ProductAssociatons

Stacey Jackson

03/04/2019

library(arules)

## Warning: package 'arules' was built under R version 3.5.2

## Loading required package: Matrix

##   
## Attaching package: 'arules'

## The following objects are masked from 'package:base':  
##   
## abbreviate, write

library(arulesViz)

## Loading required package: grid

library(dplyr)

## Warning: package 'dplyr' was built under R version 3.5.2

##   
## Attaching package: 'dplyr'

## The following objects are masked from 'package:arules':  
##   
## intersect, recode, setdiff, setequal, union

## The following objects are masked from 'package:stats':  
##   
## filter, lag

## The following objects are masked from 'package:base':  
##   
## intersect, setdiff, setequal, union

#### 1. Upload the dataset

transactions\_B2B<-read.transactions(file="/Users/staceyjackson/Dropbox (Personal)/Ubiqum/DataAnalytics2/ProductAssociations/Data/B2BTransacs.csv",sep = ",", header = T, rm.duplicates = FALSE, quote = "\"'", skip = 0, encoding = "unknown")

## Warning in readLines(file, encoding = encoding): incomplete final line  
## found on '/Users/staceyjackson/Dropbox (Personal)/Ubiqum/DataAnalytics2/  
## ProductAssociations/Data/B2BTransacs.csv'

## Warning in asMethod(object): removing duplicated items in transactions

transactions\_B2C<-read.transactions(file="/Users/staceyjackson/Dropbox (Personal)/Ubiqum/DataAnalytics2/ProductAssociations/Data/B2CTransacs.csv",sep = ",", header = T, rm.duplicates = FALSE, quote = "\"'", skip = 0, encoding = "unknown")

## Warning in readLines(file, encoding = encoding): incomplete final line  
## found on '/Users/staceyjackson/Dropbox (Personal)/Ubiqum/DataAnalytics2/  
## ProductAssociations/Data/B2CTransacs.csv'  
  
## Warning in readLines(file, encoding = encoding): removing duplicated items  
## in transactions

Categories<-read.csv(file="/Users/staceyjackson/Dropbox (Personal)/Ubiqum/DataAnalytics2/ProductAssociations/Data/ProductCategories.csv", header=TRUE, sep=",")

#### 2. Inspect dataset

length(transactions\_B2B)

## [1] 4605

size(transactions\_B2B)

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## [24] 5 4 3 6 3 4 2 3 8 7 8 4 5 5 4 10 7 2 2 3 4 9 9  
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## [3336] 5 2 5 8 5 6 3 12 11 6 4 6 3 9 5 3 3 3 10 15 4 4 5  
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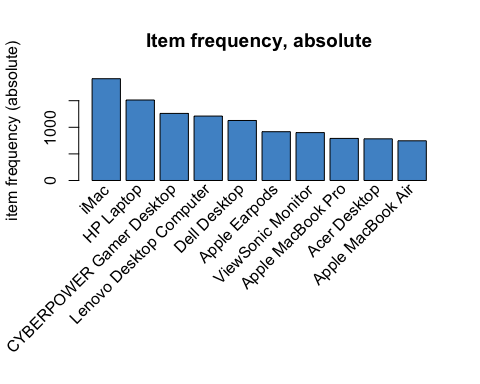
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## [2] "2TB Portable External Hard Drive"   
## [3] "3-Button Mouse"   
## [4] "3TB Portable External Hard Drive"   
## [5] "5TB Desktop Hard Drive"   
## [6] "Acer Aspire"   
## [7] "Acer Desktop"   
## [8] "Acer Monitor"   
## [9] "Ailihen Stereo 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"

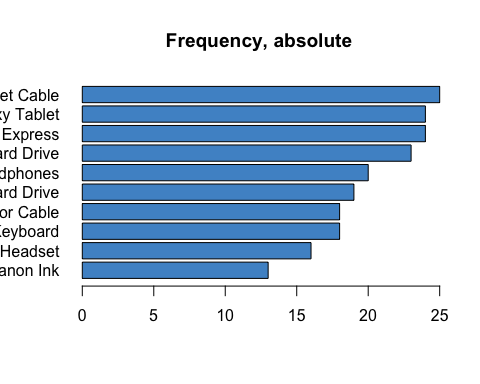
#### 3. PLOTS OF FREQUENCY

#### 3.1 Plots of most frequent items

itemFrequencyPlot(transactions\_B2B,  
 type="absolute",  
 topN=10,  
 horiz=FALSE,  
 col='steelblue3',  
 xlab='',  
 main='Item frequency, absolute')

 ####3.2 Plots of least frequent items

barplot(sort(table(unlist(LIST(transactions\_B2B))))[1:10],  
 horiz=TRUE,  
 las=1,  
 col='steelblue3',  
 xlab='',  
 main='Frequency, absolute')

 ####4. ASSOCIATION RULES

rules <- apriori(transactions\_B2B,parameter = list(minlen=2, supp=0.002, conf=0.8),control = list(verbose=F))  
rules.sorted <- sort(rules, by="lift")  
inspect(rules.sorted[1:10])

## lhs rhs support confidence lift count  
## [1] {Apple MacBook Pro,   
## HP Black & Tri-color Ink,   
## HP Laptop,   
## iMac} => {Acer Aspire} 0.002171553 0.8333333 5.702080 10  
## [2] {Dell Desktop,   
## iMac,   
## Lenovo Desktop Computer,   
## Mackie CR Speakers} => {ViewSonic Monitor} 0.002388708 1.0000000 5.116667 11  
## [3] {Dell Desktop,   
## HP Laptop,   
## iMac,   
## Lenovo Desktop Computer,   
## Mackie CR Speakers} => {ViewSonic Monitor} 0.002171553 1.0000000 5.116667 10  
## [4] {Dell Desktop,   
## Lenovo Desktop Computer,   
## Mackie CR Speakers} => {ViewSonic Monitor} 0.002605863 0.9230769 4.723077 12  
## [5] {Dell Desktop,   
## HP Laptop,   
## Lenovo Desktop Computer,   
## Mackie CR Speakers} => {ViewSonic Monitor} 0.002388708 0.9166667 4.690278 11  
## [6] {Dell Desktop,   
## Etekcity Power Extension Cord Cable,   
## HP Laptop,   
## iMac,   
## Lenovo Desktop Computer} => {ViewSonic Monitor} 0.002388708 0.9166667 4.690278 11  
## [7] {Acer Aspire,   
## Apple Earpods,   
## HP Laptop,   
## HP Monitor} => {ViewSonic Monitor} 0.002171553 0.9090909 4.651515 10  
## [8] {HP Laptop,   
## iMac,   
## Lenovo Desktop Computer,   
## Mackie CR Speakers} => {ViewSonic Monitor} 0.002823018 0.8666667 4.434444 13  
## [9] {Acer Aspire,   
## Dell Desktop,   
## Epson Printer,   
## HP Laptop} => {ViewSonic Monitor} 0.002605863 0.8571429 4.385714 12  
## [10] {Acer Aspire,   
## ASUS Chromebook,   
## Dell Desktop,   
## HP Laptop} => {ViewSonic Monitor} 0.002605863 0.8571429 4.385714 12

#ruleExplorer(rules.sorted)

#### 5. CREATE LABELS FOR B2B CATEGORIES

TempDFB2B <- as.data.frame(transactions\_B2B@itemInfo$labels)  
  
colnames(TempDFB2B) <- "ProdName"  
  
TempDFB2B

## ProdName  
## 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

TempDFB2B2 <- merge(TempDFB2B, Categories, by.x="ProdName", by.y="ProdName")  
  
transactions\_B2B@itemInfo$categories <- TempDFB2B2$BWCat  
  
transactions\_B2BAgg <- aggregate(transactions\_B2B, by = "categories")  
  
summary(transactions\_B2BAgg)

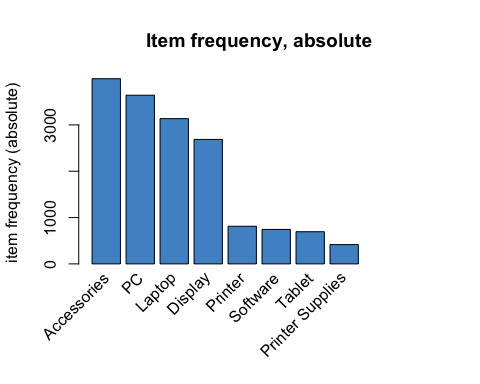
## transactions as itemMatrix in sparse format with  
## 4605 rows (elements/itemsets/transactions) and  
## 8 columns (items) and a density of 0.4377307   
##   
## most frequent items:  
## Accessories PC Laptop Display Printer (Other)   
## 3997 3641 3135 2687 812 1854   
##   
## element (itemset/transaction) length distribution:  
## sizes  
## 1 2 3 4 5 6 7 8   
## 289 814 1224 1257 694 256 65 6   
##   
## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 1.000 3.000 3.000 3.502 4.000 8.000   
##   
## includes extended item information - examples:  
## labels categories  
## 1 Accessories Accessories  
## 2 Display Display  
## 3 Laptop Laptop

str(transactions\_B2BAgg)

## Formal class 'transactions' [package "arules"] with 3 slots  
## ..@ data :Formal class 'ngCMatrix' [package "Matrix"] with 5 slots  
## .. .. ..@ i : int [1:16126] 0 3 0 3 2 3 5 0 1 3 ...  
## .. .. ..@ p : int [1:4606] 0 2 4 7 10 13 16 20 23 25 ...  
## .. .. ..@ Dim : int [1:2] 8 4605  
## .. .. ..@ Dimnames:List of 2  
## .. .. .. ..$ : chr [1:8] "Accessories" "Display" "Laptop" "PC" ...  
## .. .. .. ..$ : NULL  
## .. .. ..@ factors : list()  
## ..@ itemInfo :'data.frame': 8 obs. of 2 variables:  
## .. ..$ labels : Factor w/ 8 levels "Accessories",..: 1 2 3 4 5 6 7 8  
## .. ..$ categories: Factor w/ 8 levels "Accessories",..: 1 2 3 4 5 6 7 8  
## ..@ itemsetInfo:'data.frame': 0 obs. of 0 variables

#### 5.1.Plot for transactions\_B2BAgg

itemFrequencyPlot(transactions\_B2BAgg,  
 type="absolute",  
 topN=10,  
 horiz=FALSE,  
 col='steelblue3',  
 xlab='',  
 main='Item frequency, absolute')



#### 6. B2B TRANSACTION RULES

rules <- apriori(transactions\_B2BAgg,parameter = list(minlen=2, supp=0.002, conf=0.9),control = list(verbose=F))  
rules.sorted <- sort(rules, by="lift")  
inspect(rules.sorted[1:10])

## lhs rhs support confidence lift count  
## [1] {Laptop,   
## Printer,   
## Printer Supplies,   
## Tablet} => {Display} 0.004560261 0.9130435 1.564781 21  
## [2] {Accessories,   
## Laptop,   
## Printer,   
## Printer Supplies,   
## Tablet} => {Display} 0.004560261 0.9130435 1.564781 21  
## [3] {PC,   
## Printer,   
## Software,   
## Tablet} => {Display} 0.008686211 0.9090909 1.558007 40  
## [4] {Accessories,   
## PC,   
## Printer,   
## Software,   
## Tablet} => {Display} 0.008469055 0.9069767 1.554383 39  
## [5] {Laptop,   
## PC,   
## Printer,   
## Printer Supplies,   
## Tablet} => {Display} 0.004125950 0.9047619 1.550587 19  
## [6] {Accessories,   
## Laptop,   
## PC,   
## Printer,   
## Printer Supplies,   
## Tablet} => {Display} 0.004125950 0.9047619 1.550587 19  
## [7] {Display,   
## PC,   
## Printer Supplies,   
## Software} => {Laptop} 0.014332248 0.9565217 1.405034 66  
## [8] {Accessories,   
## Display,   
## PC,   
## Printer Supplies,   
## Software} => {Laptop} 0.013680782 0.9545455 1.402131 63  
## [9] {PC,   
## Printer Supplies,   
## Software,   
## Tablet} => {Laptop} 0.003691640 0.9444444 1.387294 17  
## [10] {Accessories,   
## PC,   
## Printer Supplies,   
## Software,   
## Tablet} => {Laptop} 0.003691640 0.9444444 1.387294 17

labels(rules.sorted[1:10], itemSep = " + ", setStart = "", setEnd="", ruleSep = " ---> ")

## [1] "Laptop + Printer + Printer Supplies + Tablet ---> Display"   
## [2] "Accessories + Laptop + Printer + Printer Supplies + Tablet ---> Display"   
## [3] "PC + Printer + Software + Tablet ---> Display"   
## [4] "Accessories + PC + Printer + Software + Tablet ---> Display"   
## [5] "Laptop + PC + Printer + Printer Supplies + Tablet ---> Display"   
## [6] "Accessories + Laptop + PC + Printer + Printer Supplies + Tablet ---> Display"  
## [7] "Display + PC + Printer Supplies + Software ---> Laptop"   
## [8] "Accessories + Display + PC + Printer Supplies + Software ---> Laptop"   
## [9] "PC + Printer Supplies + Software + Tablet ---> Laptop"   
## [10] "Accessories + PC + Printer Supplies + Software + Tablet ---> Laptop"

#ruleExplorer(rules.sorted)

#### 6.1 Redundant rules

is.redundant(rules.sorted)

## [1] FALSE TRUE FALSE TRUE TRUE TRUE FALSE TRUE FALSE TRUE TRUE  
## [12] TRUE TRUE TRUE FALSE TRUE FALSE TRUE FALSE TRUE TRUE TRUE  
## [23] FALSE FALSE FALSE TRUE TRUE TRUE TRUE TRUE FALSE TRUE FALSE  
## [34] TRUE FALSE TRUE FALSE TRUE FALSE TRUE FALSE TRUE FALSE FALSE  
## [45] FALSE TRUE FALSE TRUE FALSE TRUE TRUE FALSE TRUE FALSE FALSE  
## [56] FALSE TRUE FALSE TRUE TRUE FALSE FALSE FALSE FALSE FALSE TRUE  
## [67] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE FALSE  
## [78] TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE TRUE  
## [89] TRUE TRUE TRUE FALSE FALSE FALSE FALSE TRUE TRUE FALSE FALSE  
## [100] FALSE FALSE FALSE FALSE FALSE TRUE TRUE FALSE FALSE FALSE TRUE  
## [111] TRUE TRUE FALSE FALSE TRUE TRUE FALSE TRUE FALSE TRUE TRUE  
## [122] FALSE FALSE FALSE TRUE FALSE FALSE TRUE FALSE TRUE TRUE TRUE  
## [133] FALSE TRUE TRUE TRUE FALSE TRUE TRUE FALSE FALSE TRUE FALSE  
## [144] TRUE FALSE FALSE FALSE TRUE TRUE FALSE FALSE FALSE TRUE TRUE  
## [155] FALSE FALSE FALSE TRUE FALSE FALSE FALSE TRUE FALSE TRUE FALSE  
## [166] FALSE FALSE TRUE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [177] TRUE FALSE TRUE TRUE FALSE FALSE FALSE FALSE FALSE FALSE

#### 6.2 Prune redundant rules

subset.matrix <- is.subset(rules.sorted, rules.sorted)  
subset.matrix[lower.tri(subset.matrix, diag=T)] <- NA

## Warning in `[<-`(`\*tmp\*`, as.vector(i), value = NA): x[.] <- val: x is  
## "ngTMatrix", val not in {TRUE, FALSE} is coerced; NA |--> TRUE.

redundant <- colSums(subset.matrix, na.rm=T) >= 1  
which(redundant)

## {Display,Laptop,Printer,Printer Supplies,Tablet}   
## 1   
## {Accessories,Display,Laptop,Printer,Printer Supplies,Tablet}   
## 2   
## {Display,PC,Printer,Software,Tablet}   
## 3   
## {Accessories,Display,PC,Printer,Software,Tablet}   
## 4   
## {Display,Laptop,PC,Printer,Printer Supplies,Tablet}   
## 5   
## {Accessories,Display,Laptop,PC,Printer,Printer Supplies,Tablet}   
## 6   
## {Display,Laptop,PC,Printer Supplies,Software}   
## 7   
## {Accessories,Display,Laptop,PC,Printer Supplies,Software}   
## 8   
## {Laptop,PC,Printer Supplies,Software,Tablet}   
## 9   
## {Accessories,Laptop,PC,Printer Supplies,Software,Tablet}   
## 10   
## {Display,Laptop,PC,Printer Supplies,Software,Tablet}   
## 11   
## {Accessories,Display,Laptop,PC,Printer Supplies,Software,Tablet}   
## 12   
## {Display,Laptop,PC,Printer,Printer Supplies,Software}   
## 13   
## {Accessories,Display,Laptop,PC,Printer,Printer Supplies,Software}   
## 14   
## {Display,Laptop,Printer Supplies,Software}   
## 15   
## {Accessories,Display,Laptop,Printer Supplies,Software}   
## 16   
## {Laptop,Printer Supplies,Software,Tablet}   
## 17   
## {Accessories,Laptop,Printer Supplies,Software,Tablet}   
## 18   
## {Laptop,PC,Printer Supplies,Software}   
## 19   
## {Accessories,Laptop,PC,Printer Supplies,Software}   
## 20   
## {Laptop,PC,Printer,Printer Supplies,Software}   
## 21   
## {Accessories,Laptop,PC,Printer,Printer Supplies,Software}   
## 22   
## {Laptop,PC,Printer,Software,Tablet}   
## 23   
## {Display,Laptop,PC,Printer Supplies,Software,Tablet}   
## 24   
## {Display,Laptop,PC,Printer,Printer Supplies,Software}   
## 25   
## {Display,Laptop,PC,Printer,Software,Tablet}   
## 26   
## {Accessories,Laptop,PC,Printer,Software,Tablet}   
## 27   
## {Accessories,Display,Laptop,PC,Printer Supplies,Software,Tablet}   
## 28   
## {Accessories,Display,Laptop,PC,Printer,Printer Supplies,Software}   
## 29   
## {Accessories,Display,Laptop,PC,Printer,Software,Tablet}   
## 30   
## {Display,Laptop,PC,Printer Supplies,Software}   
## 31   
## {Accessories,Display,Laptop,PC,Printer Supplies,Software}   
## 32   
## {Display,PC,Printer,Software,Tablet}   
## 33   
## {Accessories,Display,PC,Printer,Software,Tablet}   
## 34   
## {Display,Laptop,PC,Software,Tablet}   
## 35   
## {Accessories,Display,Laptop,PC,Software,Tablet}   
## 36   
## {Accessories,Laptop,PC,Printer,Tablet}   
## 37   
## {Accessories,Display,Laptop,PC,Printer,Tablet}   
## 38   
## {PC,Printer,Software,Tablet}   
## 39   
## {Accessories,PC,Printer,Software,Tablet}   
## 40   
## {Display,PC,Printer Supplies,Software,Tablet}   
## 41   
## {Accessories,Display,PC,Printer Supplies,Software,Tablet}   
## 42   
## {Display,PC,Printer Supplies,Software}   
## 43   
## {Accessories,Display,Laptop,PC,Printer,Printer Supplies}   
## 44   
## {Laptop,PC,Printer,Printer Supplies,Software}   
## 45   
## {Accessories,Laptop,PC,Printer,Printer Supplies,Software}   
## 46   
## {Display,Laptop,PC,Printer,Tablet}   
## 47   
## {Accessories,Display,PC,Printer Supplies,Software}   
## 48   
## {Laptop,PC,Printer,Tablet}   
## 49   
## {Display,PC,Printer,Printer Supplies,Software}   
## 50   
## {Accessories,Display,PC,Printer,Printer Supplies,Software}   
## 51   
## {Display,PC,Software,Tablet}   
## 52   
## {Accessories,Display,PC,Software,Tablet}   
## 53   
## {Display,Laptop,PC,Printer,Printer Supplies}   
## 54   
## {Accessories,Display,Laptop,PC,Software}   
## 55   
## {Accessories,Laptop,PC,Printer,Printer Supplies}   
## 56   
## {Accessories,Display,Laptop,PC,Printer,Software}   
## 57   
## {Accessories,Display,PC,Printer,Tablet}   
## 58   
## {Laptop,PC,Printer,Printer Supplies,Tablet}   
## 59   
## {Accessories,Laptop,PC,Printer,Printer Supplies,Tablet}   
## 60   
## {Accessories,Display,PC,Printer,Printer Supplies}   
## 61   
## {Accessories,Printer Supplies,Software,Tablet}   
## 62   
## {Accessories,Display,Printer Supplies,Tablet}   
## 63   
## {Accessories,Laptop,Printer Supplies,Tablet}   
## 64   
## {Accessories,Printer,Printer Supplies,Software}   
## 65   
## {Accessories,Display,Printer Supplies,Software,Tablet}   
## 66   
## {Accessories,Laptop,Printer Supplies,Software,Tablet}   
## 67   
## {Accessories,PC,Printer Supplies,Software,Tablet}   
## 68   
## {Accessories,Display,Printer,Printer Supplies,Tablet}   
## 69   
## {Accessories,Laptop,Printer,Printer Supplies,Tablet}   
## 70   
## {Accessories,Display,Laptop,Printer Supplies,Tablet}   
## 71   
## {Accessories,Display,PC,Printer Supplies,Tablet}   
## 72   
## {Accessories,Laptop,PC,Printer Supplies,Tablet}   
## 73   
## {Accessories,Display,Printer,Printer Supplies,Software}   
## 74   
## {Accessories,Laptop,Printer,Printer Supplies,Software}   
## 75   
## {Accessories,PC,Printer,Printer Supplies,Software}   
## 76   
## {Accessories,Laptop,PC,Printer,Printer Supplies}   
## 77   
## {Accessories,Display,Laptop,Printer Supplies,Software,Tablet}   
## 78   
## {Accessories,Display,PC,Printer Supplies,Software,Tablet}   
## 79   
## {Accessories,Laptop,PC,Printer Supplies,Software,Tablet}   
## 80   
## {Accessories,Display,Laptop,Printer,Printer Supplies,Tablet}   
## 81   
## {Accessories,Display,PC,Printer,Printer Supplies,Tablet}   
## 82   
## {Accessories,Laptop,PC,Printer,Printer Supplies,Tablet}   
## 83   
## {Accessories,Display,Laptop,PC,Printer Supplies,Tablet}   
## 84   
## {Accessories,Display,Laptop,Printer,Printer Supplies,Software}   
## 85   
## {Accessories,Display,PC,Printer,Printer Supplies,Software}   
## 86   
## {Accessories,Laptop,PC,Printer,Printer Supplies,Software}   
## 87   
## {Accessories,Display,Laptop,PC,Printer,Printer Supplies}   
## 88   
## {Accessories,Display,Laptop,PC,Printer Supplies,Software,Tablet}   
## 89   
## {Accessories,Display,Laptop,PC,Printer,Printer Supplies,Tablet}   
## 90   
## {Accessories,Display,Laptop,PC,Printer,Printer Supplies,Software}   
## 91   
## {Display,PC,Printer,Tablet}   
## 92   
## {Display,Laptop,PC,Printer,Software}   
## 93   
## {Laptop,PC,Printer,Printer Supplies}   
## 94   
## {Accessories,PC,Printer,Tablet}   
## 95   
## {Display,Laptop,PC,Printer,Printer Supplies,Tablet}   
## 96   
## {Accessories,Display,Laptop,PC,Printer,Printer Supplies,Tablet}   
## 97   
## {Accessories,PC,Printer,Printer Supplies}   
## 98   
## {Display,PC,Printer,Printer Supplies}   
## 99   
## {Accessories,Laptop,PC,Printer,Software}   
## 100   
## {Accessories,Laptop,Printer,Printer Supplies}   
## 101   
## {Accessories,Printer Supplies,Tablet}   
## 102   
## {Display,Laptop,PC,Software}   
## 103   
## {Accessories,Display,PC,Printer,Printer Supplies}   
## 104   
## {Accessories,PC,Printer Supplies,Tablet}   
## 105   
## {Accessories,Display,Laptop,Printer,Printer Supplies}   
## 106   
## {Accessories,PC,Printer,Printer Supplies}   
## 107   
## {Accessories,Printer,Software,Tablet}   
## 108   
## {Accessories,Display,Printer,Printer Supplies}   
## 109   
## {Accessories,PC,Printer,Software,Tablet}   
## 110   
## {Accessories,Display,Printer,Software,Tablet}   
## 111   
## {Accessories,Display,PC,Printer,Software,Tablet}   
## 112   
## {Accessories,Printer,Printer Supplies}   
## 113   
## {Accessories,Laptop,Software,Tablet}   
## 114   
## {Accessories,Laptop,Printer,Software,Tablet}   
## 115   
## {Accessories,Laptop,PC,Printer,Software,Tablet}   
## 116   
## {Accessories,Display,Laptop,PC,Printer,Tablet}   
## 117   
## {Accessories,Laptop,PC,Software,Tablet}   
## 118   
## {Accessories,Display,Laptop,PC,Printer,Software}   
## 119   
## {Accessories,Display,Laptop,Printer,Software,Tablet}   
## 120   
## {Accessories,Display,Laptop,PC,Printer,Software,Tablet}   
## 121   
## {Accessories,Display,PC,Printer,Tablet}   
## 122   
## {Accessories,Laptop,PC,Printer,Tablet}   
## 123   
## {Accessories,Laptop,PC,Printer,Software}   
## 124   
## {Accessories,Printer,Printer Supplies,Tablet}   
## 125   
## {Accessories,Software,Tablet}   
## 126   
## {Accessories,Display,Printer,Tablet}   
## 127   
## {Accessories,Display,Laptop,Printer,Tablet}   
## 128   
## {Accessories,Laptop,Printer,Software}   
## 129   
## {Accessories,Display,Laptop,Printer,Software}   
## 130   
## {Accessories,Display,Laptop,Software,Tablet}   
## 131   
## {Accessories,Display,Software,Tablet}   
## 132   
## {Accessories,PC,Printer,Tablet}   
## 133   
## {Accessories,PC,Printer,Printer Supplies,Tablet}   
## 134   
## {Accessories,PC,Software,Tablet}   
## 135   
## {Accessories,Display,Laptop,PC,Software,Tablet}   
## 136   
## {Accessories,Printer Supplies,Software}   
## 137   
## {Accessories,Display,PC,Software,Tablet}   
## 138   
## {Accessories,Display,Printer Supplies,Software}   
## 139   
## {Accessories,Display,Laptop,PC,Printer}   
## 140   
## {Accessories,Laptop,Printer,Tablet}   
## 141   
## {Accessories,Display,PC,Printer Supplies,Software}   
## 142   
## {Accessories,Display,Laptop,PC,Tablet}   
## 143   
## {Accessories,Display,Laptop,Printer Supplies,Software}   
## 144   
## {Accessories,Display,Laptop,Tablet}   
## 145   
## {Accessories,Display,PC,Tablet}   
## 146   
## {Accessories,Printer,Tablet}   
## 147   
## {Accessories,Laptop,Printer Supplies,Software}   
## 148   
## {Accessories,Display,Laptop,PC,Printer Supplies,Software}   
## 149   
## {Accessories,Display,Tablet}   
## 150   
## {Accessories,Display,Laptop,PC,Software}   
## 151   
## {Accessories,Laptop,PC,Printer Supplies}   
## 152   
## {Accessories,PC,Printer Supplies,Software}   
## 153   
## {Accessories,Display,Laptop,PC,Printer Supplies}   
## 154   
## {Accessories,Display,PC,Printer,Software}   
## 155   
## {Accessories,Display,Printer,Software}   
## 156   
## {Accessories,Laptop,PC,Software}   
## 157   
## {Accessories,Laptop,PC,Printer Supplies,Software}   
## 158   
## {Accessories,Printer,Software}   
## 159   
## {Accessories,Display,PC,Printer Supplies}   
## 160   
## {Accessories,Display,Laptop,Printer}   
## 161   
## {Accessories,PC,Printer,Software}   
## 162   
## {Accessories,Laptop,Printer Supplies}   
## 163   
## {Accessories,Display,Laptop,Printer Supplies}   
## 164   
## {Accessories,Display,PC,Printer}   
## 165   
## {Accessories,PC,Tablet}   
## 166   
## {Accessories,Laptop,PC,Printer}   
## 167   
## {Accessories,Laptop,PC,Tablet}   
## 168   
## {Accessories,Display,Printer}   
## 169   
## {Accessories,Display,PC,Software}   
## 170   
## {Accessories,Display,Printer Supplies}   
## 171   
## {Accessories,PC,Printer Supplies}   
## 172   
## {Accessories,Laptop,Software}   
## 173   
## {Accessories,Laptop,Printer}   
## 174   
## {Accessories,Printer}   
## 175   
## {Accessories,Tablet}   
## 176   
## {Accessories,PC,Printer}   
## 177   
## {Accessories,Printer Supplies}   
## 178   
## {Accessories,Display,Laptop,Software}   
## 179   
## {Accessories,Laptop,Tablet}   
## 180   
## {Accessories,PC,Software}   
## 181   
## {Accessories,Display,Software}   
## 182   
## {Accessories,Software}   
## 183   
## {Accessories,Display,Laptop,PC}   
## 184   
## {Accessories,Display,PC}   
## 185   
## {Accessories,Display,Laptop}   
## 186

rules.pruned <- rules.sorted[!redundant]  
inspect(rules.pruned)

#### 6.3 Inspect pruned rules

rules.pruned <- sort(rules, by="lift")  
inspect(rules.pruned[1:10])

## lhs rhs support confidence lift count  
## [1] {Laptop,   
## Printer,   
## Printer Supplies,   
## Tablet} => {Display} 0.004560261 0.9130435 1.564781 21  
## [2] {Accessories,   
## Laptop,   
## Printer,   
## Printer Supplies,   
## Tablet} => {Display} 0.004560261 0.9130435 1.564781 21  
## [3] {PC,   
## Printer,   
## Software,   
## Tablet} => {Display} 0.008686211 0.9090909 1.558007 40  
## [4] {Accessories,   
## PC,   
## Printer,   
## Software,   
## Tablet} => {Display} 0.008469055 0.9069767 1.554383 39  
## [5] {Laptop,   
## PC,   
## Printer,   
## Printer Supplies,   
## Tablet} => {Display} 0.004125950 0.9047619 1.550587 19  
## [6] {Accessories,   
## Laptop,   
## PC,   
## Printer,   
## Printer Supplies,   
## Tablet} => {Display} 0.004125950 0.9047619 1.550587 19  
## [7] {Display,   
## PC,   
## Printer Supplies,   
## Software} => {Laptop} 0.014332248 0.9565217 1.405034 66  
## [8] {Accessories,   
## Display,   
## PC,   
## Printer Supplies,   
## Software} => {Laptop} 0.013680782 0.9545455 1.402131 63  
## [9] {PC,   
## Printer Supplies,   
## Software,   
## Tablet} => {Laptop} 0.003691640 0.9444444 1.387294 17  
## [10] {Accessories,   
## PC,   
## Printer Supplies,   
## Software,   
## Tablet} => {Laptop} 0.003691640 0.9444444 1.387294 17

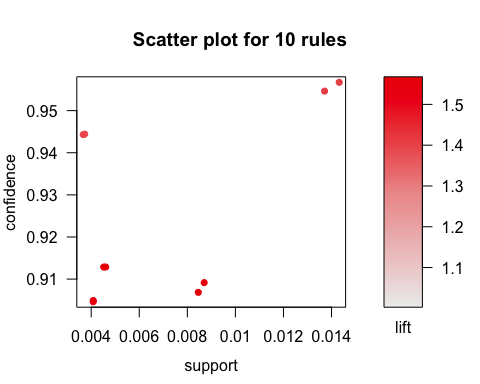
labels(rules.pruned[1:10], itemSep = " + ", setStart = "", setEnd="", ruleSep = " ---> ")

## [1] "Laptop + Printer + Printer Supplies + Tablet ---> Display"   
## [2] "Accessories + Laptop + Printer + Printer Supplies + Tablet ---> Display"   
## [3] "PC + Printer + Software + Tablet ---> Display"   
## [4] "Accessories + PC + Printer + Software + Tablet ---> Display"   
## [5] "Laptop + PC + Printer + Printer Supplies + Tablet ---> Display"   
## [6] "Accessories + Laptop + PC + Printer + Printer Supplies + Tablet ---> Display"  
## [7] "Display + PC + Printer Supplies + Software ---> Laptop"   
## [8] "Accessories + Display + PC + Printer Supplies + Software ---> Laptop"   
## [9] "PC + Printer Supplies + Software + Tablet ---> Laptop"   
## [10] "Accessories + PC + Printer Supplies + Software + Tablet ---> Laptop"

#### 6.4 Plots of the pruned rules

#ruleExplorer(rules.pruned)  
plot(rules.pruned[1:10])

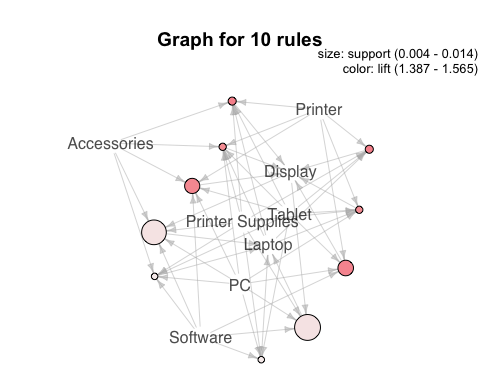
## To reduce overplotting, jitter is added! Use jitter = 0 to prevent jitter.



plot(rules.pruned[1:10], method = "graph", control = list(type = "items"))

## Warning: Unknown control parameters: type

## Available control parameters (with default values):  
## main = Graph for 10 rules  
## nodeColors = c("#66CC6680", "#9999CC80")  
## nodeCol = c("#EE0000FF", "#EE0303FF", "#EE0606FF", "#EE0909FF", "#EE0C0CFF", "#EE0F0FFF", "#EE1212FF", "#EE1515FF", "#EE1818FF", "#EE1B1BFF", "#EE1E1EFF", "#EE2222FF", "#EE2525FF", "#EE2828FF", "#EE2B2BFF", "#EE2E2EFF", "#EE3131FF", "#EE3434FF", "#EE3737FF", "#EE3A3AFF", "#EE3D3DFF", "#EE4040FF", "#EE4444FF", "#EE4747FF", "#EE4A4AFF", "#EE4D4DFF", "#EE5050FF", "#EE5353FF", "#EE5656FF", "#EE5959FF", "#EE5C5CFF", "#EE5F5FFF", "#EE6262FF", "#EE6666FF", "#EE6969FF", "#EE6C6CFF", "#EE6F6FFF", "#EE7272FF", "#EE7575FF", "#EE7878FF", "#EE7B7BFF", "#EE7E7EFF", "#EE8181FF", "#EE8484FF", "#EE8888FF", "#EE8B8BFF", "#EE8E8EFF", "#EE9191FF", "#EE9494FF", "#EE9797FF", "#EE9999FF", "#EE9B9BFF", "#EE9D9DFF", "#EE9F9FFF", "#EEA0A0FF", "#EEA2A2FF", "#EEA4A4FF", "#EEA5A5FF", "#EEA7A7FF", "#EEA9A9FF", "#EEABABFF", "#EEACACFF", "#EEAEAEFF", "#EEB0B0FF", "#EEB1B1FF", "#EEB3B3FF", "#EEB5B5FF", "#EEB7B7FF", "#EEB8B8FF", "#EEBABAFF", "#EEBCBCFF", "#EEBDBDFF", "#EEBFBFFF", "#EEC1C1FF", "#EEC3C3FF", "#EEC4C4FF", "#EEC6C6FF", "#EEC8C8FF", "#EEC9C9FF", "#EECBCBFF", "#EECDCDFF", "#EECFCFFF", "#EED0D0FF", "#EED2D2FF", "#EED4D4FF", "#EED5D5FF", "#EED7D7FF", "#EED9D9FF", "#EEDBDBFF", "#EEDCDCFF", "#EEDEDEFF", "#EEE0E0FF", "#EEE1E1FF", "#EEE3E3FF", "#EEE5E5FF", "#EEE7E7FF", "#EEE8E8FF", "#EEEAEAFF", "#EEECECFF", "#EEEEEEFF")  
## edgeCol = c("#474747FF", "#494949FF", "#4B4B4BFF", "#4D4D4DFF", "#4F4F4FFF", "#515151FF", "#535353FF", "#555555FF", "#575757FF", "#595959FF", "#5B5B5BFF", "#5E5E5EFF", "#606060FF", "#626262FF", "#646464FF", "#666666FF", "#686868FF", "#6A6A6AFF", "#6C6C6CFF", "#6E6E6EFF", "#707070FF", "#727272FF", "#747474FF", "#767676FF", "#787878FF", "#7A7A7AFF", "#7C7C7CFF", "#7E7E7EFF", "#808080FF", "#828282FF", "#848484FF", "#868686FF", "#888888FF", "#8A8A8AFF", "#8C8C8CFF", "#8D8D8DFF", "#8F8F8FFF", "#919191FF", "#939393FF", "#959595FF", "#979797FF", "#999999FF", "#9A9A9AFF", "#9C9C9CFF", "#9E9E9EFF", "#A0A0A0FF", "#A2A2A2FF", "#A3A3A3FF", "#A5A5A5FF", "#A7A7A7FF", "#A9A9A9FF", "#AAAAAAFF", "#ACACACFF", "#AEAEAEFF", "#AFAFAFFF", "#B1B1B1FF", "#B3B3B3FF", "#B4B4B4FF", "#B6B6B6FF", "#B7B7B7FF", "#B9B9B9FF", "#BBBBBBFF", "#BCBCBCFF", "#BEBEBEFF", "#BFBFBFFF", "#C1C1C1FF", "#C2C2C2FF", "#C3C3C4FF", "#C5C5C5FF", "#C6C6C6FF", "#C8C8C8FF", "#C9C9C9FF", "#CACACAFF", "#CCCCCCFF", "#CDCDCDFF", "#CECECEFF", "#CFCFCFFF", "#D1D1D1FF", "#D2D2D2FF", "#D3D3D3FF", "#D4D4D4FF", "#D5D5D5FF", "#D6D6D6FF", "#D7D7D7FF", "#D8D8D8FF", "#D9D9D9FF", "#DADADAFF", "#DBDBDBFF", "#DCDCDCFF", "#DDDDDDFF", "#DEDEDEFF", "#DEDEDEFF", "#DFDFDFFF", "#E0E0E0FF", "#E0E0E0FF", "#E1E1E1FF", "#E1E1E1FF", "#E2E2E2FF", "#E2E2E2FF", "#E2E2E2FF")  
## alpha = 0.5  
## cex = 1  
## itemLabels = TRUE  
## labelCol = #000000B3  
## measureLabels = FALSE  
## precision = 3  
## layout = NULL  
## layoutParams = list()  
## arrowSize = 0.5  
## engine = igraph  
## plot = TRUE  
## plot\_options = list()  
## max = 100  
## verbose = FALSE

 #####7. CREATE LABELS FOR B2C CATEGORIES

TempDFB2C <-  
as.data.frame(transactions\_B2C@itemInfo$labels)  
  
colnames(TempDFB2C) <- "ProdName"  
  
TempDFB2C

## ProdName  
## 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

TempDFB2BC <-  
 merge(TempDFB2C, Categories, by.x="ProdName", by.y="ProdName")  
  
  
  
transactions\_B2C@itemInfo$categories <- TempDFB2BC$BWCat  
  
#creating transactional for Prod. Category  
transactions\_B2CAgg <- aggregate(transactions\_B2C, by = "categories")  
  
summary(transactions\_B2CAgg)

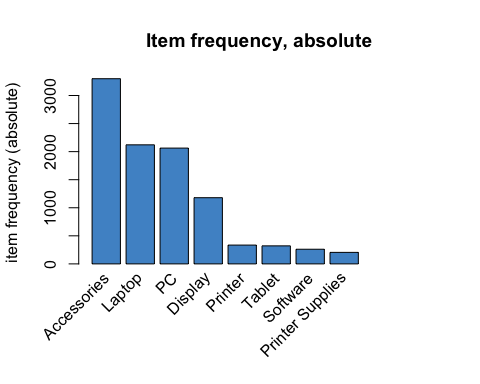
## transactions as itemMatrix in sparse format with  
## 5228 rows (elements/itemsets/transactions) and  
## 8 columns (items) and a density of 0.2339327   
##   
## most frequent items:  
## Accessories Laptop PC Display Printer (Other)   
## 3299 2121 2063 1179 335 787   
##   
## element (itemset/transaction) length distribution:  
## sizes  
## 1 2 3 4 5 6 7   
## 2381 1636 838 273 78 19 3   
##   
## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 1.000 1.000 2.000 1.871 2.000 7.000   
##   
## includes extended item information - examples:  
## labels categories  
## 1 Accessories Accessories  
## 2 Display Display  
## 3 Laptop Laptop

str(transactions\_B2CAgg)

## Formal class 'transactions' [package "arules"] with 3 slots  
## ..@ data :Formal class 'ngCMatrix' [package "Matrix"] with 5 slots  
## .. .. ..@ i : int [1:9784] 0 2 5 3 3 0 0 3 2 0 ...  
## .. .. ..@ p : int [1:5229] 0 3 4 5 6 8 9 12 14 15 ...  
## .. .. ..@ Dim : int [1:2] 8 5228  
## .. .. ..@ Dimnames:List of 2  
## .. .. .. ..$ : chr [1:8] "Accessories" "Display" "Laptop" "PC" ...  
## .. .. .. ..$ : NULL  
## .. .. ..@ factors : list()  
## ..@ itemInfo :'data.frame': 8 obs. of 2 variables:  
## .. ..$ labels : Factor w/ 8 levels "Accessories",..: 1 2 3 4 5 6 7 8  
## .. ..$ categories: Factor w/ 8 levels "Accessories",..: 1 2 3 4 5 6 7 8  
## ..@ itemsetInfo:'data.frame': 0 obs. of 0 variables

#### 7.1 Plots of transactions\_B2CAgg

itemFrequencyPlot(transactions\_B2CAgg,  
 type="absolute",  
 topN=10,  
 horiz=FALSE,  
 col='steelblue3',  
 xlab='',  
 main='Item frequency, absolute')

 #### 8.B2C TRANSACTION RULES

rulesB2C <- apriori(transactions\_B2CAgg,parameter = list(minlen=2, maxlen=5, supp=0.005, conf=0.5),control = list(verbose=F))  
rulesB2C.sorted <- sort(rulesB2C, by="lift")  
inspect(rulesB2C.sorted[1:10])

## lhs rhs support   
## [1] {Accessories,Laptop,PC,Printer} => {Display} 0.005547054  
## [2] {Accessories,Display,Laptop,Printer} => {PC} 0.005547054  
## [3] {Accessories,Display,Printer} => {PC} 0.009372609  
## [4] {Display,Laptop,Printer} => {PC} 0.006312165  
## [5] {Accessories,Display,Tablet} => {Laptop} 0.008224943  
## [6] {Accessories,Display,Software} => {PC} 0.007268554  
## [7] {Accessories,Display,PC,Printer} => {Laptop} 0.005547054  
## [8] {Accessories,Laptop,Printer} => {PC} 0.010520275  
## [9] {Accessories,Display,Printer Supplies} => {PC} 0.005738332  
## [10] {Display,PC,Printer} => {Laptop} 0.006312165  
## confidence lift count  
## [1] 0.5272727 2.338068 29   
## [2] 0.6590909 1.670251 29   
## [3] 0.6049383 1.533019 49   
## [4] 0.6000000 1.520504 33   
## [5] 0.5972222 1.472078 43   
## [6] 0.5757576 1.459070 38   
## [7] 0.5918367 1.458804 29   
## [8] 0.5729167 1.451870 55   
## [9] 0.5660377 1.434438 30   
## [10] 0.5789474 1.427033 33

labels(rulesB2C.sorted[1:10], itemSep = " + ", setStart = "", setEnd="", ruleSep = " ---> ")

## [1] "Accessories + Laptop + PC + Printer ---> Display"  
## [2] "Accessories + Display + Laptop + Printer ---> PC"  
## [3] "Accessories + Display + Printer ---> PC"   
## [4] "Display + Laptop + Printer ---> PC"   
## [5] "Accessories + Display + Tablet ---> Laptop"   
## [6] "Accessories + Display + Software ---> PC"   
## [7] "Accessories + Display + PC + Printer ---> Laptop"  
## [8] "Accessories + Laptop + Printer ---> PC"   
## [9] "Accessories + Display + Printer Supplies ---> PC"  
## [10] "Display + PC + Printer ---> Laptop"

#ruleExplorer(rulesB2C.sorted)

#### 8.1 Redundant rules

is.redundant(rulesB2C.sorted)

## [1] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [12] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [23] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [34] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [45] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE  
## [56] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE

#### 8.2 Prune redundant rules

subset.matrix <- is.subset(rulesB2C.sorted, rulesB2C.sorted)  
subset.matrix[lower.tri(subset.matrix, diag=T)] <- NA

## Warning in `[<-`(`\*tmp\*`, as.vector(i), value = NA): x[.] <- val: x is  
## "ngTMatrix", val not in {TRUE, FALSE} is coerced; NA |--> TRUE.

redundant <- colSums(subset.matrix, na.rm=T) >= 1  
which(redundant)

## {Accessories,Display,Laptop,PC,Printer}   
## 1   
## {Accessories,Display,Laptop,PC,Printer}   
## 2   
## {Accessories,Display,PC,Printer}   
## 3   
## {Display,Laptop,PC,Printer}   
## 4   
## {Accessories,Display,Laptop,Tablet}   
## 5   
## {Accessories,Display,PC,Software}   
## 6   
## {Accessories,Display,Laptop,PC,Printer}   
## 7   
## {Accessories,Laptop,PC,Printer}   
## 8   
## {Accessories,Display,PC,Printer Supplies}   
## 9   
## {Display,Laptop,PC,Printer}   
## 10   
## {Display,PC,Software}   
## 11   
## {Display,PC,Printer Supplies}   
## 12   
## {Display,Laptop,PC,Tablet}   
## 13   
## {Accessories,Display,Laptop,Printer Supplies}   
## 14   
## {Accessories,Display,Laptop,PC,Printer}   
## 15   
## {Accessories,Display,Laptop,Tablet}   
## 16   
## {Accessories,Display,PC,Tablet}   
## 17   
## {Laptop,PC,Printer}   
## 18   
## {Display,PC,Printer}   
## 19   
## {Accessories,Display,PC,Printer}   
## 20   
## {Display,Laptop,PC,Tablet}   
## 21   
## {Accessories,Laptop,PC,Printer Supplies}   
## 22   
## {Display,PC,Tablet}   
## 23   
## {Accessories,Display,Laptop,Printer Supplies}   
## 24   
## {Accessories,Display,Laptop,Printer}   
## 25   
## {Accessories,Display,PC,Printer Supplies}   
## 26   
## {Accessories,Laptop,PC,Software}   
## 27   
## {Display,Laptop,Tablet}   
## 28   
## {Accessories,PC,Software}   
## 29   
## {Accessories,Display,Laptop,Software}   
## 30   
## {Accessories,Laptop,PC,Tablet}   
## 31   
## {Accessories,Display,Printer Supplies}   
## 32   
## {Display,Laptop,Printer}   
## 33   
## {Accessories,Laptop,PC,Tablet}   
## 34   
## {Accessories,Display,PC}   
## 35   
## {Accessories,Display,Laptop,Printer}   
## 36   
## {Accessories,Display,PC,Tablet}   
## 37   
## {Display,Laptop,Printer Supplies}   
## 38   
## {Accessories,Laptop,PC,Printer}   
## 39   
## {Accessories,Laptop,PC,Printer}   
## 40   
## {Accessories,Display,Tablet}   
## 41   
## {Accessories,Laptop,PC,Tablet}   
## 42   
## {Accessories,Laptop,Printer Supplies}   
## 43   
## {Accessories,Laptop,PC,Software}   
## 44   
## {Accessories,Display,Printer}   
## 45   
## {Accessories,Display,PC,Software}   
## 46   
## {Accessories,PC,Printer Supplies}   
## 47   
## {Accessories,Display,Software}   
## 48   
## {Accessories,Laptop,Printer}   
## 49   
## {Accessories,Display,Laptop,PC}   
## 50   
## {Accessories,Laptop,Software}   
## 51   
## {Accessories,PC,Tablet}   
## 52   
## {Accessories,Laptop,Tablet}   
## 53   
## {Accessories,PC,Printer}   
## 54   
## {Accessories,Display,Laptop}   
## 55   
## {Accessories,PC,Software}   
## 56   
## {Accessories,Display,PC}   
## 57   
## {Accessories,Printer Supplies}   
## 58   
## {Accessories,Software}   
## 59   
## {Accessories,Printer}   
## 60   
## {Accessories,Tablet}   
## 61   
## {Accessories,Laptop,PC}   
## 62   
## {Accessories,Display}   
## 63   
## {Accessories,PC}   
## 64   
## {Accessories,Laptop}   
## 65

rulesB2C.pruned <- rulesB2C.sorted[!redundant]  
inspect(rulesB2C.pruned)

#### 8.3 Inspect pruned rules

rulesB2C.pruned <- sort(rulesB2C, by="lift")  
inspect(rulesB2C.pruned[1:10])

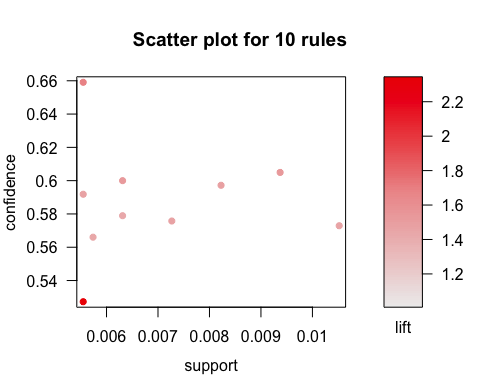
## lhs rhs support   
## [1] {Accessories,Laptop,PC,Printer} => {Display} 0.005547054  
## [2] {Accessories,Display,Laptop,Printer} => {PC} 0.005547054  
## [3] {Accessories,Display,Printer} => {PC} 0.009372609  
## [4] {Display,Laptop,Printer} => {PC} 0.006312165  
## [5] {Accessories,Display,Tablet} => {Laptop} 0.008224943  
## [6] {Accessories,Display,Software} => {PC} 0.007268554  
## [7] {Accessories,Display,PC,Printer} => {Laptop} 0.005547054  
## [8] {Accessories,Laptop,Printer} => {PC} 0.010520275  
## [9] {Accessories,Display,Printer Supplies} => {PC} 0.005738332  
## [10] {Display,PC,Printer} => {Laptop} 0.006312165  
## confidence lift count  
## [1] 0.5272727 2.338068 29   
## [2] 0.6590909 1.670251 29   
## [3] 0.6049383 1.533019 49   
## [4] 0.6000000 1.520504 33   
## [5] 0.5972222 1.472078 43   
## [6] 0.5757576 1.459070 38   
## [7] 0.5918367 1.458804 29   
## [8] 0.5729167 1.451870 55   
## [9] 0.5660377 1.434438 30   
## [10] 0.5789474 1.427033 33

labels(rulesB2C.pruned[1:10], itemSep = " + ", setStart = "", setEnd="", ruleSep = " ---> ")

## [1] "Accessories + Laptop + PC + Printer ---> Display"  
## [2] "Accessories + Display + Laptop + Printer ---> PC"  
## [3] "Accessories + Display + Printer ---> PC"   
## [4] "Display + Laptop + Printer ---> PC"   
## [5] "Accessories + Display + Tablet ---> Laptop"   
## [6] "Accessories + Display + Software ---> PC"   
## [7] "Accessories + Display + PC + Printer ---> Laptop"  
## [8] "Accessories + Laptop + Printer ---> PC"   
## [9] "Accessories + Display + Printer Supplies ---> PC"  
## [10] "Display + PC + Printer ---> Laptop"

#### 8.4 Plots of the pruned rules

#ruleExplorer(rulesB2C.pruned)  
plot(rulesB2C.pruned[1:10])



plot(rulesB2C.pruned[1:10], method = "graph", control = list(type = "items"))

## Warning: Unknown control parameters: type

## Available control parameters (with default values):  
## main = Graph for 10 rules  
## nodeColors = c("#66CC6680", "#9999CC80")  
## nodeCol = c("#EE0000FF", "#EE0303FF", "#EE0606FF", "#EE0909FF", "#EE0C0CFF", "#EE0F0FFF", "#EE1212FF", "#EE1515FF", "#EE1818FF", "#EE1B1BFF", "#EE1E1EFF", "#EE2222FF", "#EE2525FF", "#EE2828FF", "#EE2B2BFF", "#EE2E2EFF", "#EE3131FF", "#EE3434FF", "#EE3737FF", "#EE3A3AFF", "#EE3D3DFF", "#EE4040FF", "#EE4444FF", "#EE4747FF", "#EE4A4AFF", "#EE4D4DFF", "#EE5050FF", "#EE5353FF", "#EE5656FF", "#EE5959FF", "#EE5C5CFF", "#EE5F5FFF", "#EE6262FF", "#EE6666FF", "#EE6969FF", "#EE6C6CFF", "#EE6F6FFF", "#EE7272FF", "#EE7575FF", "#EE7878FF", "#EE7B7BFF", "#EE7E7EFF", "#EE8181FF", "#EE8484FF", "#EE8888FF", "#EE8B8BFF", "#EE8E8EFF", "#EE9191FF", "#EE9494FF", "#EE9797FF", "#EE9999FF", "#EE9B9BFF", "#EE9D9DFF", "#EE9F9FFF", "#EEA0A0FF", "#EEA2A2FF", "#EEA4A4FF", "#EEA5A5FF", "#EEA7A7FF", "#EEA9A9FF", "#EEABABFF", "#EEACACFF", "#EEAEAEFF", "#EEB0B0FF", "#EEB1B1FF", "#EEB3B3FF", "#EEB5B5FF", "#EEB7B7FF", "#EEB8B8FF", "#EEBABAFF", "#EEBCBCFF", "#EEBDBDFF", "#EEBFBFFF", "#EEC1C1FF", "#EEC3C3FF", "#EEC4C4FF", "#EEC6C6FF", "#EEC8C8FF", "#EEC9C9FF", "#EECBCBFF", "#EECDCDFF", "#EECFCFFF", "#EED0D0FF", "#EED2D2FF", "#EED4D4FF", "#EED5D5FF", "#EED7D7FF", "#EED9D9FF", "#EEDBDBFF", "#EEDCDCFF", "#EEDEDEFF", "#EEE0E0FF", "#EEE1E1FF", "#EEE3E3FF", "#EEE5E5FF", "#EEE7E7FF", "#EEE8E8FF", "#EEEAEAFF", "#EEECECFF", "#EEEEEEFF")  
## edgeCol = c("#474747FF", "#494949FF", "#4B4B4BFF", "#4D4D4DFF", "#4F4F4FFF", "#515151FF", "#535353FF", "#555555FF", "#575757FF", "#595959FF", "#5B5B5BFF", "#5E5E5EFF", "#606060FF", "#626262FF", "#646464FF", "#666666FF", "#686868FF", "#6A6A6AFF", "#6C6C6CFF", "#6E6E6EFF", "#707070FF", "#727272FF", "#747474FF", "#767676FF", "#787878FF", "#7A7A7AFF", "#7C7C7CFF", "#7E7E7EFF", "#808080FF", "#828282FF", "#848484FF", "#868686FF", "#888888FF", "#8A8A8AFF", "#8C8C8CFF", "#8D8D8DFF", "#8F8F8FFF", "#919191FF", "#939393FF", "#959595FF", "#979797FF", "#999999FF", "#9A9A9AFF", "#9C9C9CFF", "#9E9E9EFF", "#A0A0A0FF", "#A2A2A2FF", "#A3A3A3FF", "#A5A5A5FF", "#A7A7A7FF", "#A9A9A9FF", "#AAAAAAFF", "#ACACACFF", "#AEAEAEFF", "#AFAFAFFF", "#B1B1B1FF", "#B3B3B3FF", "#B4B4B4FF", "#B6B6B6FF", "#B7B7B7FF", "#B9B9B9FF", "#BBBBBBFF", "#BCBCBCFF", "#BEBEBEFF", "#BFBFBFFF", "#C1C1C1FF", "#C2C2C2FF", "#C3C3C4FF", "#C5C5C5FF", "#C6C6C6FF", "#C8C8C8FF", "#C9C9C9FF", "#CACACAFF", "#CCCCCCFF", "#CDCDCDFF", "#CECECEFF", "#CFCFCFFF", "#D1D1D1FF", "#D2D2D2FF", "#D3D3D3FF", "#D4D4D4FF", "#D5D5D5FF", "#D6D6D6FF", "#D7D7D7FF", "#D8D8D8FF", "#D9D9D9FF", "#DADADAFF", "#DBDBDBFF", "#DCDCDCFF", "#DDDDDDFF", "#DEDEDEFF", "#DEDEDEFF", "#DFDFDFFF", "#E0E0E0FF", "#E0E0E0FF", "#E1E1E1FF", "#E1E1E1FF", "#E2E2E2FF", "#E2E2E2FF", "#E2E2E2FF")  
## alpha = 0.5  
## cex = 1  
## itemLabels = TRUE  
## labelCol = #000000B3  
## measureLabels = FALSE  
## precision = 3  
## layout = NULL  
## layoutParams = list()  
## arrowSize = 0.5  
## engine = igraph  
## plot = TRUE  
## plot\_options = list()  
## max = 100  
## verbose = FALSE

