Shetty S Module 5 - Association Rules

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This homework assignment focuses on Association Rules.

## Additional packages needed

Additional packages that are required.

* If necessary install following packages.

# `install.packages("arules");`  
# `install.packages("arulesViz");`  
# `install.packages("Matrix")`

require("arules")

## Loading required package: arules

## Loading required package: Matrix

##   
## Attaching package: 'arules'

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

require("arulesViz")

## Loading required package: arulesViz

## Loading required package: grid

require("Matrix")

The data set I am using for the assignment is Adult data set

data\_url <- 'https://archive.ics.uci.edu/ml/machine-learning-databases/adult/adult.data'  
adultS <- read.transactions(url(data\_url))

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

summary(adultS)

## transactions as itemMatrix in sparse format with  
## 32562 rows (elements/itemsets/transactions) and  
## 22055 columns (items) and a density of 0.0006367609   
##   
## most frequent items:  
## 0, United-States, White, <=50K Private,   
## 32561 29170 27816 24720 22696   
## (Other)   
## 320330   
##   
## element (itemset/transaction) length distribution:  
## sizes  
## 0 12 13 14 15   
## 1 72 2343 26220 3926   
##   
## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 0.00 14.00 14.00 14.04 14.00 15.00   
##   
## includes extended item information - examples:  
## labels  
## 1 ?,  
## 2 <=50K  
## 3 >50K

head(adultS)

## transactions in sparse format with  
## 6 transactions (rows) and  
## 22055 items (columns)

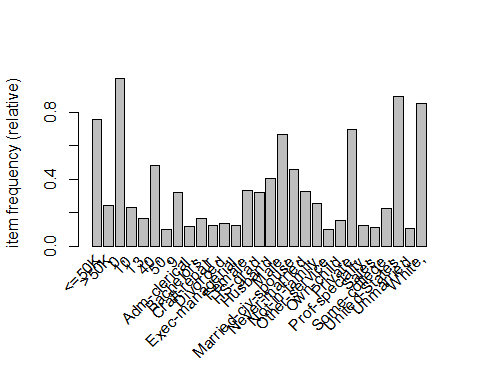
# look at the first transactions  
inspect(adultS[1:6])

## items   
## [1] {<=50K,   
## 0,,   
## 13,,   
## 2174,,   
## 39,,   
## 40,,   
## 77516,,   
## Adm-clerical,,   
## Bachelors,,   
## Male,,   
## Never-married,,   
## Not-in-family,,   
## State-gov,,   
## United-States,,   
## White,}   
## [2] {<=50K,   
## 0,,   
## 13,,   
## 50,,   
## 83311,,   
## Bachelors,,   
## Exec-managerial,,   
## Husband,,   
## Male,,   
## Married-civ-spouse,,  
## Self-emp-not-inc,,   
## United-States,,   
## White,}   
## [3] {<=50K,   
## 0,,   
## 215646,,   
## 38,,   
## 40,,   
## 9,,   
## Divorced,,   
## Handlers-cleaners,,   
## HS-grad,,   
## Male,,   
## Not-in-family,,   
## Private,,   
## United-States,,   
## White,}   
## [4] {<=50K,   
## 0,,   
## 11th,,   
## 234721,,   
## 40,,   
## 53,,   
## 7,,   
## Black,,   
## Handlers-cleaners,,   
## Husband,,   
## Male,,   
## Married-civ-spouse,,  
## Private,,   
## United-States,}   
## [5] {<=50K,   
## 0,,   
## 13,,   
## 28,,   
## 338409,,   
## 40,,   
## Bachelors,,   
## Black,,   
## Cuba,,   
## Female,,   
## Married-civ-spouse,,  
## Private,,   
## Prof-specialty,,   
## Wife,}   
## [6] {<=50K,   
## 0,,   
## 14,,   
## 284582,,   
## 37,,   
## 40,,   
## Exec-managerial,,   
## Female,,   
## Married-civ-spouse,,  
## Masters,,   
## Private,,   
## United-States,,   
## White,,   
## Wife,}

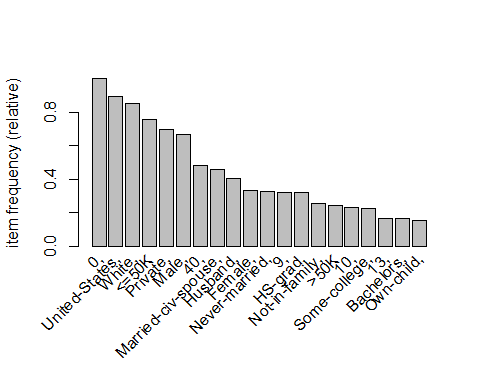
# Look at the frequency   
itemFrequency(adultS[1:100, 1:10])

## ?, <=50K >50K 0, 1, 10, 100009, 100029, 100054,   
## 0.08 0.75 0.25 1.00 0.00 0.20 0.00 0.00 0.00   
## 100063,   
## 0.00

# plot the frequency   
itemFrequencyPlot(adultS,support=0.1)

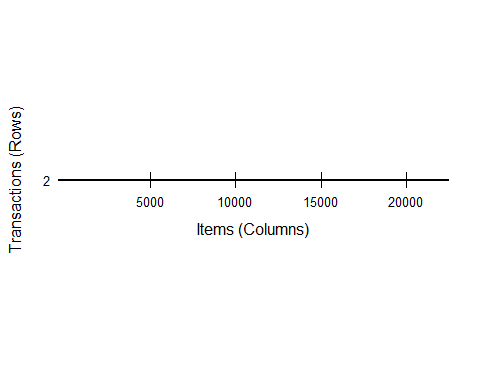


itemFrequencyPlot(adultS,topN=20)

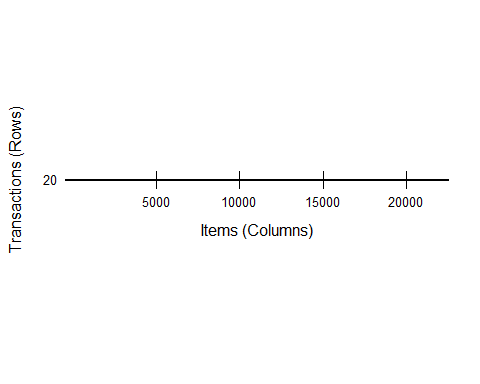


Visualization of transactions

image(adultS[1:10])



image(sample(adultS, 100))

 \* Generate a set of 50 or so (non-redundant) rules.

adultS.rules<-apriori(adultS)

## Apriori  
##   
## Parameter specification:  
## confidence minval smax arem aval originalSupport maxtime support minlen  
## 0.8 0.1 1 none FALSE TRUE 5 0.1 1  
## maxlen target ext  
## 10 rules FALSE  
##   
## Algorithmic control:  
## filter tree heap memopt load sort verbose  
## 0.1 TRUE TRUE FALSE TRUE 2 TRUE  
##   
## Absolute minimum support count: 3256   
##   
## set item appearances ...[0 item(s)] done [0.00s].  
## set transactions ...[22055 item(s), 32562 transaction(s)] done [0.04s].  
## sorting and recoding items ... [29 item(s)] done [0.00s].  
## creating transaction tree ... done [0.02s].  
## checking subsets of size 1 2 3 4 5 6 7 8 done [0.01s].  
## writing ... [3681 rule(s)] done [0.02s].  
## creating S4 object ... done [0.00s].

summary(adultS.rules)

## set of 3681 rules  
##   
## rule length distribution (lhs + rhs):sizes  
## 1 2 3 4 5 6 7 8   
## 3 100 470 997 1129 714 237 31   
##   
## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 1.000 4.000 5.000 4.737 6.000 8.000   
##   
## summary of quality measures:  
## support confidence lift   
## Min. :0.1002 Min. :0.8006 Min. :0.9392   
## 1st Qu.:0.1155 1st Qu.:0.8933 1st Qu.:1.0000   
## Median :0.1345 Median :0.9446 Median :1.0494   
## Mean :0.1692 Mean :0.9418 Mean :1.5055   
## 3rd Qu.:0.1906 3rd Qu.:1.0000 3rd Qu.:1.4942   
## Max. :1.0000 Max. :1.0000 Max. :6.0661   
##   
## mining info:  
## data ntransactions support confidence  
## adultS 32562 0.1 0.8

adultS.rules

## set of 3681 rules

Improving model performance.

adultS.rules.2 <- apriori(adultS, parameter = list(support = 0.01, confidence = 0.50, minlen = 2))

## Apriori  
##   
## Parameter specification:  
## confidence minval smax arem aval originalSupport maxtime support minlen  
## 0.5 0.1 1 none FALSE TRUE 5 0.01 2  
## maxlen target ext  
## 10 rules FALSE  
##   
## Algorithmic control:  
## filter tree heap memopt load sort verbose  
## 0.1 TRUE TRUE FALSE TRUE 2 TRUE  
##   
## Absolute minimum support count: 325   
##   
## set item appearances ...[0 item(s)] done [0.00s].  
## set transactions ...[22055 item(s), 32562 transaction(s)] done [0.04s].  
## sorting and recoding items ... [116 item(s)] done [0.02s].  
## creating transaction tree ... done [0.02s].  
## checking subsets of size 1 2 3 4 5 6 7 8 9 10

## Warning in apriori(adultS, parameter = list(support = 0.01, confidence =  
## 0.5, : Mining stopped (maxlen reached). Only patterns up to a length of 10  
## returned!

## done [0.50s].  
## writing ... [190475 rule(s)] done [0.02s].  
## creating S4 object ... done [0.07s].

## Warning: closing unused connection 5 (https://archive.ics.uci.edu/ml/  
## machine-learning-databases/adult/adult.data)

adultS.rules.2

## set of 190475 rules

summary(adultS.rules.2)

## set of 190475 rules  
##   
## rule length distribution (lhs + rhs):sizes  
## 2 3 4 5 6 7 8 9 10   
## 778 7078 24098 44234 50502 37850 18719 5990 1226   
##   
## Min. 1st Qu. Median Mean 3rd Qu. Max.   
## 2.000 5.000 6.000 5.902 7.000 10.000   
##   
## summary of quality measures:  
## support confidence lift   
## Min. :0.01001 Min. :0.5000 Min. : 0.6565   
## 1st Qu.:0.01228 1st Qu.:0.7644 1st Qu.: 1.0000   
## Median :0.01637 Median :0.9216 Median : 1.0963   
## Mean :0.02592 Mean :0.8643 Mean : 1.9385   
## 3rd Qu.:0.02626 3rd Qu.:1.0000 3rd Qu.: 1.7342   
## Max. :0.89583 Max. :1.0000 Max. :87.7682   
##   
## mining info:  
## data ntransactions support confidence  
## adultS 32562 0.01 0.5

# converting the rule set to a data frame  
adultSdataframe<- as(adultS.rules.2, "data.frame")  
str(adultSdataframe)

## 'data.frame': 190475 obs. of 4 variables:  
## $ rules : Factor w/ 190475 levels "{?,,<=50K,0,,10,,Never-married,} => {Some-college,}",..: 163950 145513 163949 163948 163947 145511 145512 143203 143205 143204 ...  
## $ support : num 0.0102 0.0102 0.0102 0.01 0.0111 ...  
## $ confidence: num 1 0.898 1 0.908 1 ...  
## $ lift : num 87.77 87.77 1 1.06 1 ...

Pruning redundant rules.

adultSrules.2.test=adultS.rules.2[1:500] #First 500 rows  
subset.matrix <- is.subset(adultSrules.2.test, adultSrules.2.test)  
subset.matrix[lower.tri(subset.matrix, diag=T)] <- NA  
redundant <- colSums(subset.matrix, na.rm=T) >= 1  
which(redundant)

## {3,,5th-6th,} {16,,Doctorate,} {12th,,8,}   
## 2 28 38   
## {5,,9th,} {15,,Prof-school,} {4,,7th-8th,}   
## 57 77 131   
## {10th,,6,} {12,,Assoc-acdm,} {11th,,7,}   
## 268 380 415   
## {11,,Assoc-voc,} {14,,Masters,}   
## 456 496

# remove redundant rules  
rules.pruned <- adultSrules.2.test[!redundant]  
inspect(rules.pruned)

## lhs rhs support   
## [1] {5th-6th,} => {3,} 0.01022664  
## [2] {5th-6th,} => {0,} 0.01022664  
## [3] {59,} => {White,} 0.01004238  
## [4] {59,} => {0,} 0.01105583  
## [5] {3,} => {<=50K} 0.01087157  
## [6] {3,} => {0,} 0.01139365  
## [7] {15024,} => {>50K} 0.01065659  
## [8] {15024,} => {Married-civ-spouse,} 0.01065659  
## [9] {15024,} => {0,} 0.01065659  
## [10] {57,} => {United-States,} 0.01016522  
## [11] {57,} => {0,} 0.01148578  
## [12] {70,} => {White,} 0.01081015  
## [13] {70,} => {United-States,} 0.01044162  
## [14] {70,} => {0,} 0.01160862  
## [15] {58,} => {White,} 0.01068730  
## [16] {58,} => {United-States,} 0.01120939  
## [17] {58,} => {0,} 0.01206928  
## [18] {17,} => {Own-child,} 0.01114796  
## [19] {17,} => {Never-married,} 0.01237639  
## [20] {17,} => {<=50K} 0.01283705  
## [21] {17,} => {White,} 0.01133223  
## [22] {17,} => {United-States,} 0.01216142  
## [23] {17,} => {0,} 0.01286776  
## [24] {Married-spouse-absent,} => {<=50K} 0.01179289  
## [25] {Married-spouse-absent,} => {0,} 0.01283705  
## [26] {Doctorate,} => {16,} 0.01268350  
## [27] {Doctorate,} => {Male,} 0.01004238  
## [28] {Doctorate,} => {White,} 0.01133223  
## [29] {Doctorate,} => {United-States,} 0.01007309  
## [30] {Doctorate,} => {0,} 0.01268350  
## [31] {65,} => {Male,} 0.01010380  
## [32] {65,} => {White,} 0.01188502  
## [33] {65,} => {United-States,} 0.01200786  
## [34] {65,} => {0,} 0.01289847  
## [35] {12th,} => {8,} 0.01329771  
## [36] {12th,} => {Private,} 0.01022664  
## [37] {12th,} => {<=50K} 0.01228426  
## [38] {12th,} => {White,} 0.01028807  
## [39] {12th,} => {United-States,} 0.01120939  
## [40] {12th,} => {0,} 0.01329771  
## [41] {54,} => {Male,} 0.01041091  
## [42] {54,} => {White,} 0.01237639  
## [43] {54,} => {United-States,} 0.01234568  
## [44] {54,} => {0,} 0.01394263  
## [45] {56,} => {Male,} 0.01028807  
## [46] {56,} => {White,} 0.01234568  
## [47] {56,} => {United-States,} 0.01265279  
## [48] {56,} => {0,} 0.01418832  
## [49] {53,} => {Male,} 0.01071801  
## [50] {53,} => {White,} 0.01265279  
## [51] {53,} => {United-States,} 0.01323629  
## [52] {53,} => {0,} 0.01501751  
## [53] {9th,} => {5,} 0.01578527  
## [54] {9th,} => {Male,} 0.01136294  
## [55] {9th,} => {Private,} 0.01188502  
## [56] {9th,} => {<=50K} 0.01495608  
## [57] {9th,} => {White,} 0.01237639  
## [58] {9th,} => {United-States,} 0.01213070  
## [59] {9th,} => {0,} 0.01578527  
## [60] {5,} => {Male,} 0.01219213  
## [61] {5,} => {Private,} 0.01262207  
## [62] {5,} => {<=50K} 0.01649162  
## [63] {5,} => {White,} 0.01400405  
## [64] {5,} => {United-States,} 0.01372766  
## [65] {5,} => {0,} 0.01753578  
## [66] {8,} => {Male,} 0.01093299  
## [67] {8,} => {Private,} 0.01237639  
## [68] {8,} => {<=50K} 0.01633806  
## [69] {8,} => {White,} 0.01421903  
## [70] {8,} => {United-States,} 0.01517106  
## [71] {8,} => {0,} 0.01768933  
## [72] {Prof-school,} => {15,} 0.01768933  
## [73] {Prof-school,} => {Prof-specialty,} 0.01388121  
## [74] {Prof-school,} => {>50K} 0.01299060  
## [75] {Prof-school,} => {Husband,} 0.01182360  
## [76] {Prof-school,} => {Married-civ-spouse,} 0.01265279  
## [77] {Prof-school,} => {Male,} 0.01486395  
## [78] {Prof-school,} => {White,} 0.01578527  
## [79] {Prof-school,} => {United-States,} 0.01541674  
## [80] {Prof-school,} => {0,} 0.01768933  
## [81] {49,} => {Husband,} 0.01013451  
## [82] {49,} => {Married-civ-spouse,} 0.01105583  
## [83] {49,} => {Male,} 0.01320558  
## [84] {49,} => {Private,} 0.01139365  
## [85] {49,} => {<=50K} 0.01209999  
## [86] {49,} => {White,} 0.01636877  
## [87] {49,} => {United-States,} 0.01704441  
## [88] {49,} => {0,} 0.01861065  
## [89] {51,} => {Husband,} 0.01102512  
## [90] {51,} => {Married-civ-spouse,} 0.01213070  
## [91] {51,} => {Male,} 0.01366624  
## [92] {51,} => {Private,} 0.01163933  
## [93] {51,} => {<=50K} 0.01114796  
## [94] {51,} => {White,} 0.01618451  
## [95] {51,} => {United-States,} 0.01722867  
## [96] {51,} => {0,} 0.01867207  
## [97] {18,} => {Own-child,} 0.01510964  
## [98] {18,} => {Never-married,} 0.01772004  
## [99] {18,} => {Private,} 0.01418832  
## [100] {18,} => {<=50K} 0.01882562  
## [101] {18,} => {White,} 0.01676801  
## [102] {18,} => {United-States,} 0.01808857  
## [103] {18,} => {0,} 0.01904060  
## [104] {52,} => {Husband,} 0.01053375  
## [105] {52,} => {Married-civ-spouse,} 0.01154720  
## [106] {52,} => {Male,} 0.01366624  
## [107] {52,} => {Private,} 0.01243781  
## [108] {52,} => {<=50K} 0.01154720  
## [109] {52,} => {White,} 0.01633806  
## [110] {52,} => {United-States,} 0.01698299  
## [111] {52,} => {0,} 0.01885634  
## [112] {16,} => {Prof-specialty,} 0.01056446  
## [113] {16,} => {Married-civ-spouse,} 0.01031878  
## [114] {16,} => {Male,} 0.01286776  
## [115] {16,} => {Private,} 0.01034949  
## [116] {16,} => {White,} 0.01707512  
## [117] {16,} => {United-States,} 0.01587740  
## [118] {16,} => {0,} 0.01897918  
## [119] {Mexico,} => {40,} 0.01148578  
## [120] {Mexico,} => {Male,} 0.01526319  
## [121] {Mexico,} => {Private,} 0.01698299  
## [122] {Mexico,} => {<=50K} 0.01873349  
## [123] {Mexico,} => {White,} 0.01811928  
## [124] {Mexico,} => {0,} 0.01974694  
## [125] {7th-8th,} => {4,} 0.01983908  
## [126] {7th-8th,} => {Husband,} 0.01022664  
## [127] {7th-8th,} => {Married-civ-spouse,} 0.01102512  
## [128] {7th-8th,} => {Male,} 0.01492537  
## [129] {7th-8th,} => {Private,} 0.01302131  
## [130] {7th-8th,} => {<=50K} 0.01861065  
## [131] {7th-8th,} => {White,} 0.01698299  
## [132] {7th-8th,} => {United-States,} 0.01532461  
## [133] {7th-8th,} => {0,} 0.01983908  
## [134] {Protective-serv,} => {Husband,} 0.01142436  
## [135] {Protective-serv,} => {Married-civ-spouse,} 0.01176218  
## [136] {Protective-serv,} => {40,} 0.01142436  
## [137] {Protective-serv,} => {Male,} 0.01759720  
## [138] {Protective-serv,} => {<=50K} 0.01345126  
## [139] {Protective-serv,} => {White,} 0.01593882  
## [140] {Protective-serv,} => {United-States,} 0.01861065  
## [141] {Protective-serv,} => {0,} 0.01993121  
## [142] {4,} => {Married-civ-spouse,} 0.01160862  
## [143] {4,} => {Male,} 0.01553959  
## [144] {4,} => {Private,} 0.01348197  
## [145] {4,} => {<=50K} 0.02008476  
## [146] {4,} => {White,} 0.01833425  
## [147] {4,} => {United-States,} 0.01673730  
## [148] {4,} => {0,} 0.02140532  
## [149] {19,} => {Own-child,} 0.01560101  
## [150] {19,} => {Never-married,} 0.02112892  
## [151] {19,} => {Female,} 0.01124010  
## [152] {19,} => {Private,} 0.01686014  
## [153] {19,} => {<=50K} 0.02220380  
## [154] {19,} => {White,} 0.01965481  
## [155] {19,} => {United-States,} 0.02057613  
## [156] {19,} => {0,} 0.02226522  
## [157] {21,} => {Own-child,} 0.01342055  
## [158] {21,} => {Some-college,} 0.01160862  
## [159] {21,} => {10,} 0.01173147  
## [160] {21,} => {Never-married,} 0.02033045  
## [161] {21,} => {Male,} 0.01222284  
## [162] {21,} => {Private,} 0.01824212  
## [163] {21,} => {<=50K} 0.02269517  
## [164] {21,} => {White,} 0.01974694  
## [165] {21,} => {United-States,} 0.02054542  
## [166] {21,} => {0,} 0.02284872  
## [167] {47,} => {Husband,} 0.01286776  
## [168] {47,} => {Married-civ-spouse,} 0.01449542  
## [169] {47,} => {Male,} 0.01621522  
## [170] {47,} => {Private,} 0.01492537  
## [171] {47,} => {<=50K} 0.01391192  
## [172] {47,} => {White,} 0.01971623  
## [173] {47,} => {United-States,} 0.02069897  
## [174] {47,} => {0,} 0.02315583  
## [175] {22,} => {Never-married,} 0.02060684  
## [176] {22,} => {Male,} 0.01363553  
## [177] {22,} => {Private,} 0.01940913  
## [178] {22,} => {<=50K} 0.02423070  
## [179] {22,} => {White,} 0.02103679  
## [180] {22,} => {United-States,} 0.02220380  
## [181] {22,} => {0,} 0.02475278  
## [182] {26,} => {Never-married,} 0.01467969  
## [183] {26,} => {Male,} 0.01572385  
## [184] {26,} => {Private,} 0.02033045  
## [185] {26,} => {<=50K} 0.02297156  
## [186] {26,} => {White,} 0.02066826  
## [187] {26,} => {United-States,} 0.02211166  
## [188] {26,} => {0,} 0.02502918  
## [189] {29,} => {40,} 0.01305202  
## [190] {29,} => {Male,} 0.01670659  
## [191] {29,} => {Private,} 0.01913273  
## [192] {29,} => {<=50K} 0.02103679  
## [193] {29,} => {White,} 0.02079111  
## [194] {29,} => {United-States,} 0.02186598  
## [195] {29,} => {0,} 0.02518273  
## [196] {46,} => {Husband,} 0.01320558  
## [197] {46,} => {Married-civ-spouse,} 0.01477182  
## [198] {46,} => {Male,} 0.01735151  
## [199] {46,} => {Private,} 0.01716725  
## [200] {46,} => {<=50K} 0.01532461  
## [201] {46,} => {White,} 0.02165100  
## [202] {46,} => {United-States,} 0.02266446  
## [203] {46,} => {0,} 0.02509060  
## [204] {41,} => {Husband,} 0.01332842  
## [205] {41,} => {Married-civ-spouse,} 0.01498679  
## [206] {41,} => {Male,} 0.01845710  
## [207] {41,} => {Private,} 0.01722867  
## [208] {41,} => {<=50K} 0.01710583  
## [209] {41,} => {White,} 0.02195811  
## [210] {41,} => {United-States,} 0.02269517  
## [211] {41,} => {0,} 0.02588907  
## [212] {39,} => {Married-civ-spouse,} 0.01403476  
## [213] {39,} => {Male,} 0.01768933  
## [214] {39,} => {Private,} 0.01867207  
## [215] {39,} => {<=50K} 0.01744365  
## [216] {39,} => {White,} 0.02223451  
## [217] {39,} => {United-States,} 0.02358577  
## [218] {39,} => {0,} 0.02619618  
## [219] {27,} => {Never-married,} 0.01514035  
## [220] {27,} => {40,} 0.01348197  
## [221] {27,} => {Male,} 0.01695228  
## [222] {27,} => {Private,} 0.02094466  
## [223] {27,} => {<=50K} 0.02404643  
## [224] {27,} => {White,} 0.02208095  
## [225] {27,} => {United-States,} 0.02318654  
## [226] {27,} => {0,} 0.02656471  
## [227] {23,} => {Never-married,} 0.02232664  
## [228] {23,} => {Male,} 0.01603096  
## [229] {23,} => {Private,} 0.02300227  
## [230] {23,} => {<=50K} 0.02714821  
## [231] {23,} => {White,} 0.02284872  
## [232] {23,} => {United-States,} 0.02423070  
## [233] {23,} => {0,} 0.02751674  
## [234] {31,} => {Male,} 0.01864136  
## [235] {31,} => {Private,} 0.02115963  
## [236] {31,} => {<=50K} 0.02180456  
## [237] {31,} => {White,} 0.02306369  
## [238] {31,} => {United-States,} 0.02423070  
## [239] {31,} => {0,} 0.02742461  
## [240] {33,} => {Male,} 0.01937842  
## [241] {33,} => {Private,} 0.02063755  
## [242] {33,} => {<=50K} 0.02205024  
## [243] {33,} => {White,} 0.02312512  
## [244] {33,} => {United-States,} 0.02475278  
## [245] {33,} => {0,} 0.02800811  
## [246] {34,} => {Married-civ-spouse,} 0.01461827  
## [247] {34,} => {Male,} 0.01956268  
## [248] {34,} => {Private,} 0.02069897  
## [249] {34,} => {<=50K} 0.02051471  
## [250] {34,} => {White,} 0.02380075  
## [251] {34,} => {United-States,} 0.02481420  
## [252] {34,} => {0,} 0.02803882  
## [253] {43,} => {Husband,} 0.01418832  
## [254] {43,} => {Married-civ-spouse,} 0.01606167  
## [255] {43,} => {Male,} 0.01940913  
## [256] {43,} => {Private,} 0.01879491  
## [257] {43,} => {<=50K} 0.01867207  
## [258] {43,} => {White,} 0.02416928  
## [259] {43,} => {United-States,} 0.02555126  
## [260] {43,} => {0,} 0.02816166  
## [261] {10th,} => {6,} 0.02865303  
## [262] {10th,} => {Male,} 0.01959339  
## [263] {10th,} => {Private,} 0.02134390  
## [264] {10th,} => {<=50K} 0.02674897  
## [265] {10th,} => {White,} 0.02340151  
## [266] {10th,} => {United-States,} 0.02604263  
## [267] {10th,} => {0,} 0.02865303  
## [268] {Tech-support,} => {40,} 0.01633806  
## [269] {Tech-support,} => {Male,} 0.01781217  
## [270] {Tech-support,} => {Private,} 0.02260303  
## [271] {Tech-support,} => {<=50K} 0.01980837  
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## [273] {Tech-support,} => {United-States,} 0.02610405  
## [274] {Tech-support,} => {0,} 0.02849948  
## [275] {44,} => {Husband,} 0.01517106  
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## [278] {44,} => {Private,} 0.02005405  
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## [283] {28,} => {Male,} 0.01811928  
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## [285] {28,} => {<=50K} 0.02539770  
## [286] {28,} => {White,} 0.02407715  
## [287] {28,} => {United-States,} 0.02533628  
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## [289] {Federal-gov,} => {40,} 0.02109821  
## [290] {Federal-gov,} => {Male,} 0.01980837  
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## [292] {Federal-gov,} => {White,} 0.02214237  
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## [295] {Other-relative,} => {Never-married,} 0.01876420  
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## [302] {Other-relative,} => {0,} 0.03012714  
## [303] {6,} => {Male,} 0.02054542  
## [304] {6,} => {Private,} 0.02220380  
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## [307] {6,} => {United-States,} 0.02763958  
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## [309] {Widowed,} => {Not-in-family,} 0.01679872  
## [310] {Widowed,} => {Female,} 0.02533628  
## [311] {Widowed,} => {Private,} 0.01805786  
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## [324] {Farming-fishing,} => {Husband,} 0.01701370  
## [325] {Farming-fishing,} => {Married-civ-spouse,} 0.01765862  
## [326] {Farming-fishing,} => {Male,} 0.02853019  
## [327] {Farming-fishing,} => {<=50K} 0.02699466  
## [328] {Farming-fishing,} => {White,} 0.02810024  
## [329] {Farming-fishing,} => {United-States,} 0.02699466  
## [330] {Farming-fishing,} => {0,} 0.03052638  
## [331] {42,} => {Married-civ-spouse,} 0.01689085  
## [332] {42,} => {Male,} 0.02174314  
## [333] {42,} => {Private,} 0.02020760  
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## [338] {37,} => {Married-civ-spouse,} 0.01643019  
## [339] {37,} => {Male,} 0.02109821  
## [340] {37,} => {Private,} 0.02217309  
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## [359] {Asian-Pac-Islander,} => {40,} 0.01787359  
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## [141] 1.0000000 1.0000307  
## [142] 0.5423242 1.1791641  
## [143] 0.7259684 1.0848547  
## [144] 0.6298422 0.9036359  
## [145] 0.9383070 1.2359690  
## [146] 0.8565280 1.0026698  
## [147] 0.7819225 0.8728475  
## [148] 1.0000000 1.0000307  
## [149] 0.7006897 4.5019449  
## [150] 0.9489655 2.8924661  
## [151] 0.5048276 1.5261532  
## [152] 0.7572414 1.0864158  
## [153] 0.9972414 1.3135993  
## [154] 0.8827586 1.0333760  
## [155] 0.9241379 1.0316003  
## [156] 1.0000000 1.0000307  
## [157] 0.5873656 3.7738355  
## [158] 0.5080645 2.2690436  
## [159] 0.5134409 2.2387067  
## [160] 0.8897849 2.7120825  
## [161] 0.5349462 0.7993997  
## [162] 0.7983871 1.1454477  
## [163] 0.9932796 1.3083806  
## [164] 0.8642473 1.0117062  
## [165] 0.8991935 1.0037552  
## [166] 1.0000000 1.0000307  
## [167] 0.5557029 1.3715454  
## [168] 0.6259947 1.3610870  
## [169] 0.7002653 1.0464450  
## [170] 0.6445623 0.9247550  
## [171] 0.6007958 0.7913880  
## [172] 0.8514589 0.9967358  
## [173] 0.8938992 0.9978452  
## [174] 1.0000000 1.0000307  
## [175] 0.8325062 2.5374957  
## [176] 0.5508685 0.8231932  
## [177] 0.7841191 1.1249774  
## [178] 0.9789082 1.2894502  
## [179] 0.8498759 0.9948828  
## [180] 0.8970223 1.0013315  
## [181] 1.0000000 1.0000307  
## [182] 0.5865031 1.7876732  
## [183] 0.6282209 0.9387851  
## [184] 0.8122699 1.1653654  
## [185] 0.9177914 1.2089451  
## [186] 0.8257669 0.9666602  
## [187] 0.8834356 0.9861649  
## [188] 1.0000000 1.0000307  
## [189] 0.5182927 1.0807971  
## [190] 0.6634146 0.9913771  
## [191] 0.7597561 1.0900237  
## [192] 0.8353659 1.1003715  
## [193] 0.8256098 0.9664763  
## [194] 0.8682927 0.9692611  
## [195] 1.0000000 1.0000307  
## [196] 0.5263158 1.2990142  
## [197] 0.5887393 1.2800834  
## [198] 0.6915545 1.0334280  
## [199] 0.6842105 0.9816383  
## [200] 0.6107711 0.8045279  
## [201] 0.8629131 1.0101444  
## [202] 0.9033048 1.0083445  
## [203] 1.0000000 1.0000307  
## [204] 0.5148280 1.2706609  
## [205] 0.5788849 1.2586573  
## [206] 0.7129300 1.0653707  
## [207] 0.6654804 0.9547662  
## [208] 0.6607355 0.8703426  
## [209] 0.8481613 0.9928757  
## [210] 0.8766311 0.9785691  
## [211] 1.0000000 1.0000307  
## [212] 0.5357562 1.1648833  
## [213] 0.6752638 1.0090839  
## [214] 0.7127784 1.0226247  
## [215] 0.6658851 0.8771258  
## [216] 0.8487691 0.9935871  
## [217] 0.9003517 1.0050481  
## [218] 1.0000000 1.0000307  
## [219] 0.5699422 1.7371953  
## [220] 0.5075145 1.0583212  
## [221] 0.6381503 0.9536232  
## [222] 0.7884393 1.1311756  
## [223] 0.9052023 1.1923624  
## [224] 0.8312139 0.9730366  
## [225] 0.8728324 0.9743287  
## [226] 1.0000000 1.0000307  
## [227] 0.8113839 2.4731146  
## [228] 0.5825893 0.8705953  
## [229] 0.8359375 1.1993213  
## [230] 0.9866071 1.2995915  
## [231] 0.8303571 0.9720337  
## [232] 0.8805804 0.9829776  
## [233] 1.0000000 1.0000307  
## [234] 0.6797312 1.0157599  
## [235] 0.7715566 1.1069538  
## [236] 0.7950728 1.0472961  
## [237] 0.8409854 0.9844754  
## [238] 0.8835386 0.9862799  
## [239] 1.0000000 1.0000307  
## [240] 0.6918860 1.0339234  
## [241] 0.7368421 1.0571490  
## [242] 0.7872807 1.0370321  
## [243] 0.8256579 0.9665327  
## [244] 0.8837719 0.9865403  
## [245] 1.0000000 1.0000307  
## [246] 0.5213582 1.1335780  
## [247] 0.6976999 1.0426115  
## [248] 0.7382256 1.0591339  
## [249] 0.7316539 0.9637587  
## [250] 0.8488499 0.9936818  
## [251] 0.8849945 0.9879051  
## [252] 1.0000000 1.0000307  
## [253] 0.5038168 1.2434839  
## [254] 0.5703381 1.2400740  
## [255] 0.6892039 1.0299155  
## [256] 0.6673937 0.9575111  
## [257] 0.6630316 0.8733671  
## [258] 0.8582334 1.0046662  
## [259] 0.9073064 1.0128115  
## [260] 1.0000000 1.0000307  
## [261] 1.0000000 32.8245968  
## [262] 0.6838156 1.0218635  
## [263] 0.7449089 1.0687224  
## [264] 0.9335477 1.2296998  
## [265] 0.8167203 0.9560701  
## [266] 0.9088960 1.0145860  
## [267] 1.0000000 1.0000307  
## [268] 0.5732759 1.1954536  
## [269] 0.6250000 0.9339720  
## [270] 0.7931034 1.1378672  
## [271] 0.6950431 0.9155337  
## [272] 0.8685345 1.0167249  
## [273] 0.9159483 1.0224583  
## [274] 1.0000000 1.0000307  
## [275] 0.5323276 1.3138521  
## [276] 0.5872845 1.2769202  
## [277] 0.7327586 1.0950017  
## [278] 0.7036638 1.0095480  
## [279] 0.6228448 0.8204318  
## [280] 0.8599138 1.0066333  
## [281] 0.9148707 1.0212554  
## [282] 1.0000000 1.0000307  
## [283] 0.6210526 0.9280732  
## [284] 0.7631579 1.0949043  
## [285] 0.8705263 1.1466860  
## [286] 0.8252632 0.9660706  
## [287] 0.8684211 0.9694044  
## [288] 1.0000000 1.0000307  
## [289] 0.7156250 1.4922947  
## [290] 0.6718750 1.0040199  
## [291] 0.6135417 0.8081773  
## [292] 0.7510417 0.8791853  
## [293] 0.9229167 1.0302370  
## [294] 1.0000000 1.0000307  
## [295] 0.6228338 1.8984101  
## [296] 0.5127421 1.0692224  
## [297] 0.5616718 0.8393371  
## [298] 0.7889908 1.1319668  
## [299] 0.9622834 1.2675514  
## [300] 0.7074414 0.8281459  
## [301] 0.7094801 0.7919812  
## [302] 1.0000000 1.0000307  
## [303] 0.6743952 1.0077859  
## [304] 0.7288306 1.0456549  
## [305] 0.9294355 1.2242831  
## [306] 0.8185484 0.9582101  
## [307] 0.9072581 1.0127575  
## [308] 1.0000000 1.0000307  
## [309] 0.5508560 2.1597800  
## [310] 0.8308157 2.5116536  
## [311] 0.5921450 0.8495517  
## [312] 0.9144008 1.2044789  
## [313] 0.8277946 0.9690339  
## [314] 0.9083585 1.0139859  
## [315] 1.0000000 1.0000307  
## [316] 0.5035751 3.9607275  
## [317] 0.5076609 1.1037963  
## [318] 0.6649642 0.9936928  
## [319] 0.5321757 0.7635136  
## [320] 0.5536261 0.7292546  
## [321] 0.8927477 1.0450694  
## [322] 0.8998979 1.0045414  
## [323] 1.0000000 1.0000307  
## [324] 0.5573441 1.3755960  
## [325] 0.5784708 1.2577569  
## [326] 0.9346076 1.3966358  
## [327] 0.8843058 1.1648368  
## [328] 0.9205231 1.0775839  
## [329] 0.8843058 0.9871363  
## [330] 1.0000000 1.0000307  
## [331] 0.5527638 1.2018627  
## [332] 0.7115578 1.0633201  
## [333] 0.6613065 0.9487779  
## [334] 0.6592965 0.8684471  
## [335] 0.8582915 1.0047342  
## [336] 0.9055276 1.0108259  
## [337] 1.0000000 1.0000307  
## [338] 0.5350000 1.1632392  
## [339] 0.6870000 1.0266220  
## [340] 0.7220000 1.0358550  
## [341] 0.6900000 0.9088908  
## [342] 0.8470000 0.9915162  
## [343] 0.8900000 0.9934926  
## [344] 1.0000000 1.0000307  
## [345] 0.6156098 1.8610607  
## [346] 0.5317073 1.1087706  
## [347] 0.7356098 1.0553809  
## [348] 0.9356098 1.2324161  
## [349] 0.6995122 0.8188638  
## [350] 0.8614634 0.9616377  
## [351] 1.0000000 1.0000307  
## [352] 0.6516315 1.9861859  
## [353] 0.5854127 0.8748145  
## [354] 0.8023033 1.1510662  
## [355] 0.9481766 1.2489695  
## [356] 0.8310940 0.9728963  
## [357] 0.8809981 0.9834439  
## [358] 1.0000000 1.0000307  
## [359] 0.5601540 1.1680906  
## [360] 0.6669875 0.9967162  
## [361] 0.6862368 0.9845454  
## [362] 0.7343600 0.9673232  
## [363] 1.0000000 1.0000307  
## [364] 0.5189753 1.2808970  
## [365] 0.5645161 1.2274155  
## [366] 0.7390892 1.1044618  
## [367] 0.7058824 1.0127309  
## [368] 0.6499051 0.8560765  
## [369] 0.8652751 1.0129094  
## [370] 0.8994307 1.0040200  
## [371] 1.0000000 1.0000307  
## [372] 1.0000000 26.3021002  
## [373] 0.6054358 0.9047361  
## [374] 0.6832240 0.9802229  
## [375] 0.7516401 0.9900852  
## [376] 0.8575445 1.0038598  
## [377] 0.9203374 1.0273578  
## [378] 1.0000000 1.0000307  
## [379] 0.6222426 0.9298515  
## [380] 0.7545956 1.0826199  
## [381] 0.8023897 1.0569342  
## [382] 0.8327206 0.9748004  
## [383] 0.8906250 0.9941903  
## [384] 1.0000000 1.0000307  
## [385] 0.5878071 1.4507826  
## [386] 0.6296633 1.3690637  
## [387] 0.7816197 1.1680174  
## [388] 0.6715196 0.9634306  
## [389] 0.5823476 0.7670875  
## [390] 0.9126479 1.0683650  
## [391] 0.9199272 1.0268999  
## [392] 1.0000000 1.0000307  
## [393] 0.6276978 0.9380035  
## [394] 0.7365108 1.0566736  
## [395] 0.7266187 0.9571261  
## [396] 0.8417266 0.9853430  
## [397] 0.8866906 0.9897985  
## [398] 1.0000000 1.0000307  
## [399] 0.5573477 2.3145460  
## [400] 0.7043011 1.7383045  
## [401] 0.7500000 1.6307091  
## [402] 0.8790323 1.3135864  
## [403] 0.9318996 1.0909015  
## [404] 0.8879928 0.9912521  
## [405] 1.0000000 1.0000307  
## [406] 1.0000000 27.2257525  
## [407] 0.6323404 0.9449412  
## [408] 0.7855319 1.1270043  
## [409] 0.9489362 1.2499700  
## [410] 0.8314894 0.9733591  
## [411] 0.9080851 1.0136807  
## [412] 1.0000000 1.0000307  
## [413] 0.6279264 0.9383451  
## [414] 0.7809365 1.1204112  
## [415] 0.9464883 1.2467456  
## [416] 0.8327759 0.9748652  
## [417] 0.9080268 1.0136156  
## [418] 1.0000000 1.0000307  
## [419] 0.5848142 0.8739202  
## [420] 0.6736672 0.9665118  
## [421] 0.7762520 1.0225048  
## [422] 0.8618740 1.0089280  
## [423] 0.9159935 1.0225088  
## [424] 1.0000000 1.0000307  
## [425] 0.5019335 1.0913434  
## [426] 0.6117556 0.9141802  
## [427] 0.7045630 1.0108381  
## [428] 0.7161640 0.9433548  
## [429] 0.8453210 0.9895507  
## [430] 0.9033256 1.0083678  
## [431] 1.0000000 1.0000307  
## [432] 0.5308166 1.1069133  
## [433] 0.6232666 0.9313816  
## [434] 0.7280431 0.9590025  
## [435] 0.8181818 0.9577810  
## [436] 0.9322034 1.0406036  
## [437] 1.0000000 1.0000307  
## [438] 0.5080292 1.5484833  
## [439] 0.5686131 1.1857305  
## [440] 0.8802920 1.3154689  
## [441] 0.9291971 1.3331210  
## [442] 0.9372263 1.2345454  
## [443] 0.8277372 0.9689668  
## [444] 0.8678832 0.9688040  
## [445] 1.0000000 1.0000307  
## [446] 1.0000000 23.3754487  
## [447] 0.5426918 1.1316765  
## [448] 0.6382055 0.9537057  
## [449] 0.7272069 1.0433254  
## [450] 0.7387844 0.9731512  
## [451] 0.8733719 1.0223877  
## [452] 0.9327062 1.0411649  
## [453] 1.0000000 1.0000307  
## [454] 0.5384063 1.1227401  
## [455] 0.6374731 0.9526112  
## [456] 0.7257717 1.0412662  
## [457] 0.7408471 0.9758682  
## [458] 0.8729361 1.0218775  
## [459] 0.9318019 1.0401554  
## [460] 1.0000000 1.0000307  
## [461] 0.6245825 1.9037401  
## [462] 0.5544422 0.8285336  
## [463] 0.7601870 1.0906420  
## [464] 0.9412158 1.2398005  
## [465] 0.8517034 0.9970221  
## [466] 0.8884436 0.9917552  
## [467] 1.0000000 1.0000307  
## [468] 0.9987245 3.0192616  
## [469] 0.9923469 2.1576390  
## [470] 0.6371173 0.9140736  
## [471] 0.5248724 0.6913793  
## [472] 0.8360969 0.9787528  
## [473] 0.8679847 0.9689173  
## [474] 1.0000000 1.0000307  
## [475] 0.5165936 1.6018780  
## [476] 0.5165936 1.5995931  
## [477] 0.6061365 1.4960219  
## [478] 0.6224170 1.3533082  
## [479] 0.9436443 1.4101398  
## [480] 0.7927364 1.1373406  
## [481] 0.7996243 1.0532915  
## [482] 0.8515967 0.9968972  
## [483] 0.9336255 1.0421911  
## [484] 1.0000000 1.0000307  
## [485] 1.0000000 18.5432802  
## [486] 0.5565873 2.3113885  
## [487] 0.5142194 1.2691588  
## [488] 0.5821242 1.2657003  
## [489] 0.6889147 1.0294832

* Which rules make sense to you? Highlight the five best and five worst of your rule set.

{5th-6th,} => {3,} 0.01022664 1.0000000 87.7681941 {Doctorate,} => {16,} 0.01268350 1.0000000 52.6893204 {12th,} => {8,} 0.01329771 1.0000000 56.5312500 {9th,} => {5,} 0.01578527 1.0000000 57.0262697 {7th-8th,} => {4,} 0.01983908 1.0000000 46.7173601

The above rules look like the best since they have low support high confidence and high lift.

{21,} => {United-States,} 0.02054542 0.8991935 1.0037552 {21,} => {White,} 0.01974694 0.8642473 1.0117062 {21,} => {<=50K} 0.02269517 0.9932796 1.3083806 {18,} => {0,} 0.01904060 1.0000000 1.0000307 {19,} => {United-States,} 0.02057613 0.9241379 1.0316003

The above rules look like the worst because of their high support and lower confidence and lift value.

* How did you choose the level of support and confidence?

Higher level of confidence and lower level of support is preferable. So, we set support at 0.01 and confidence at 0.5.

* What is the lift and conviction of your best and worst rules?

Lift for best and worst rules are shown above.

Convicrion is calculated below.

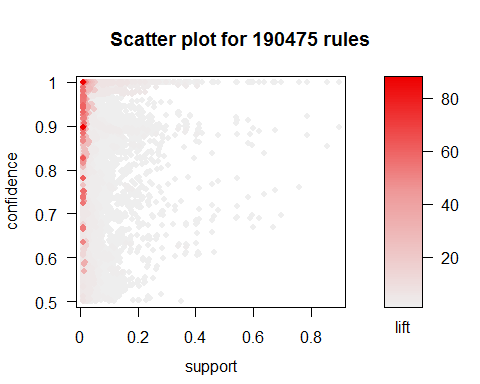
Conviction:

conviction <- interestMeasure(rules.pruned, "conviction", transactions=adultS)  
rules.conviction<-as(rules.pruned, "data.frame")  
rules.conviction<-data.frame(rules.conviction, conviction)  
rules.conviction

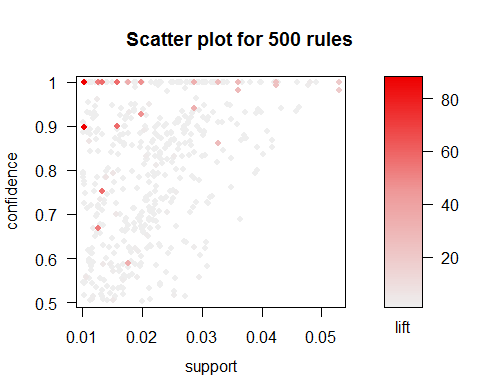
## rules support confidence  
## 1 {5th-6th,} => {3,} 0.01022664 1.0000000  
## 3 {5th-6th,} => {0,} 0.01022664 1.0000000  
## 4 {59,} => {White,} 0.01004238 0.9083333  
## 5 {59,} => {0,} 0.01105583 1.0000000  
## 6 {3,} => {<=50K} 0.01087157 0.9541779  
## 7 {3,} => {0,} 0.01139365 1.0000000  
## 8 {15024,} => {>50K} 0.01065659 1.0000000  
## 9 {15024,} => {Married-civ-spouse,} 0.01065659 1.0000000  
## 10 {15024,} => {0,} 0.01065659 1.0000000  
## 11 {57,} => {United-States,} 0.01016522 0.8850267  
## 12 {57,} => {0,} 0.01148578 1.0000000  
## 13 {70,} => {White,} 0.01081015 0.9312169  
## 14 {70,} => {United-States,} 0.01044162 0.8994709  
## 15 {70,} => {0,} 0.01160862 1.0000000  
## 16 {58,} => {White,} 0.01068730 0.8854962  
## 17 {58,} => {United-States,} 0.01120939 0.9287532  
## 18 {58,} => {0,} 0.01206928 1.0000000  
## 19 {17,} => {Own-child,} 0.01114796 0.8663484  
## 20 {17,} => {Never-married,} 0.01237639 0.9618138  
## 21 {17,} => {<=50K} 0.01283705 0.9976134  
## 22 {17,} => {White,} 0.01133223 0.8806683  
## 23 {17,} => {United-States,} 0.01216142 0.9451074  
## 24 {17,} => {0,} 0.01286776 1.0000000  
## 25 {Married-spouse-absent,} => {<=50K} 0.01179289 0.9186603  
## 26 {Married-spouse-absent,} => {0,} 0.01283705 1.0000000  
## 27 {Doctorate,} => {16,} 0.01268350 1.0000000  
## 29 {Doctorate,} => {Male,} 0.01004238 0.7917676  
## 30 {Doctorate,} => {White,} 0.01133223 0.8934625  
## 31 {Doctorate,} => {United-States,} 0.01007309 0.7941889  
## 32 {Doctorate,} => {0,} 0.01268350 1.0000000  
## 33 {65,} => {Male,} 0.01010380 0.7833333  
## 34 {65,} => {White,} 0.01188502 0.9214286  
## 35 {65,} => {United-States,} 0.01200786 0.9309524  
## 36 {65,} => {0,} 0.01289847 1.0000000  
## 37 {12th,} => {8,} 0.01329771 1.0000000  
## 39 {12th,} => {Private,} 0.01022664 0.7690531  
## 40 {12th,} => {<=50K} 0.01228426 0.9237875  
## 41 {12th,} => {White,} 0.01028807 0.7736721  
## 42 {12th,} => {United-States,} 0.01120939 0.8429561  
## 43 {12th,} => {0,} 0.01329771 1.0000000  
## 44 {54,} => {Male,} 0.01041091 0.7466960  
## 45 {54,} => {White,} 0.01237639 0.8876652  
## 46 {54,} => {United-States,} 0.01234568 0.8854626  
## 47 {54,} => {0,} 0.01394263 1.0000000  
## 48 {56,} => {Male,} 0.01028807 0.7251082  
## 49 {56,} => {White,} 0.01234568 0.8701299  
## 50 {56,} => {United-States,} 0.01265279 0.8917749  
## 51 {56,} => {0,} 0.01418832 1.0000000  
## 52 {53,} => {Male,} 0.01071801 0.7137014  
## 53 {53,} => {White,} 0.01265279 0.8425358  
## 54 {53,} => {United-States,} 0.01323629 0.8813906  
## 55 {53,} => {0,} 0.01501751 1.0000000  
## 56 {9th,} => {5,} 0.01578527 1.0000000  
## 58 {9th,} => {Male,} 0.01136294 0.7198444  
## 59 {9th,} => {Private,} 0.01188502 0.7529183  
## 60 {9th,} => {<=50K} 0.01495608 0.9474708  
## 61 {9th,} => {White,} 0.01237639 0.7840467  
## 62 {9th,} => {United-States,} 0.01213070 0.7684825  
## 63 {9th,} => {0,} 0.01578527 1.0000000  
## 64 {5,} => {Male,} 0.01219213 0.6952715  
## 65 {5,} => {Private,} 0.01262207 0.7197898  
## 66 {5,} => {<=50K} 0.01649162 0.9404553  
## 67 {5,} => {White,} 0.01400405 0.7985989  
## 68 {5,} => {United-States,} 0.01372766 0.7828371  
## 69 {5,} => {0,} 0.01753578 1.0000000  
## 70 {8,} => {Male,} 0.01093299 0.6180556  
## 71 {8,} => {Private,} 0.01237639 0.6996528  
## 72 {8,} => {<=50K} 0.01633806 0.9236111  
## 73 {8,} => {White,} 0.01421903 0.8038194  
## 74 {8,} => {United-States,} 0.01517106 0.8576389  
## 75 {8,} => {0,} 0.01768933 1.0000000  
## 76 {Prof-school,} => {15,} 0.01768933 1.0000000  
## 78 {Prof-school,} => {Prof-specialty,} 0.01388121 0.7847222  
## 79 {Prof-school,} => {>50K} 0.01299060 0.7343750  
## 80 {Prof-school,} => {Husband,} 0.01182360 0.6684028  
## 81 {Prof-school,} => {Married-civ-spouse,} 0.01265279 0.7152778  
## 82 {Prof-school,} => {Male,} 0.01486395 0.8402778  
## 83 {Prof-school,} => {White,} 0.01578527 0.8923611  
## 84 {Prof-school,} => {United-States,} 0.01541674 0.8715278  
## 85 {Prof-school,} => {0,} 0.01768933 1.0000000  
## 86 {49,} => {Husband,} 0.01013451 0.5445545  
## 87 {49,} => {Married-civ-spouse,} 0.01105583 0.5940594  
## 88 {49,} => {Male,} 0.01320558 0.7095710  
## 89 {49,} => {Private,} 0.01139365 0.6122112  
## 90 {49,} => {<=50K} 0.01209999 0.6501650  
## 91 {49,} => {White,} 0.01636877 0.8795380  
## 92 {49,} => {United-States,} 0.01704441 0.9158416  
## 93 {49,} => {0,} 0.01861065 1.0000000  
## 94 {51,} => {Husband,} 0.01102512 0.5904605  
## 95 {51,} => {Married-civ-spouse,} 0.01213070 0.6496711  
## 96 {51,} => {Male,} 0.01366624 0.7319079  
## 97 {51,} => {Private,} 0.01163933 0.6233553  
## 98 {51,} => {<=50K} 0.01114796 0.5970395  
## 99 {51,} => {White,} 0.01618451 0.8667763  
## 100 {51,} => {United-States,} 0.01722867 0.9226974  
## 101 {51,} => {0,} 0.01867207 1.0000000  
## 102 {18,} => {Own-child,} 0.01510964 0.7935484  
## 103 {18,} => {Never-married,} 0.01772004 0.9306452  
## 104 {18,} => {Private,} 0.01418832 0.7451613  
## 105 {18,} => {<=50K} 0.01882562 0.9887097  
## 106 {18,} => {White,} 0.01676801 0.8806452  
## 107 {18,} => {United-States,} 0.01808857 0.9500000  
## 108 {18,} => {0,} 0.01904060 1.0000000  
## 109 {52,} => {Husband,} 0.01053375 0.5586319  
## 110 {52,} => {Married-civ-spouse,} 0.01154720 0.6123779  
## 111 {52,} => {Male,} 0.01366624 0.7247557  
## 112 {52,} => {Private,} 0.01243781 0.6596091  
## 113 {52,} => {<=50K} 0.01154720 0.6123779  
## 114 {52,} => {White,} 0.01633806 0.8664495  
## 115 {52,} => {United-States,} 0.01698299 0.9006515  
## 116 {52,} => {0,} 0.01885634 1.0000000  
## 117 {16,} => {Prof-specialty,} 0.01056446 0.5566343  
## 118 {16,} => {Married-civ-spouse,} 0.01031878 0.5436893  
## 119 {16,} => {Male,} 0.01286776 0.6779935  
## 120 {16,} => {Private,} 0.01034949 0.5453074  
## 121 {16,} => {White,} 0.01707512 0.8996764  
## 122 {16,} => {United-States,} 0.01587740 0.8365696  
## 123 {16,} => {0,} 0.01897918 1.0000000  
## 124 {Mexico,} => {40,} 0.01148578 0.5816485  
## 125 {Mexico,} => {Male,} 0.01526319 0.7729393  
## 126 {Mexico,} => {Private,} 0.01698299 0.8600311  
## 127 {Mexico,} => {<=50K} 0.01873349 0.9486781  
## 128 {Mexico,} => {White,} 0.01811928 0.9175739  
## 129 {Mexico,} => {0,} 0.01974694 1.0000000  
## 130 {7th-8th,} => {4,} 0.01983908 1.0000000  
## 132 {7th-8th,} => {Husband,} 0.01022664 0.5154799  
## 133 {7th-8th,} => {Married-civ-spouse,} 0.01102512 0.5557276  
## 134 {7th-8th,} => {Male,} 0.01492537 0.7523220  
## 135 {7th-8th,} => {Private,} 0.01302131 0.6563467  
## 136 {7th-8th,} => {<=50K} 0.01861065 0.9380805  
## 137 {7th-8th,} => {White,} 0.01698299 0.8560372  
## 138 {7th-8th,} => {United-States,} 0.01532461 0.7724458  
## 139 {7th-8th,} => {0,} 0.01983908 1.0000000  
## 140 {Protective-serv,} => {Husband,} 0.01142436 0.5731895  
## 141 {Protective-serv,} => {Married-civ-spouse,} 0.01176218 0.5901387  
## 142 {Protective-serv,} => {40,} 0.01142436 0.5731895  
## 143 {Protective-serv,} => {Male,} 0.01759720 0.8828968  
## 144 {Protective-serv,} => {<=50K} 0.01345126 0.6748844  
## 145 {Protective-serv,} => {White,} 0.01593882 0.7996918  
## 146 {Protective-serv,} => {United-States,} 0.01861065 0.9337442  
## 147 {Protective-serv,} => {0,} 0.01993121 1.0000000  
## 148 {4,} => {Married-civ-spouse,} 0.01160862 0.5423242  
## 149 {4,} => {Male,} 0.01553959 0.7259684  
## 150 {4,} => {Private,} 0.01348197 0.6298422  
## 151 {4,} => {<=50K} 0.02008476 0.9383070  
## 152 {4,} => {White,} 0.01833425 0.8565280  
## 153 {4,} => {United-States,} 0.01673730 0.7819225  
## 154 {4,} => {0,} 0.02140532 1.0000000  
## 155 {19,} => {Own-child,} 0.01560101 0.7006897  
## 156 {19,} => {Never-married,} 0.02112892 0.9489655  
## 157 {19,} => {Female,} 0.01124010 0.5048276  
## 158 {19,} => {Private,} 0.01686014 0.7572414  
## 159 {19,} => {<=50K} 0.02220380 0.9972414  
## 160 {19,} => {White,} 0.01965481 0.8827586  
## 161 {19,} => {United-States,} 0.02057613 0.9241379  
## 162 {19,} => {0,} 0.02226522 1.0000000  
## 163 {21,} => {Own-child,} 0.01342055 0.5873656  
## 164 {21,} => {Some-college,} 0.01160862 0.5080645  
## 165 {21,} => {10,} 0.01173147 0.5134409  
## 166 {21,} => {Never-married,} 0.02033045 0.8897849  
## 167 {21,} => {Male,} 0.01222284 0.5349462  
## 168 {21,} => {Private,} 0.01824212 0.7983871  
## 169 {21,} => {<=50K} 0.02269517 0.9932796  
## 170 {21,} => {White,} 0.01974694 0.8642473  
## 171 {21,} => {United-States,} 0.02054542 0.8991935  
## 172 {21,} => {0,} 0.02284872 1.0000000  
## 173 {47,} => {Husband,} 0.01286776 0.5557029  
## 174 {47,} => {Married-civ-spouse,} 0.01449542 0.6259947  
## 175 {47,} => {Male,} 0.01621522 0.7002653  
## 176 {47,} => {Private,} 0.01492537 0.6445623  
## 177 {47,} => {<=50K} 0.01391192 0.6007958  
## 178 {47,} => {White,} 0.01971623 0.8514589  
## 179 {47,} => {United-States,} 0.02069897 0.8938992  
## 180 {47,} => {0,} 0.02315583 1.0000000  
## 181 {22,} => {Never-married,} 0.02060684 0.8325062  
## 182 {22,} => {Male,} 0.01363553 0.5508685  
## 183 {22,} => {Private,} 0.01940913 0.7841191  
## 184 {22,} => {<=50K} 0.02423070 0.9789082  
## 185 {22,} => {White,} 0.02103679 0.8498759  
## 186 {22,} => {United-States,} 0.02220380 0.8970223  
## 187 {22,} => {0,} 0.02475278 1.0000000  
## 188 {26,} => {Never-married,} 0.01467969 0.5865031  
## 189 {26,} => {Male,} 0.01572385 0.6282209  
## 190 {26,} => {Private,} 0.02033045 0.8122699  
## 191 {26,} => {<=50K} 0.02297156 0.9177914  
## 192 {26,} => {White,} 0.02066826 0.8257669  
## 193 {26,} => {United-States,} 0.02211166 0.8834356  
## 194 {26,} => {0,} 0.02502918 1.0000000  
## 195 {29,} => {40,} 0.01305202 0.5182927  
## 196 {29,} => {Male,} 0.01670659 0.6634146  
## 197 {29,} => {Private,} 0.01913273 0.7597561  
## 198 {29,} => {<=50K} 0.02103679 0.8353659  
## 199 {29,} => {White,} 0.02079111 0.8256098  
## 200 {29,} => {United-States,} 0.02186598 0.8682927  
## 201 {29,} => {0,} 0.02518273 1.0000000  
## 202 {46,} => {Husband,} 0.01320558 0.5263158  
## 203 {46,} => {Married-civ-spouse,} 0.01477182 0.5887393  
## 204 {46,} => {Male,} 0.01735151 0.6915545  
## 205 {46,} => {Private,} 0.01716725 0.6842105  
## 206 {46,} => {<=50K} 0.01532461 0.6107711  
## 207 {46,} => {White,} 0.02165100 0.8629131  
## 208 {46,} => {United-States,} 0.02266446 0.9033048  
## 209 {46,} => {0,} 0.02509060 1.0000000  
## 210 {41,} => {Husband,} 0.01332842 0.5148280  
## 211 {41,} => {Married-civ-spouse,} 0.01498679 0.5788849  
## 212 {41,} => {Male,} 0.01845710 0.7129300  
## 213 {41,} => {Private,} 0.01722867 0.6654804  
## 214 {41,} => {<=50K} 0.01710583 0.6607355  
## 215 {41,} => {White,} 0.02195811 0.8481613  
## 216 {41,} => {United-States,} 0.02269517 0.8766311  
## 217 {41,} => {0,} 0.02588907 1.0000000  
## 218 {39,} => {Married-civ-spouse,} 0.01403476 0.5357562  
## 219 {39,} => {Male,} 0.01768933 0.6752638  
## 220 {39,} => {Private,} 0.01867207 0.7127784  
## 221 {39,} => {<=50K} 0.01744365 0.6658851  
## 222 {39,} => {White,} 0.02223451 0.8487691  
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## 224 {39,} => {0,} 0.02619618 1.0000000  
## 225 {27,} => {Never-married,} 0.01514035 0.5699422  
## 226 {27,} => {40,} 0.01348197 0.5075145  
## 227 {27,} => {Male,} 0.01695228 0.6381503  
## 228 {27,} => {Private,} 0.02094466 0.7884393  
## 229 {27,} => {<=50K} 0.02404643 0.9052023  
## 230 {27,} => {White,} 0.02208095 0.8312139  
## 231 {27,} => {United-States,} 0.02318654 0.8728324  
## 232 {27,} => {0,} 0.02656471 1.0000000  
## 233 {23,} => {Never-married,} 0.02232664 0.8113839  
## 234 {23,} => {Male,} 0.01603096 0.5825893  
## 235 {23,} => {Private,} 0.02300227 0.8359375  
## 236 {23,} => {<=50K} 0.02714821 0.9866071  
## 237 {23,} => {White,} 0.02284872 0.8303571  
## 238 {23,} => {United-States,} 0.02423070 0.8805804  
## 239 {23,} => {0,} 0.02751674 1.0000000  
## 240 {31,} => {Male,} 0.01864136 0.6797312  
## 241 {31,} => {Private,} 0.02115963 0.7715566  
## 242 {31,} => {<=50K} 0.02180456 0.7950728  
## 243 {31,} => {White,} 0.02306369 0.8409854  
## 244 {31,} => {United-States,} 0.02423070 0.8835386  
## 245 {31,} => {0,} 0.02742461 1.0000000  
## 246 {33,} => {Male,} 0.01937842 0.6918860  
## 247 {33,} => {Private,} 0.02063755 0.7368421  
## 248 {33,} => {<=50K} 0.02205024 0.7872807  
## 249 {33,} => {White,} 0.02312512 0.8256579  
## 250 {33,} => {United-States,} 0.02475278 0.8837719  
## 251 {33,} => {0,} 0.02800811 1.0000000  
## 252 {34,} => {Married-civ-spouse,} 0.01461827 0.5213582  
## 253 {34,} => {Male,} 0.01956268 0.6976999  
## 254 {34,} => {Private,} 0.02069897 0.7382256  
## 255 {34,} => {<=50K} 0.02051471 0.7316539  
## 256 {34,} => {White,} 0.02380075 0.8488499  
## 257 {34,} => {United-States,} 0.02481420 0.8849945  
## 258 {34,} => {0,} 0.02803882 1.0000000  
## 259 {43,} => {Husband,} 0.01418832 0.5038168  
## 260 {43,} => {Married-civ-spouse,} 0.01606167 0.5703381  
## 261 {43,} => {Male,} 0.01940913 0.6892039  
## 262 {43,} => {Private,} 0.01879491 0.6673937  
## 263 {43,} => {<=50K} 0.01867207 0.6630316  
## 264 {43,} => {White,} 0.02416928 0.8582334  
## 265 {43,} => {United-States,} 0.02555126 0.9073064  
## 266 {43,} => {0,} 0.02816166 1.0000000  
## 267 {10th,} => {6,} 0.02865303 1.0000000  
## 269 {10th,} => {Male,} 0.01959339 0.6838156  
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## 275 {Tech-support,} => {40,} 0.01633806 0.5732759  
## 276 {Tech-support,} => {Male,} 0.01781217 0.6250000  
## 277 {Tech-support,} => {Private,} 0.02260303 0.7931034  
## 278 {Tech-support,} => {<=50K} 0.01980837 0.6950431  
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## 281 {Tech-support,} => {0,} 0.02849948 1.0000000  
## 282 {44,} => {Husband,} 0.01517106 0.5323276  
## 283 {44,} => {Married-civ-spouse,} 0.01673730 0.5872845  
## 284 {44,} => {Male,} 0.02088324 0.7327586  
## 285 {44,} => {Private,} 0.02005405 0.7036638  
## 286 {44,} => {<=50K} 0.01775075 0.6228448  
## 287 {44,} => {White,} 0.02450709 0.8599138  
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## 289 {44,} => {0,} 0.02849948 1.0000000  
## 290 {28,} => {Male,} 0.01811928 0.6210526  
## 291 {28,} => {Private,} 0.02226522 0.7631579  
## 292 {28,} => {<=50K} 0.02539770 0.8705263  
## 293 {28,} => {White,} 0.02407715 0.8252632  
## 294 {28,} => {United-States,} 0.02533628 0.8684211  
## 295 {28,} => {0,} 0.02917511 1.0000000  
## 296 {Federal-gov,} => {40,} 0.02109821 0.7156250  
## 297 {Federal-gov,} => {Male,} 0.01980837 0.6718750  
## 298 {Federal-gov,} => {<=50K} 0.01808857 0.6135417  
## 299 {Federal-gov,} => {White,} 0.02214237 0.7510417  
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## 301 {Federal-gov,} => {0,} 0.02948222 1.0000000  
## 302 {Other-relative,} => {Never-married,} 0.01876420 0.6228338  
## 303 {Other-relative,} => {40,} 0.01544745 0.5127421  
## 304 {Other-relative,} => {Male,} 0.01692157 0.5616718  
## 305 {Other-relative,} => {Private,} 0.02377004 0.7889908  
## 306 {Other-relative,} => {<=50K} 0.02899085 0.9622834  
## 307 {Other-relative,} => {White,} 0.02131319 0.7074414  
## 308 {Other-relative,} => {United-States,} 0.02137461 0.7094801  
## 309 {Other-relative,} => {0,} 0.03012714 1.0000000  
## 310 {6,} => {Male,} 0.02054542 0.6743952  
## 311 {6,} => {Private,} 0.02220380 0.7288306  
## 312 {6,} => {<=50K} 0.02831521 0.9294355  
## 313 {6,} => {White,} 0.02493704 0.8185484  
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## 315 {6,} => {0,} 0.03046496 1.0000000  
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## 317 {Widowed,} => {Female,} 0.02533628 0.8308157  
## 318 {Widowed,} => {Private,} 0.01805786 0.5921450  
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## 323 {15,} => {Prof-specialty,} 0.01514035 0.5035751  
## 324 {15,} => {Married-civ-spouse,} 0.01526319 0.5076609  
## 325 {15,} => {Male,} 0.01999263 0.6649642  
## 326 {15,} => {Private,} 0.01600025 0.5321757  
## 327 {15,} => {<=50K} 0.01664517 0.5536261  
## 328 {15,} => {White,} 0.02684110 0.8927477  
## 329 {15,} => {United-States,} 0.02705608 0.8998979  
## 330 {15,} => {0,} 0.03006572 1.0000000  
## 331 {Farming-fishing,} => {Husband,} 0.01701370 0.5573441  
## 332 {Farming-fishing,} => {Married-civ-spouse,} 0.01765862 0.5784708  
## 333 {Farming-fishing,} => {Male,} 0.02853019 0.9346076  
## 334 {Farming-fishing,} => {<=50K} 0.02699466 0.8843058  
## 335 {Farming-fishing,} => {White,} 0.02810024 0.9205231  
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## 337 {Farming-fishing,} => {0,} 0.03052638 1.0000000  
## 338 {42,} => {Married-civ-spouse,} 0.01689085 0.5527638  
## 339 {42,} => {Male,} 0.02174314 0.7115578  
## 340 {42,} => {Private,} 0.02020760 0.6613065  
## 341 {42,} => {<=50K} 0.02014618 0.6592965  
## 342 {42,} => {White,} 0.02622689 0.8582915  
## 343 {42,} => {United-States,} 0.02767029 0.9055276  
## 344 {42,} => {0,} 0.03055709 1.0000000  
## 345 {37,} => {Married-civ-spouse,} 0.01643019 0.5350000  
## 346 {37,} => {Male,} 0.02109821 0.6870000  
## 347 {37,} => {Private,} 0.02217309 0.7220000  
## 348 {37,} => {<=50K} 0.02119034 0.6900000  
## 349 {37,} => {White,} 0.02601192 0.8470000  
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## 353 {Separated,} => {40,} 0.01673730 0.5317073  
## 354 {Separated,} => {Private,} 0.02315583 0.7356098  
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## 358 {Separated,} => {0,} 0.03147841 1.0000000  
## 359 {24,} => {Never-married,} 0.02085253 0.6516315  
## 360 {24,} => {Male,} 0.01873349 0.5854127  
## 361 {24,} => {Private,} 0.02567410 0.8023033  
## 362 {24,} => {<=50K} 0.03034212 0.9481766  
## 363 {24,} => {White,} 0.02659542 0.8310940  
## 364 {24,} => {United-States,} 0.02819237 0.8809981  
## 365 {24,} => {0,} 0.03200049 1.0000000  
## 366 {Asian-Pac-Islander,} => {40,} 0.01787359 0.5601540  
## 367 {Asian-Pac-Islander,} => {Male,} 0.02128248 0.6669875  
## 368 {Asian-Pac-Islander,} => {Private,} 0.02189669 0.6862368  
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## 370 {Asian-Pac-Islander,} => {0,} 0.03190836 1.0000000  
## 371 {48,} => {Husband,} 0.01679872 0.5189753  
## 372 {48,} => {Married-civ-spouse,} 0.01827283 0.5645161  
## 373 {48,} => {Male,} 0.02392359 0.7390892  
## 374 {48,} => {Private,} 0.02284872 0.7058824  
## 375 {48,} => {<=50K} 0.02103679 0.6499051  
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## 378 {48,} => {0,} 0.03236902 1.0000000  
## 379 {Assoc-acdm,} => {12,} 0.03276826 1.0000000  
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## 382 {Assoc-acdm,} => {Private,} 0.02238806 0.6832240  
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## 384 {Assoc-acdm,} => {White,} 0.02810024 0.8575445  
## 385 {Assoc-acdm,} => {United-States,} 0.03015785 0.9203374  
## 386 {Assoc-acdm,} => {0,} 0.03276826 1.0000000  
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## 388 {32,} => {Private,} 0.02521344 0.7545956  
## 389 {32,} => {<=50K} 0.02681039 0.8023897  
## 390 {32,} => {White,} 0.02782384 0.8327206  
## 391 {32,} => {United-States,} 0.02975861 0.8906250  
## 392 {32,} => {0,} 0.03341318 1.0000000  
## 393 {55,} => {Husband,} 0.01983908 0.5878071  
## 394 {55,} => {Married-civ-spouse,} 0.02125177 0.6296633  
## 395 {55,} => {Male,} 0.02638044 0.7816197  
## 396 {55,} => {Private,} 0.02266446 0.6715196  
## 397 {55,} => {<=50K} 0.01965481 0.5823476  
## 398 {55,} => {White,} 0.03080278 0.9126479  
## 399 {55,} => {United-States,} 0.03104846 0.9199272  
## 400 {55,} => {0,} 0.03375100 1.0000000  
## 401 {36,} => {Male,} 0.02143603 0.6276978  
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## 414 {11th,} => {7,} 0.03608501 1.0000000  
## 416 {11th,} => {Male,} 0.02281801 0.6323404  
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## 423 {7,} => {Private,} 0.02868374 0.7809365  
## 424 {7,} => {<=50K} 0.03476445 0.9464883  
## 425 {7,} => {White,} 0.03058780 0.8327759  
## 426 {7,} => {United-States,} 0.03335176 0.9080268  
## 427 {7,} => {0,} 0.03672993 1.0000000  
## 428 {12,} => {Male,} 0.02223451 0.5848142  
## 429 {12,} => {Private,} 0.02561268 0.6736672  
## 430 {12,} => {<=50K} 0.02951293 0.7762520  
## 431 {12,} => {White,} 0.03276826 0.8618740  
## 432 {12,} => {United-States,} 0.03482587 0.9159935  
## 433 {12,} => {0,} 0.03801978 1.0000000  
## 434 {38,} => {Married-civ-spouse,} 0.01993121 0.5019335  
## 435 {38,} => {Male,} 0.02429212 0.6117556  
## 436 {38,} => {Private,} 0.02797740 0.7045630  
## 437 {38,} => {<=50K} 0.02843806 0.7161640  
## 438 {38,} => {White,} 0.03356673 0.8453210  
## 439 {38,} => {United-States,} 0.03587003 0.9033256  
## 440 {38,} => {0,} 0.03970886 1.0000000  
## 441 {State-gov,} => {40,} 0.02115963 0.5308166  
## 442 {State-gov,} => {Male,} 0.02484491 0.6232666  
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## 444 {State-gov,} => {White,} 0.03261470 0.8181818  
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## 448 {Handlers-cleaners,} => {40,} 0.02392359 0.5686131  
## 449 {Handlers-cleaners,} => {Male,} 0.03703704 0.8802920  
## 450 {Handlers-cleaners,} => {Private,} 0.03909465 0.9291971  
## 451 {Handlers-cleaners,} => {<=50K} 0.03943247 0.9372263  
## 452 {Handlers-cleaners,} => {White,} 0.03482587 0.8277372  
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## 454 {Handlers-cleaners,} => {0,} 0.04207358 1.0000000  
## 455 {Assoc-voc,} => {11,} 0.04244211 1.0000000  
## 457 {Assoc-voc,} => {40,} 0.02303298 0.5426918  
## 458 {Assoc-voc,} => {Male,} 0.02708679 0.6382055  
## 459 {Assoc-voc,} => {Private,} 0.03086420 0.7272069  
## 460 {Assoc-voc,} => {<=50K} 0.03135557 0.7387844  
## 461 {Assoc-voc,} => {White,} 0.03706775 0.8733719  
## 462 {Assoc-voc,} => {United-States,} 0.03958602 0.9327062  
## 463 {Assoc-voc,} => {0,} 0.04244211 1.0000000  
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## 465 {11,} => {Male,} 0.02727105 0.6374731  
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## 468 {11,} => {White,} 0.03734414 0.8729361  
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## 470 {11,} => {0,} 0.04277993 1.0000000  
## 471 {25,} => {Never-married,} 0.02871445 0.6245825  
## 472 {25,} => {Male,} 0.02548983 0.5544422  
## 473 {25,} => {Private,} 0.03494871 0.7601870  
## 474 {25,} => {<=50K} 0.04327130 0.9412158  
## 475 {25,} => {White,} 0.03915607 0.8517034  
## 476 {25,} => {United-States,} 0.04084516 0.8884436  
## 477 {25,} => {0,} 0.04597383 1.0000000  
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## 479 {Wife,} => {Married-civ-spouse,} 0.04778576 0.9923469  
## 480 {Wife,} => {Private,} 0.03067993 0.6371173  
## 481 {Wife,} => {<=50K} 0.02527486 0.5248724  
## 482 {Wife,} => {White,} 0.04026165 0.8360969  
## 483 {Wife,} => {United-States,} 0.04179719 0.8679847  
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## 451 1.2345454 3.8365237  
## 452 0.9689668 0.8461069  
## 453 0.9688040 0.7884729  
## 454 1.0000307 NA  
## 455 23.3754487 NA  
## 457 1.1316765 1.1380798  
## 458 0.9537057 0.9143728  
## 459 1.0433254 1.1106999  
## 460 0.9731512 0.9219696  
## 461 1.0223877 1.1510300  
## 462 1.0411649 1.5479961  
## 463 1.0000307 NA  
## 464 1.1227401 1.1275139  
## 465 0.9526112 0.9125255  
## 466 1.0412662 1.1048868  
## 467 0.9758682 0.9293080  
## 468 1.0218775 1.1470821  
## 469 1.0401554 1.5274686  
## 470 1.0000307 NA  
## 471 1.9037401 1.7897892  
## 472 0.8285336 0.7424740  
## 473 1.0906420 1.2634481  
## 474 1.2398005 4.0968956  
## 475 0.9970221 0.9828460  
## 476 0.9917552 0.9337919  
## 477 1.0000307 NA  
## 478 3.0192616 524.6650697  
## 479 2.1576390 70.5701124  
## 480 0.9140736 0.8349565  
## 481 0.6913793 0.5068805  
## 482 0.9787528 0.8892617  
## 483 0.9689173 0.7890790  
## 484 1.0000307 NA  
## 485 1.6018780 1.4015279  
## 486 1.5995931 1.4005749  
## 487 1.4960219 1.5102554  
## 488 1.3533082 1.4303542  
## 489 1.4101398 5.8701295  
## 490 1.1373406 1.4618640  
## 491 1.0532915 1.2019066  
## 492 0.9968972 0.9821396  
## 493 1.0421911 1.5694368  
## 494 1.0000307 NA  
## 495 18.5432802 NA  
## 497 2.3113885 1.7121700  
## 498 1.2691588 1.2244920  
## 499 1.2657003 1.2924352  
## 500 1.0294832 1.0634223

* Visualize your 50 association rules. Where do the best and worst end up in your plot?

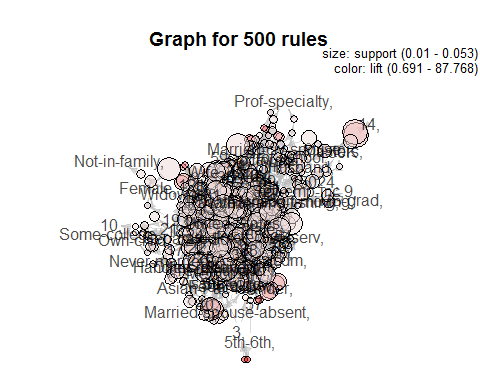
plot(adultS.rules.2)



plot(adultSrules.2.test)



plot(adultSrules.2.test, method="graph", control=list(type="items"))



* Does the model make sense?

The model makes sense. Each number represents one item. Also, the rules are valuable since it would be beneficial from using them by analyzing values for each role.