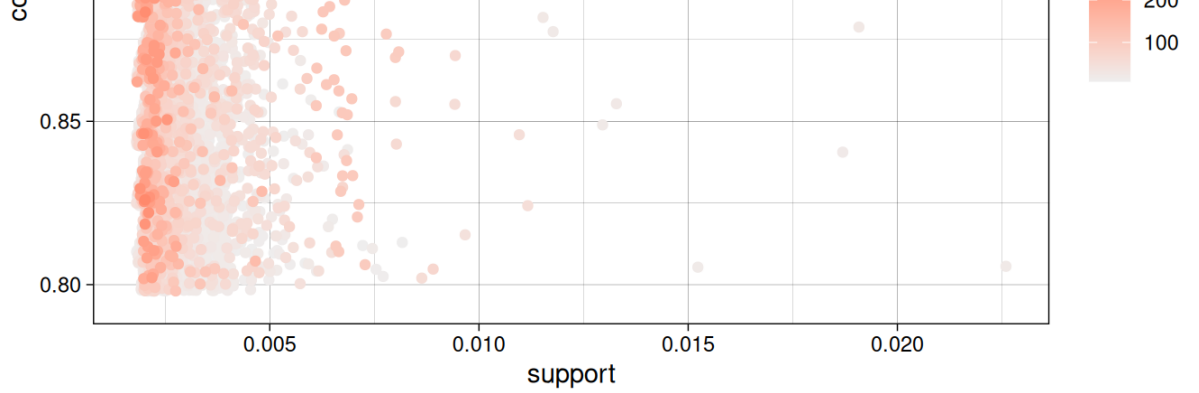
```
Apriori

Parameter specification:
 confidence minval smax arem  aval originalSupport maxtime support minlen
       0.95    0.1    1 none FALSE            TRUE       5   0.001      1
 maxlen target  ext
     10  rules TRUE

Algorithmic control:
 filter tree heap memopt load sort verbose
    0.1 TRUE TRUE  FALSE TRUE    2    TRUE

Absolute minimum support count: 18

set item appearances ...[1 item(s)] done [0.00s].
set transactions ...[7887 item(s), 18839 transaction(s)] done [0.06s].
sorting and recoding items ... [2455 item(s)] done [0.01s].
creating transaction tree ... done [0.00s].
checking subsets of size 1 2 3 4 5 6 7 8 9 10

Warning in apriori(tr, parameter = list(supp = 0.001, conf = 0.95), appearance
= list(default = "lhs", : Mining stopped (maxlen reached). Only patterns up to
a length of 10 returned!

 done [0.20s].
writing ... [135 rule(s)] done [0.04s].
creating S4 object  ... done [0.01s].

    lhs                          rhs      support     confidence coverage
[1] {BLACK TEA}               => {COFFEE} 0.002441743 1          0.002441743
[2] {WHITE TEA}               => {COFFEE} 0.003397208 1          0.003397208
[3] {SUGAR JARS}              => {COFFEE} 0.004883486 1          0.004883486
[4] {SET 3 RETROSPOT TEA}     => {COFFEE} 0.012261797 1          0.012261797
[5] {SUGAR}                   => {COFFEE} 0.012261797 1          0.012261797
[6] {BLACK TEA, SUGAR JARS} => {COFFEE} 0.002441743 1          0.002441743
    lift     count
[1] 59.42902  46
[2] 59.42902  64
[3] 59.42902  92
[4] 59.42902 231
[5] 59.42902 231
[6] 59.42902  46
```

Visualizando Regras de Associação

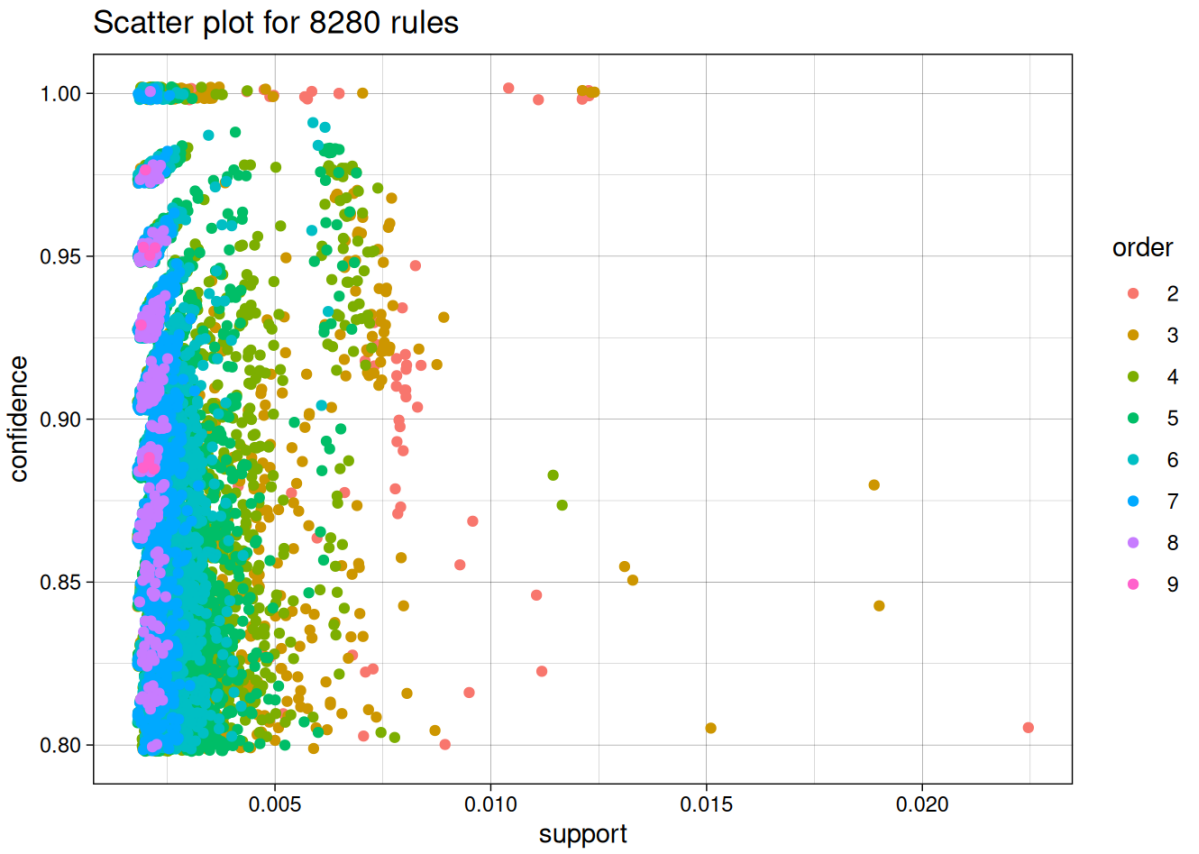
Gráfico de Dispersão

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

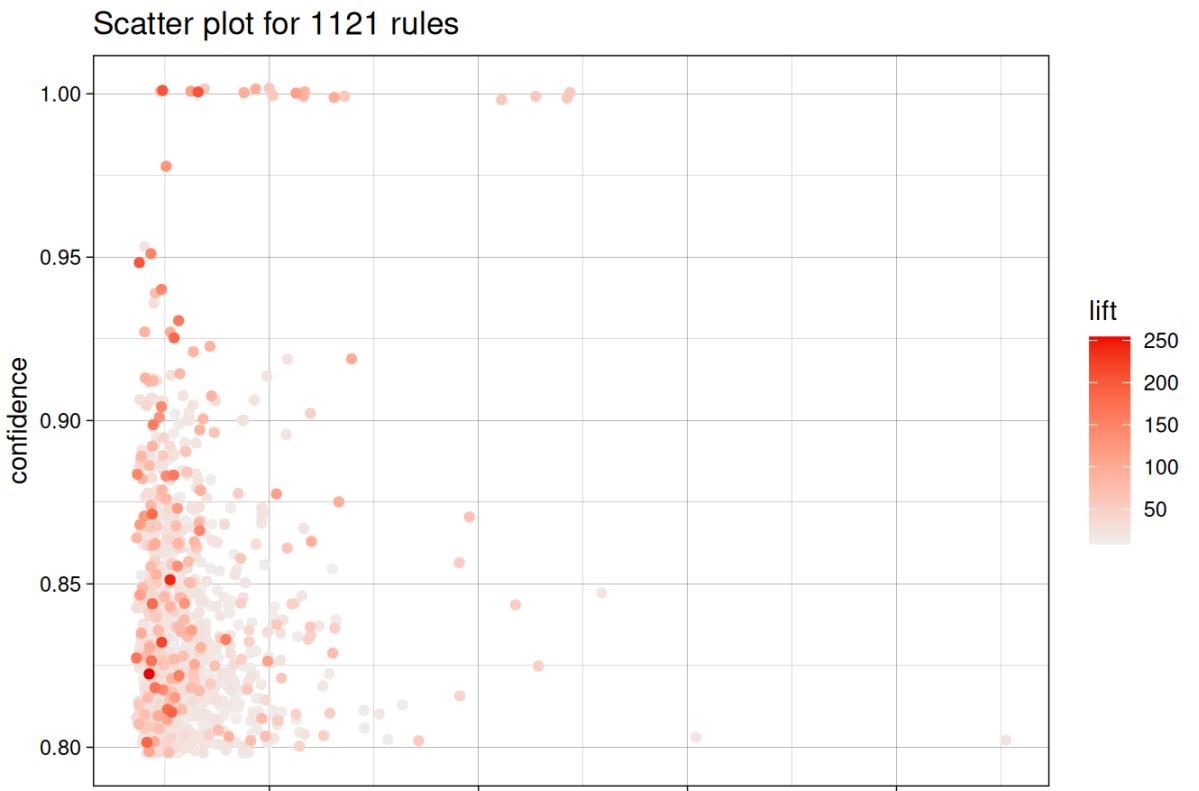


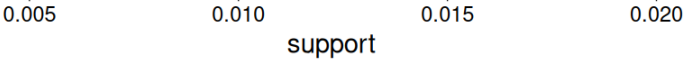



```
To reduce overplotting, jitter is added! Use jitter = 0 to prevent jitter.
```

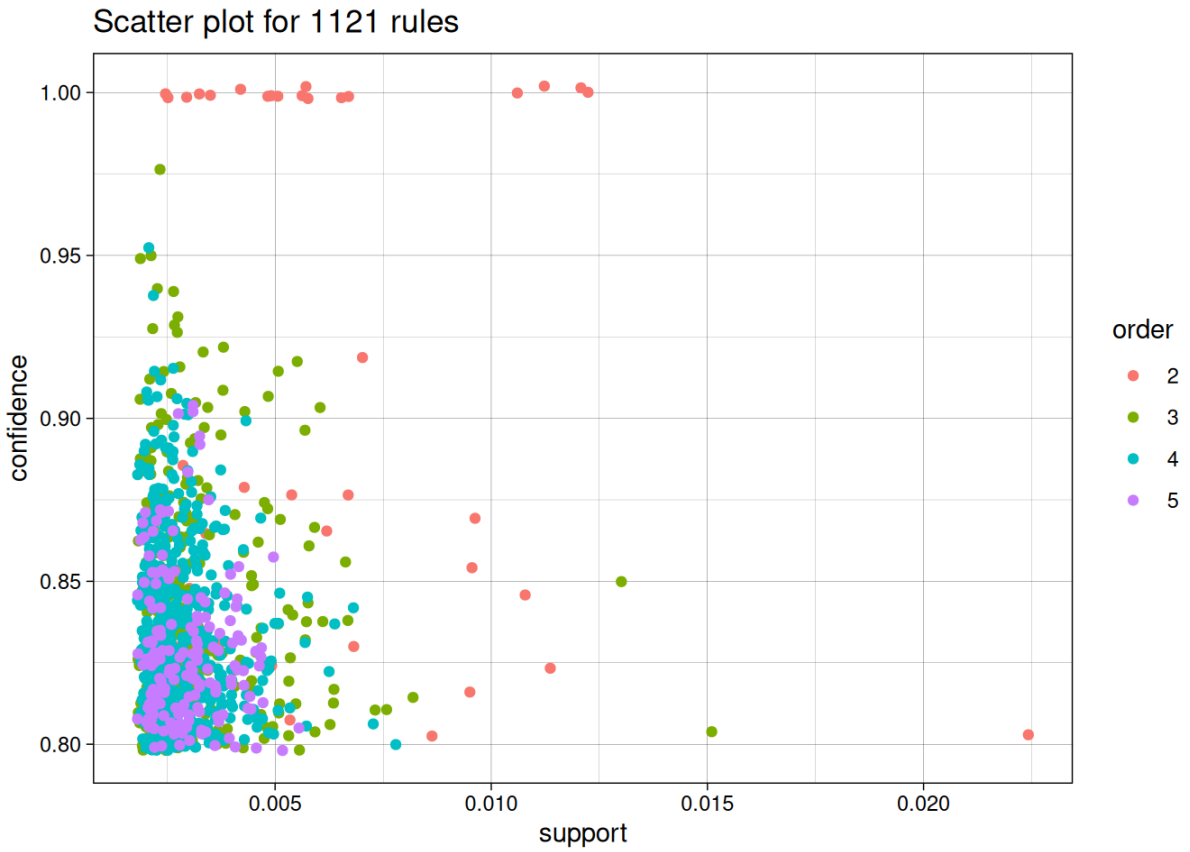



```
To reduce overplotting, jitter is added! Use jitter = 0 to prevent jitter.
```

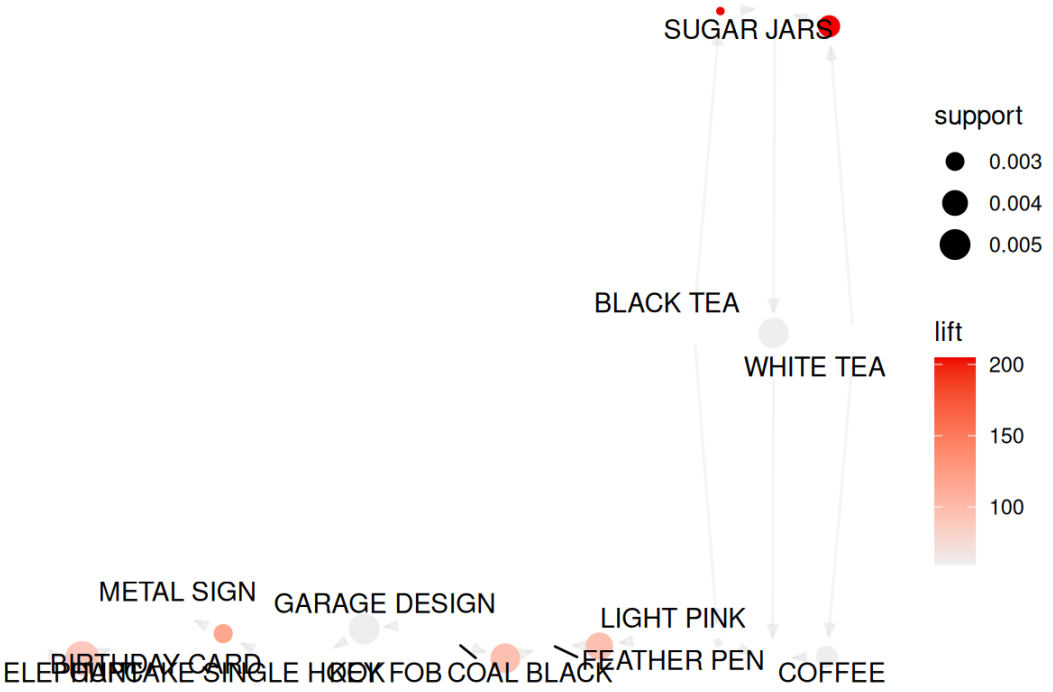




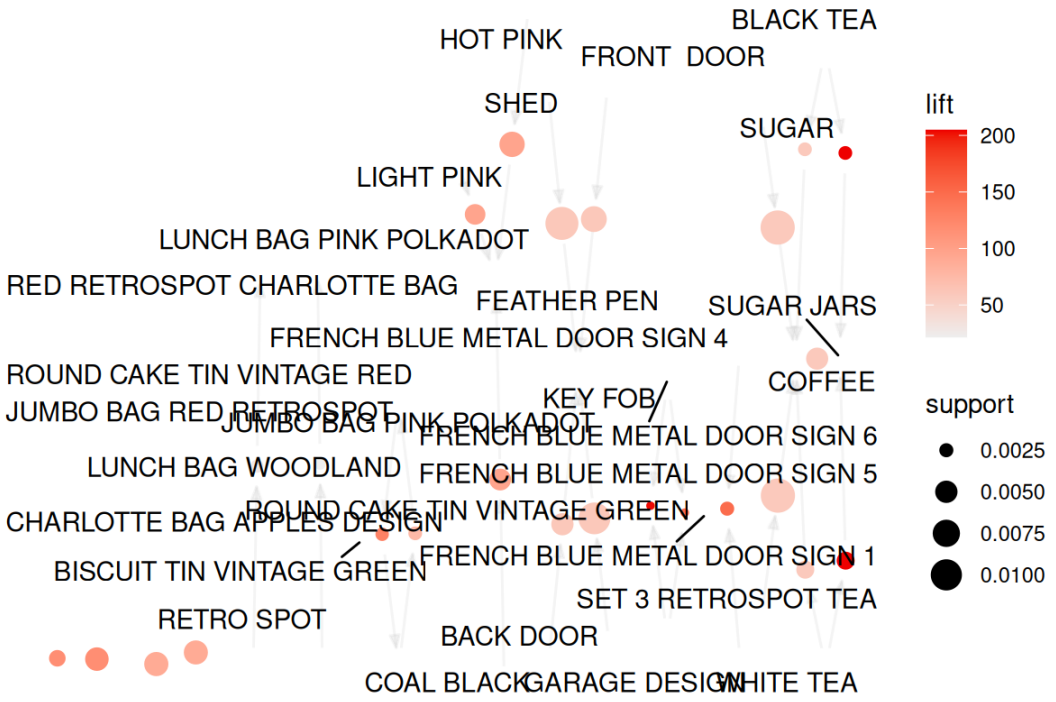

```
To reduce overplotting, jitter is added! Use jitter = 0 to prevent jitter.
```



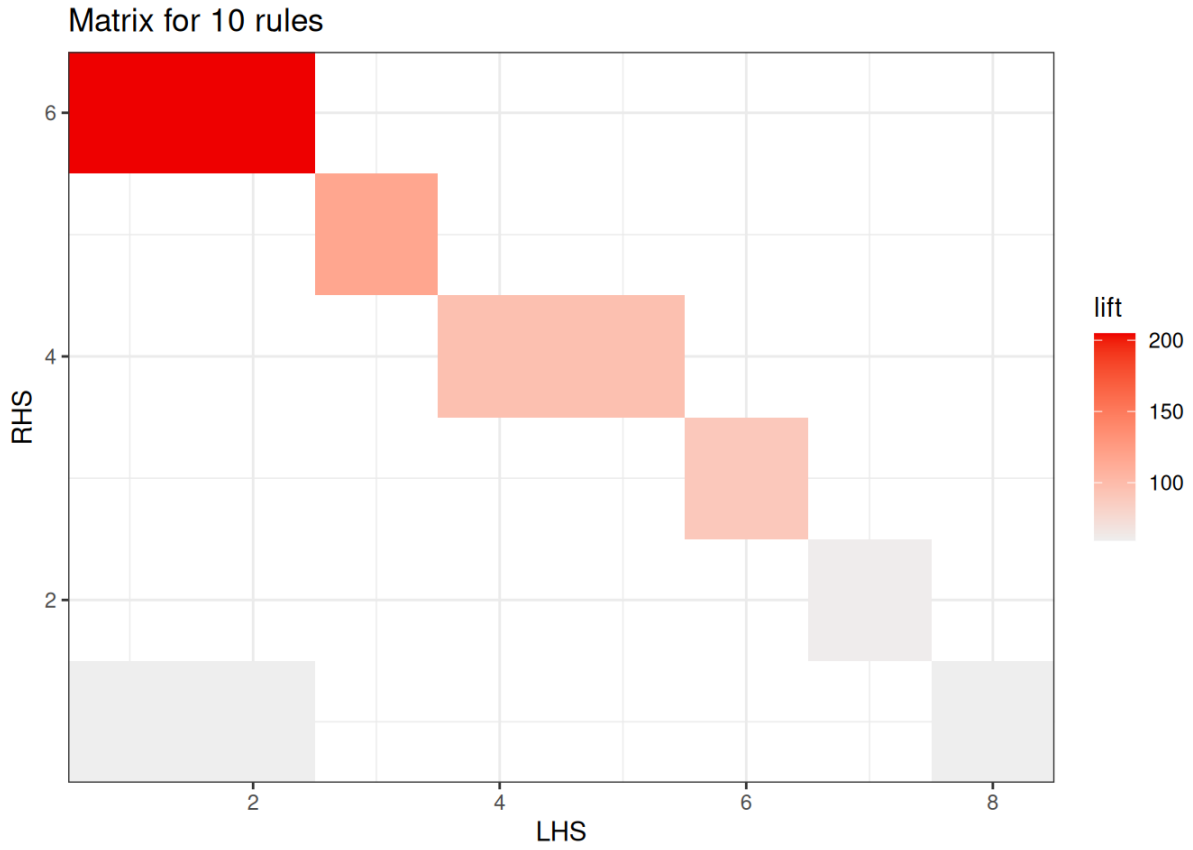
Visualizações Baseadas em Grafos




```
Warning: ggrepel: 10 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```

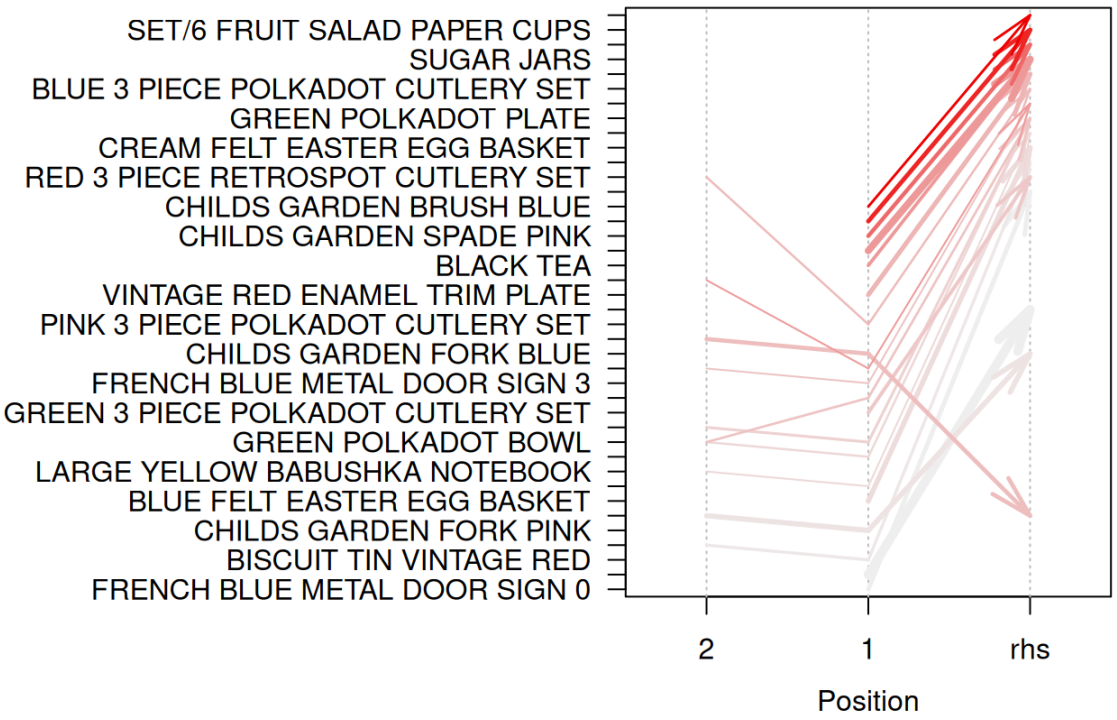



```
Itemsets in Antecedent (LHS)
[1] "{BLACK TEA}"           "{WHITE TEA}"           "{CUPCAKE SINGLE HOOK}"
[4] "{COAL BLACK}"          "{LIGHT PINK}"          "{ELEPHANT}"
[7] "{GARAGE DESIGN}"       "{SUGAR JARS}"
Itemsets in Consequent (RHS)
[1] "{COFFEE}"        "{KEY FOB}"       "{BIRTHDAY CARD}" "{FEATHER PEN}"
[5] "{METAL SIGN}"    "{SUGAR JARS}"
```



Representação de Regra Individual

Parallel coordinates plot for 20 rules



Conclusões

Neste laboratório, trabalhamos utilizando algoritmos de regras de associação, em específico o "APRIORI". Esse tipo de modelo é amplamente utilizado na mineração de dados para descobrir padrões de associação em conjuntos de transações/cestas de produtos (inclusive para juntar tópicos de palavras). Esses algoritmos procuram identificar relações entre itens frequentemente coocorrentes, permitindo a extração de informações valiosas para tomada de decisões de negócios. Sua aplicação permite a extração de informações relevantes para apoiar a tomada de decisões de negócios em várias áreas, proporcionando oportunidades de otimização e melhoria de resultados.

Com base em regras de associação identificadas pelo APRIORI, uma empresa de varejo pode criar promoções personalizadas para incentivar a compra conjunta de produtos frequentemente associados, aumentando as vendas e a satisfação do cliente. Além disso, o APRIORI pode auxiliar na identificação de grupos de clientes com características semelhantes, permitindo a criação de campanhas de marketing direcionadas e eficientes. Para além do marketing, o APRIORI poderia auxiliar um processo de categorização de produtos com base nas palavras que aparecem em seus títulos, automatizando um processo que geralmente é inteiramente manual e subjetivo. Pensando em finanças, essa potente ferramenta pode ser utilizada para analisar o portfólio de gestores de investimento, identificando ativos que geralmente são utilizados em conjunto para implantar estratégias de investimento.

O conjunto de dados "Online-Retail" do UCI Machine Learning Repository oferece uma oportunidade interessante de explorar a análise de vendas e o comportamento dos clientes em um ambiente de varejo online. Ao aplicar técnicas de mineração de dados e análises adequadas, é possível obter insights valiosos para aprimorar as estratégias de negócios e impulsionar o sucesso da empresa. Foi possível encontrar algumas relações interessantes:

- Produtos de uma mesma linha "FRENCH BLUE METAL DOOR" são geralmente comprados em conjunto
- Itens de decoração são compratdos com itens de metal
- Compras de ART LIGHT E FUNK MONKEY estão bem relacionadas
- Apesar de obvio, o algorítmo foi capaz de encontrar relações em
    - produtos natalinos (CHRISTMAS GINGHAM TREE,WOODEN STAR CHRISTMAS SCANDINAVIAN,CHRISTMAS GINGHAM TREE)
    - Produtos relacioandos a chá e café (xírcares, talheres, pires, jarras para açúcar)
        - O Café inclusive é comprado como consequência de CHÁ