R-Workshop-James

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path2data <- "../data/"

# PART 1: INSTALLATION, SETTINGS, AND DATA MANAGEMENT

## TOPIC 1: Projects & Directories in R Studio

getwd() #get the current working directory

## [1] "/Users/rick/github/psu-psychology/r-bootcamp/talks"

#setwd("~/Dropbox/James Work Files/R Workshop/2017") #change the working directory

Since ~/Dropbox/James Work Files/R Workshop/2017 is specific to James' computer, it won't work for others. When using an RStudio project, I don't change my working directory. Instead, I just make sure I give relevant functions information about the directories where other resources can be found.

## TOPIC 2: Installing Packages & Loading into Active Library of Resources

### Install packages via syntax

# Can install by evaluating chunk, but not by "knitting"  
install.packages("multilevel") #Downloading a package to my computer  
#loading packages into working library  
library("multilevel")

### Understanding How R Searches for Information

search()  
detach(package:multilevel)  
search()

### Obtaining Help

#You may inquire about a function using any of the following:  
##If you know the exact name:  
?search  
help(search)  
  
##If want to search by part of the name  
apropos("searc")

## [1] ".rs.getCompletionsSearchPath" ".rs.objectsOnSearchPath"   
## [3] ".rs.recursiveSearch" ".rs.rpc.search"   
## [5] "help.search" "hsearch\_db"   
## [7] "hsearch\_db\_concepts" "hsearch\_db\_keywords"   
## [9] "RSiteSearch" "search"   
## [11] "searchpaths"

??sear

Another good source of help is [StackOverflow](http://stackoverflow.com).

## TOPIC 3: Data Types & Structures in R

### Numbers

x <- 2  
x

## [1] 2

y = c(1:3); y

## [1] 1 2 3

z = c("Porsche 911", "Porsche 944", "Porsche 911", "BMW 335xi")  
z

## [1] "Porsche 911" "Porsche 944" "Porsche 911" "BMW 335xi"

g=sqrt(x); g

## [1] 1.414214

is.numeric(x)

## [1] TRUE

is.numeric(z)

## [1] FALSE

### Strings

#String Data as character:  
z

## [1] "Porsche 911" "Porsche 944" "Porsche 911" "BMW 335xi"

#String Data as factor:  
z2=factor(z)  
z2

## [1] Porsche 911 Porsche 944 Porsche 911 BMW 335xi   
## Levels: BMW 335xi Porsche 911 Porsche 944

#Compute the Length of a String (or Numeric) Variable:  
nchar(x)

## [1] 1

nchar(y)

## [1] 1 1 1

nchar(y)

## [1] 1 1 1

nchar(z)

## [1] 11 11 11 9

#nchar(z2) Throws error during rendering

### Logical Data

##Assumes values of TRUE or FALSE  
###TRUE is considered equal to 1  
###FALSE is considered equal to 0  
TRUE\*5

## [1] 5

sqrt(TRUE)

## [1] 1

t=TRUE  
# you can test if a variable type is logical using:  
is.logical(x)

## [1] FALSE

is.logical(t)

## [1] TRUE

# Logical data types also used as input to functions (see Day 2 examples)  
2==2

## [1] TRUE

2==3

## [1] FALSE

### Vectors

#Vectors - 1 dimensional collections of same type data  
v1=1:5; v1 #creating vector of numbers

## [1] 1 2 3 4 5

v2=c(1,2,3,4,5); v2

## [1] 1 2 3 4 5

v3=c("Porsche 911", "Ford Mustang GT", "Plymouth Baracuda", "Chevrolet Camaro", "Honda Pilot LX")  
v1; v2; v3

## [1] 1 2 3 4 5

## [1] 1 2 3 4 5

## [1] "Porsche 911" "Ford Mustang GT" "Plymouth Baracuda"  
## [4] "Chevrolet Camaro" "Honda Pilot LX"

#Matrices - 2 dimensional collections of same type data  
m=matrix(1:20, nrow=5); m

## [,1] [,2] [,3] [,4]  
## [1,] 1 6 11 16  
## [2,] 2 7 12 17  
## [3,] 3 8 13 18  
## [4,] 4 9 14 19  
## [5,] 5 10 15 20

### Arrays & Data Frames

#Arrays - multidimensional collection of same type data  
#example of 3D array  
a=array(1:20, dim=c(2,5,2)); a

## , , 1  
##   
## [,1] [,2] [,3] [,4] [,5]  
## [1,] 1 3 5 7 9  
## [2,] 2 4 6 8 10  
##   
## , , 2  
##   
## [,1] [,2] [,3] [,4] [,5]  
## [1,] 11 13 15 17 19  
## [2,] 12 14 16 18 20

#Creating a data frame from vectors  
eng=c("Flat-6", "V-8", "V-8", "V-8", "V-6")  
doors=c(2,2,2,2,4)  
data1=data.frame(v2, v3, eng, doors)  
  
# Viewing content of data framees  
# Look at the "enviroment" tab in the upper left panel  
# Click on one of the data frames listed under Data (e.g., "data1")   
# Or, simply type:  
  
data1

## v2 v3 eng doors  
## 1 1 Porsche 911 Flat-6 2  
## 2 2 Ford Mustang GT V-8 2  
## 3 3 Plymouth Baracuda V-8 2  
## 4 4 Chevrolet Camaro V-8 2  
## 5 5 Honda Pilot LX V-6 4

# Obtain a list of the variable names in a data frame   
names(data1)

## [1] "v2" "v3" "eng" "doors"

# Change the names of the variables in a data frame  
data2=data.frame(id=v2, model=v3, eng=eng, doors=doors) #creates a new data frame   
data1

## v2 v3 eng doors  
## 1 1 Porsche 911 Flat-6 2  
## 2 2 Ford Mustang GT V-8 2  
## 3 3 Plymouth Baracuda V-8 2  
## 4 4 Chevrolet Camaro V-8 2  
## 5 5 Honda Pilot LX V-6 4

data2

## id model eng doors  
## 1 1 Porsche 911 Flat-6 2  
## 2 2 Ford Mustang GT V-8 2  
## 3 3 Plymouth Baracuda V-8 2  
## 4 4 Chevrolet Camaro V-8 2  
## 5 5 Honda Pilot LX V-6 4

data3=data1 #make a copy of the original dataframe

install.packages("plyr")  
library(plyr)  
data3=rename(data3, replace=c("v2"="id","v3" = "model")) #renames specific variables  
data3  
names(data1)=c("id","model", "eng", "doors") #replaces names of all variables in existing data frame  
data1

## TOPIC 4: Reading Data Files into R

### Reading Data - From R Data Sets

##List of avaialble data sets  
data()  
library(multilevel)  
#List data in the multilevel package  
data(package="multilevel")  
#load the univ data frame into R environment  
data(univbct, package="multilevel")  
d=univbct  
  
#Confirm it is loaded as a data frame  
class(d)

## [1] "data.frame"

### Saving data frames as comma-separated value (CSV)

#Saving a data frame as a .csv file (to be read into SPSS, Excel, Text Editor, etc.)  
write.table(d, file = paste0(path2data, "d2.csv"), sep=",",row.names=F)  
write.table(d, paste0(path2data, "d1.csv"), sep=",", row.names=FALSE)

#save the data as a text file to be read into SPSS  
install.packages("foreign")  
library("foreign")  
write.foreign(univbct,  
 datafile=paste0(path2data, "univbct.csv"),  
 codefile=paste0(path2data, "univbct.sps"),  
 package="SPSS")  
file.show(paste0(path2data, "univbct.csv"))  
file.show(paste0(path2data, "univbct.sps"))

### Reading data from SPSS

library("foreign")  
demo1=read.spss(file=paste0(path2data, "demo1.sav"),   
 use.value.labels=TRUE,   
 to.data.frame=TRUE,  
 use.missings=TRUE)  
summary(demo1)

## SUBNUM TIME BTN COMPANY   
## Min. : 1.00 Min. :0 Min. : 4.0 A :246   
## 1st Qu.: 75.75 1st Qu.:0 1st Qu.: 377.8 HHC :210   
## Median :150.50 Median :1 Median :1022.0 B :207   
## Mean :150.50 Mean :1 Mean :1860.3 D :114   
## 3rd Qu.:225.25 3rd Qu.:2 3rd Qu.:3066.0 C : 84   
## Max. :300.00 Max. :2 Max. :4042.0 SVC : 24   
## (Other): 15   
## MARITAL GENDER HOWLONG RANK   
## Min. :1.000 Min. :1.000 Min. :0.000 Min. :11.00   
## 1st Qu.:1.000 1st Qu.:1.000 1st Qu.:1.000 1st Qu.:13.00   
## Median :2.000 Median :1.000 Median :2.000 Median :14.00   
## Mean :1.711 Mean :1.039 Mean :2.371 Mean :15.26   
## 3rd Qu.:2.000 3rd Qu.:1.000 3rd Qu.:4.000 3rd Qu.:16.00   
## Max. :5.000 Max. :2.000 Max. :5.000 Max. :32.00   
## NA's :6 NA's :51 NA's :18 NA's :48   
## EDUCATE AGE   
## Min. :1.000 Min. :18.00   
## 1st Qu.:2.000 1st Qu.:20.00   
## Median :2.000 Median :24.00   
## Mean :2.663 Mean :25.75   
## 3rd Qu.:3.000 3rd Qu.:30.00   
## Max. :6.000 Max. :44.00   
## NA's :9 NA's :9

demo2=read.spss(file=paste0(path2data, "demo2.sav"),  
 use.value.labels=T,  
 to.data.frame=T,  
 use.missings=FALSE)  
summary(demo2) #oops, GENDER = 999 was a missing values code

## SUBNUM TIME BTN COMPANY MARITAL   
## Min. :301 Min. :0 Min. : 4 A :156 Min. :1.000   
## 1st Qu.:349 1st Qu.:0 1st Qu.: 404 HHC :144 1st Qu.:1.000   
## Median :398 Median :1 Median :1022 B :141 Median :2.000   
## Mean :398 Mean :1 Mean :1755 D : 69 Mean :1.756   
## 3rd Qu.:447 3rd Qu.:2 3rd Qu.:3066 C : 42 3rd Qu.:2.000   
## Max. :495 Max. :2 Max. :4042 SVC : 15 Max. :5.000   
## (Other): 18 NA's :6   
## GENDER HOWLONG RANK EDUCATE   
## Min. : 1.00 Min. :0.000 Min. :11.0 Min. :1.00   
## 1st Qu.: 1.00 1st Qu.:2.000 1st Qu.:13.0 1st Qu.:2.00   
## Median : 1.00 Median :2.000 Median :14.0 Median :2.00   
## Mean : 88.03 Mean :2.446 Mean :14.7 Mean :2.49   
## 3rd Qu.: 1.00 3rd Qu.:3.000 3rd Qu.:15.0 3rd Qu.:2.00   
## Max. :999.00 Max. :5.000 Max. :31.0 Max. :6.00   
## NA's :6 NA's :27 NA's :3   
## AGE   
## Min. :18.00   
## 1st Qu.:21.00   
## Median :24.00   
## Mean :25.68   
## 3rd Qu.:29.00   
## Max. :46.00   
## NA's :3

demo2=read.spss(file=paste0(path2data, "demo2.sav"),  
 use.value.labels=T,  
 to.data.frame=T,  
 use.missings=T)  
names(demo1); names(demo2)

## [1] "SUBNUM" "TIME" "BTN" "COMPANY" "MARITAL" "GENDER" "HOWLONG"  
## [8] "RANK" "EDUCATE" "AGE"

## [1] "SUBNUM" "TIME" "BTN" "COMPANY" "MARITAL" "GENDER" "HOWLONG"  
## [8] "RANK" "EDUCATE" "AGE"

#Reading data (csv)  
data1=read.csv(paste0(path2data, "data1.csv"), header=T)  
data2=read.csv(paste0(path2data, "data2.csv"))

#Now click on "Environment" tab and the "data1" dataframe  
#NA (not available) is automatically inserted by R for any missing data  
head(data1) # display first 6 cases

## SUBNUM TIME JOBSAT1 COMMIT1 READY1 JOBSAT2 COMMIT2 READY2 JOBSAT3  
## 1 1 0 1.666667 1.666667 2.75 1 1.666667 1 3  
## 2 1 1 1.666667 1.666667 2.75 1 1.666667 1 3  
## 3 1 2 1.666667 1.666667 2.75 1 1.666667 1 3  
## 4 2 0 3.666667 1.666667 3.00 4 1.333333 2 4  
## 5 2 1 3.666667 1.666667 3.00 4 1.333333 2 4  
## 6 2 2 3.666667 1.666667 3.00 4 1.333333 2 4  
## COMMIT3 READY3 JSAT COMMIT READY  
## 1 3.000000 3.00 1.666667 1.666667 2.75  
## 2 3.000000 3.00 1.000000 1.666667 1.00  
## 3 3.000000 3.00 3.000000 3.000000 3.00  
## 4 1.333333 1.75 3.666667 1.666667 3.00  
## 5 1.333333 1.75 4.000000 1.333333 2.00  
## 6 1.333333 1.75 4.000000 1.333333 1.75

tail(data1) # display last 6 cases

## SUBNUM TIME JOBSAT1 COMMIT1 READY1 JOBSAT2 COMMIT2 READY2 JOBSAT3  
## 895 299 0 2.333333 4.333333 2.75 3.666667 3.666667 2.75 4  
## 896 299 1 2.333333 4.333333 2.75 3.666667 3.666667 2.75 4  
## 897 299 2 2.333333 4.333333 2.75 3.666667 3.666667 2.75 4  
## 898 300 0 2.666667 3.666667 2.25 2.666667 4.333333 3.75 3  
## 899 300 1 2.666667 3.666667 2.25 2.666667 4.333333 3.75 3  
## 900 300 2 2.666667 3.666667 2.25 2.666667 4.333333 3.75 3  
## COMMIT3 READY3 JSAT COMMIT READY  
## 895 3.333333 3.00 2.333333 4.333333 2.75  
## 896 3.333333 3.00 3.666667 3.666667 2.75  
## 897 3.333333 3.00 4.000000 3.333333 3.00  
## 898 4.333333 3.25 2.666667 3.666667 2.25  
## 899 4.333333 3.25 2.666667 4.333333 3.75  
## 900 4.333333 3.25 3.000000 4.333333 3.25

summary(data1) # display summary

## SUBNUM TIME JOBSAT1 COMMIT1   
## Min. : 1.00 Min. :0 Min. : 1.000 Min. : 1.000   
## 1st Qu.: 75.75 1st Qu.:0 1st Qu.: 2.667 1st Qu.: 3.333   
## Median :150.50 Median :1 Median : 3.667 Median : 3.667   
## Mean :150.50 Mean :1 Mean : 49.763 Mean : 46.794   
## 3rd Qu.:225.25 3rd Qu.:2 3rd Qu.: 4.000 3rd Qu.: 4.333   
## Max. :300.00 Max. :2 Max. :999.000 Max. :999.000   
##   
## READY1 JOBSAT2 COMMIT2 READY2   
## Min. : 1.00 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.: 2.75 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.750   
## Median : 3.25 Median :3.333 Median :3.667 Median :3.250   
## Mean : 56.18 Mean :3.272 Mean :3.498 Mean :3.176   
## 3rd Qu.: 3.75 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.750   
## Max. :999.00 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :66 NA's :48 NA's :54   
## JOBSAT3 COMMIT3 READY3 JSAT   
## Min. :1.000 Min. :1.333 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.750 1st Qu.:2.667   
## Median :3.333 Median :3.667 Median :3.250 Median :3.333   
## Mean :3.355 Mean :3.556 Mean :3.241 Mean :3.308   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :51 NA's :48 NA's :48 NA's :53   
## COMMIT READY   
## Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.750   
## Median :3.667 Median :3.250   
## Mean :3.573 Mean :3.161   
## 3rd Qu.:4.000 3rd Qu.:3.750   
## Max. :5.000 Max. :5.000   
## NA's :45 NA's :50

summary(data2)

## SUBNUM TIME JOBSAT1 COMMIT1 READY1   
## Min. :301 Min. :0 Min. :1.000 Min. :1.000 Min. :1.00   
## 1st Qu.:349 1st Qu.:0 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.25   
## Median :398 Median :1 Median :3.333 Median :3.667 Median :3.00   
## Mean :398 Mean :1 Mean :3.137 Mean :3.543 Mean :2.92   
## 3rd Qu.:447 3rd Qu.:2 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.50   
## Max. :495 Max. :2 Max. :5.000 Max. :5.000 Max. :4.75   
## NA's :39 NA's :45 NA's :48   
## JOBSAT2 COMMIT2 READY2 JOBSAT3   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.500 1st Qu.:3.000   
## Median :3.333 Median :3.667 Median :3.000 Median :3.333   
## Mean :3.207 Mean :3.422 Mean :3.007 Mean :3.313   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.750 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :24 NA's :21 NA's :33 NA's :45   
## COMMIT3 READY3 JSAT COMMIT   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.750 1st Qu.:2.667 1st Qu.:3.000   
## Median :3.667 Median :3.250 Median :3.333 Median :3.667   
## Mean :3.508 Mean :3.165 Mean :3.219 Mean :3.490   
## 3rd Qu.:4.000 3rd Qu.:3.750 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :36 NA's :57 NA's :36 NA's :34   
## READY   
## Min. :1.00   
## 1st Qu.:2.50   
## Median :3.25   
## Mean :3.03   
## 3rd Qu.:3.75   
## Max. :5.00   
## NA's :46

### Handling missing values

#Note: I used 999 to represent missing data for JOBSAT1 COMMIT1 and READY1   
#R needs to be told that 999 is not a legitimate value, but is user-defined missing value  
data1$JOBSAT1[data1$JOBSAT1==999]=NA #Explain what the heck this means!  
data1$COMMIT1[data1$COMMIT1==999]=NA   
data1$READY1[data1$READY1==999]=NA   
summary(data1)

## SUBNUM TIME JOBSAT1 COMMIT1   
## Min. : 1.00 Min. :0 Min. :1.000 Min. :1.000   
## 1st Qu.: 75.75 1st Qu.:0 1st Qu.:2.667 1st Qu.:3.000   
## Median :150.50 Median :1 Median :3.333 Median :3.667   
## Mean :150.50 Mean :1 Mean :3.297 Mean :3.663   
## 3rd Qu.:225.25 3rd Qu.:2 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :300.00 Max. :2 Max. :5.000 Max. :5.000   
## NA's :42 NA's :39   
## READY1 JOBSAT2 COMMIT2 READY2   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:2.500 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.750   
## Median :3.000 Median :3.333 Median :3.667 Median :3.250   
## Mean :3.066 Mean :3.272 Mean :3.498 Mean :3.176   
## 3rd Qu.:3.750 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.750   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :48 NA's :66 NA's :48 NA's :54   
## JOBSAT3 COMMIT3 READY3 JSAT   
## Min. :1.000 Min. :1.333 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.750 1st Qu.:2.667   
## Median :3.333 Median :3.667 Median :3.250 Median :3.333   
## Mean :3.355 Mean :3.556 Mean :3.241 Mean :3.308   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :51 NA's :48 NA's :48 NA's :53   
## COMMIT READY   
## Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.750   
## Median :3.667 Median :3.250   
## Mean :3.573 Mean :3.161   
## 3rd Qu.:4.000 3rd Qu.:3.750   
## Max. :5.000 Max. :5.000   
## NA's :45 NA's :50

summary(data2)

## SUBNUM TIME JOBSAT1 COMMIT1 READY1   
## Min. :301 Min. :0 Min. :1.000 Min. :1.000 Min. :1.00   
## 1st Qu.:349 1st Qu.:0 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.25   
## Median :398 Median :1 Median :3.333 Median :3.667 Median :3.00   
## Mean :398 Mean :1 Mean :3.137 Mean :3.543 Mean :2.92   
## 3rd Qu.:447 3rd Qu.:2 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.50   
## Max. :495 Max. :2 Max. :5.000 Max. :5.000 Max. :4.75   
## NA's :39 NA's :45 NA's :48   
## JOBSAT2 COMMIT2 READY2 JOBSAT3   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.500 1st Qu.:3.000   
## Median :3.333 Median :3.667 Median :3.000 Median :3.333   
## Mean :3.207 Mean :3.422 Mean :3.007 Mean :3.313   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.750 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :24 NA's :21 NA's :33 NA's :45   
## COMMIT3 READY3 JSAT COMMIT   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.750 1st Qu.:2.667 1st Qu.:3.000   
## Median :3.667 Median :3.250 Median :3.333 Median :3.667   
## Mean :3.508 Mean :3.165 Mean :3.219 Mean :3.490   
## 3rd Qu.:4.000 3rd Qu.:3.750 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :36 NA's :57 NA's :36 NA's :34   
## READY   
## Min. :1.00   
## 1st Qu.:2.50   
## Median :3.25   
## Mean :3.03   
## 3rd Qu.:3.75   
## Max. :5.00   
## NA's :46

#The above can be tedious if you have a large number of variables  
### it is eaiser if you copy & paste code  
#Or, if 999 doens't hold any meaning for ANY of the variables  
data1=read.csv(paste0(path2data, "data1.csv"), na.strings=c(".", "999","9","-9"))  
summary(data1)

## SUBNUM TIME JOBSAT1 COMMIT1 READY1   
## Min. : 1 Min. :0 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.: 76 1st Qu.:0 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.500   
## Median :151 Median :1 Median :3.333 Median :3.667 Median :3.000   
## Mean :151 Mean :1 Mean :3.297 Mean :3.663 Mean :3.066   
## 3rd Qu.:226 3rd Qu.:2 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.750   
## Max. :300 Max. :2 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :3 NA's :42 NA's :39 NA's :48   
## JOBSAT2 COMMIT2 READY2 JOBSAT3   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.750 1st Qu.:3.000   
## Median :3.333 Median :3.667 Median :3.250 Median :3.333   
## Mean :3.272 Mean :3.498 Mean :3.176 Mean :3.355   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.750 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :66 NA's :48 NA's :54 NA's :51   
## COMMIT3 READY3 JSAT COMMIT   
## Min. :1.333 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.750 1st Qu.:2.667 1st Qu.:3.000   
## Median :3.667 Median :3.250 Median :3.333 Median :3.667   
## Mean :3.556 Mean :3.241 Mean :3.308 Mean :3.573   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :48 NA's :48 NA's :53 NA's :45   
## READY   
## Min. :1.000   
## 1st Qu.:2.750   
## Median :3.250   
## Mean :3.161   
## 3rd Qu.:3.750   
## Max. :5.000   
## NA's :50

#OR, you could write a function  
my999isNA=function(x) {x[x==999]=NA; x}

#Now we will apply this missing data function to the proper variables in data2  
#To do this, we use the "lapply" function which allows us to apply the same function over a list or array  
  
data1=read.csv(paste0(path2data, "data1.csv")) #reread data1 as a data.frame with missing data   
names(data1)

## [1] "SUBNUM" "TIME" "JOBSAT1" "COMMIT1" "READY1" "JOBSAT2" "COMMIT2"  
## [8] "READY2" "JOBSAT3" "COMMIT3" "READY3" "JSAT" "COMMIT" "READY"

summary(data1)

## SUBNUM TIME JOBSAT1 COMMIT1   
## Min. : 1.00 Min. :0 Min. : 1.000 Min. : 1.000   
## 1st Qu.: 75.75 1st Qu.:0 1st Qu.: 2.667 1st Qu.: 3.333   
## Median :150.50 Median :1 Median : 3.667 Median : 3.667   
## Mean :150.50 Mean :1 Mean : 49.763 Mean : 46.794   
## 3rd Qu.:225.25 3rd Qu.:2 3rd Qu.: 4.000 3rd Qu.: 4.333   
## Max. :300.00 Max. :2 Max. :999.000 Max. :999.000   
##   
## READY1 JOBSAT2 COMMIT2 READY2   
## Min. : 1.00 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.: 2.75 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.750   
## Median : 3.25 Median :3.333 Median :3.667 Median :3.250   
## Mean : 56.18 Mean :3.272 Mean :3.498 Mean :3.176   
## 3rd Qu.: 3.75 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.750   
## Max. :999.00 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :66 NA's :48 NA's :54   
## JOBSAT3 COMMIT3 READY3 JSAT   
## Min. :1.000 Min. :1.333 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.750 1st Qu.:2.667   
## Median :3.333 Median :3.667 Median :3.250 Median :3.333   
## Mean :3.355 Mean :3.556 Mean :3.241 Mean :3.308   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :51 NA's :48 NA's :48 NA's :53   
## COMMIT READY   
## Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.750   
## Median :3.667 Median :3.250   
## Mean :3.573 Mean :3.161   
## 3rd Qu.:4.000 3rd Qu.:3.750   
## Max. :5.000 Max. :5.000   
## NA's :45 NA's :50

data1[3:5]=lapply(data1[3:5],my999isNA)  
summary(data1)

## SUBNUM TIME JOBSAT1 COMMIT1   
## Min. : 1.00 Min. :0 Min. :1.000 Min. :1.000   
## 1st Qu.: 75.75 1st Qu.:0 1st Qu.:2.667 1st Qu.:3.000   
## Median :150.50 Median :1 Median :3.333 Median :3.667   
## Mean :150.50 Mean :1 Mean :3.297 Mean :3.663   
## 3rd Qu.:225.25 3rd Qu.:2 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :300.00 Max. :2 Max. :5.000 Max. :5.000   
## NA's :42 NA's :39   
## READY1 JOBSAT2 COMMIT2 READY2   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:2.500 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.750   
## Median :3.000 Median :3.333 Median :3.667 Median :3.250   
## Mean :3.066 Mean :3.272 Mean :3.498 Mean :3.176   
## 3rd Qu.:3.750 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.750   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :48 NA's :66 NA's :48 NA's :54   
## JOBSAT3 COMMIT3 READY3 JSAT   
## Min. :1.000 Min. :1.333 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.750 1st Qu.:2.667   
## Median :3.333 Median :3.667 Median :3.250 Median :3.333   
## Mean :3.355 Mean :3.556 Mean :3.241 Mean :3.308   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :51 NA's :48 NA's :48 NA's :53   
## COMMIT READY   
## Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.750   
## Median :3.667 Median :3.250   
## Mean :3.573 Mean :3.161   
## 3rd Qu.:4.000 3rd Qu.:3.750   
## Max. :5.000 Max. :5.000   
## NA's :45 NA's :50

## TOPIC 5: Merging Data Files

#Merging data by adding variables (e.g, two data.frames, demo1 + data1)  
dd1=merge(demo1,data1, by="SUBNUM")  
dd1=merge(demo1,data1, by=c("SUBNUM","TIME"), all=TRUE)  
   
dd2=merge(demo2,data2, by=c("SUBNUM","TIME"), all=TRUE)  
summary(dd1)

## SUBNUM TIME BTN COMPANY   
## Min. : 1.00 Min. :0 Min. : 4.0 A :246   
## 1st Qu.: 75.75 1st Qu.:0 1st Qu.: 377.8 HHC :210   
## Median :150.50 Median :1 Median :1022.0 B :207   
## Mean :150.50 Mean :1 Mean :1860.3 D :114   
## 3rd Qu.:225.25 3rd Qu.:2 3rd Qu.:3066.0 C : 84   
## Max. :300.00 Max. :2 Max. :4042.0 SVC : 24   
## (Other): 15   
## MARITAL GENDER HOWLONG RANK   
## Min. :1.000 Min. :1.000 Min. :0.000 Min. :11.00   
## 1st Qu.:1.000 1st Qu.:1.000 1st Qu.:1.000 1st Qu.:13.00   
## Median :2.000 Median :1.000 Median :2.000 Median :14.00   
## Mean :1.711 Mean :1.039 Mean :2.371 Mean :15.26   
## 3rd Qu.:2.000 3rd Qu.:1.000 3rd Qu.:4.000 3rd Qu.:16.00   
## Max. :5.000 Max. :2.000 Max. :5.000 Max. :32.00   
## NA's :6 NA's :51 NA's :18 NA's :48   
## EDUCATE AGE JOBSAT1 COMMIT1   
## Min. :1.000 Min. :18.00 Min. :1.000 Min. :1.000   
## 1st Qu.:2.000 1st Qu.:20.00 1st Qu.:2.667 1st Qu.:3.000   
## Median :2.000 Median :24.00 Median :3.333 Median :3.667   
## Mean :2.663 Mean :25.75 Mean :3.297 Mean :3.663   
## 3rd Qu.:3.000 3rd Qu.:30.00 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :6.000 Max. :44.00 Max. :5.000 Max. :5.000   
## NA's :9 NA's :9 NA's :42 NA's :39   
## READY1 JOBSAT2 COMMIT2 READY2   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:2.500 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.750   
## Median :3.000 Median :3.333 Median :3.667 Median :3.250   
## Mean :3.066 Mean :3.272 Mean :3.498 Mean :3.176   
## 3rd Qu.:3.750 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.750   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :48 NA's :66 NA's :48 NA's :54   
## JOBSAT3 COMMIT3 READY3 JSAT   
## Min. :1.000 Min. :1.333 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:3.000 1st Qu.:2.750 1st Qu.:2.667   
## Median :3.333 Median :3.667 Median :3.250 Median :3.333   
## Mean :3.355 Mean :3.556 Mean :3.241 Mean :3.308   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :51 NA's :48 NA's :48 NA's :53   
## COMMIT READY   
## Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.750   
## Median :3.667 Median :3.250   
## Mean :3.573 Mean :3.161   
## 3rd Qu.:4.000 3rd Qu.:3.750   
## Max. :5.000 Max. :5.000   
## NA's :45 NA's :50

summary(dd2)

## SUBNUM TIME BTN COMPANY MARITAL   
## Min. :301 Min. :0 Min. : 4 A :156 Min. :1.000   
## 1st Qu.:349 1st Qu.:0 1st Qu.: 404 HHC :144 1st Qu.:1.000   
## Median :398 Median :1 Median :1022 B :141 Median :2.000   
## Mean :398 Mean :1 Mean :1755 D : 69 Mean :1.756   
## 3rd Qu.:447 3rd Qu.:2 3rd Qu.:3066 C : 42 3rd Qu.:2.000   
## Max. :495 Max. :2 Max. :4042 SVC : 15 Max. :5.000   
## (Other): 18 NA's :6   
## GENDER HOWLONG RANK EDUCATE   
## Min. :1.000 Min. :0.000 Min. :11.0 Min. :1.00   
## 1st Qu.:1.000 1st Qu.:2.000 1st Qu.:13.0 1st Qu.:2.00   
## Median :1.000 Median :2.000 Median :14.0 Median :2.00   
## Mean :1.022 Mean :2.446 Mean :14.7 Mean :2.49   
## 3rd Qu.:1.000 3rd Qu.:3.000 3rd Qu.:15.0 3rd Qu.:2.00   
## Max. :2.000 Max. :5.000 Max. :31.0 Max. :6.00   
## NA's :51 NA's :6 NA's :27 NA's :3   
## AGE JOBSAT1 COMMIT1 READY1   
## Min. :18.00 Min. :1.000 Min. :1.000 Min. :1.00   
## 1st Qu.:21.00 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.25   
## Median :24.00 Median :3.333 Median :3.667 Median :3.00   
## Mean :25.68 Mean :3.137 Mean :3.543 Mean :2.92   
## 3rd Qu.:29.00 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.50   
## Max. :46.00 Max. :5.000 Max. :5.000 Max. :4.75   
## NA's :3 NA's :39 NA's :45 NA's :48   
## JOBSAT2 COMMIT2 READY2 JOBSAT3   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.500 1st Qu.:3.000   
## Median :3.333 Median :3.667 Median :3.000 Median :3.333   
## Mean :3.207 Mean :3.422 Mean :3.007 Mean :3.313   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.750 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :24 NA's :21 NA's :33 NA's :45   
## COMMIT3 READY3 JSAT COMMIT   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.750 1st Qu.:2.667 1st Qu.:3.000   
## Median :3.667 Median :3.250 Median :3.333 Median :3.667   
## Mean :3.508 Mean :3.165 Mean :3.219 Mean :3.490   
## 3rd Qu.:4.000 3rd Qu.:3.750 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :36 NA's :57 NA's :36 NA's :34   
## READY   
## Min. :1.00   
## 1st Qu.:2.50   
## Median :3.25   
## Mean :3.03   
## 3rd Qu.:3.75   
## Max. :5.00   
## NA's :46

### Merging data by adding rows (subjects)

#let's combine dd1 with dd2  
#when you have IDENTICAL columns in both data sets you may use rbind  
names(dd1); names(dd2)

## [1] "SUBNUM" "TIME" "BTN" "COMPANY" "MARITAL" "GENDER" "HOWLONG"  
## [8] "RANK" "EDUCATE" "AGE" "JOBSAT1" "COMMIT1" "READY1" "JOBSAT2"  
## [15] "COMMIT2" "READY2" "JOBSAT3" "COMMIT3" "READY3" "JSAT" "COMMIT"   
## [22] "READY"

## [1] "SUBNUM" "TIME" "BTN" "COMPANY" "MARITAL" "GENDER" "HOWLONG"  
## [8] "RANK" "EDUCATE" "AGE" "JOBSAT1" "COMMIT1" "READY1" "JOBSAT2"  
## [15] "COMMIT2" "READY2" "JOBSAT3" "COMMIT3" "READY3" "JSAT" "COMMIT"   
## [22] "READY"

dd3=rbind(dd1,dd2)  
summary(dd3)

## SUBNUM TIME BTN COMPANY MARITAL   
## Min. : 1 Min. :0 Min. : 4 A :402 Min. :1.000   
## 1st Qu.:124 1st Qu.:0 1st Qu.: 404 HHC :354 1st Qu.:1.000   
## Median :248 Median :1 Median :1022 B :348 Median :2.000   
## Mean :248 Mean :1 Mean :1819 D :183 Mean :1.729   
## 3rd Qu.:372 3rd Qu.:2 3rd Qu.:3066 C :126 3rd Qu.:2.000   
## Max. :495 Max. :2 Max. :4042 SVC : 39 Max. :5.000   
## (Other): 33 NA's :12   
## GENDER HOWLONG RANK EDUCATE   
## Min. :1.000 Min. :0.0 Min. :11.00 Min. :1.000   
## 1st Qu.:1.000 1st Qu.:1.0 1st Qu.:13.00 1st Qu.:2.000   
## Median :1.000 Median :2.0 Median :14.00 Median :2.000   
## Mean :1.033 Mean :2.4 Mean :15.04 Mean :2.595   
## 3rd Qu.:1.000 3rd Qu.:4.0 3rd Qu.:16.00 3rd Qu.:3.000   
## Max. :2.000 Max. :5.0 Max. :32.00 Max. :6.000   
## NA's :102 NA's :24 NA's :75 NA's :12   
## AGE JOBSAT1 COMMIT1 READY1   
## Min. :18.00 Min. :1.000 Min. :1.000 Min. :1.00   
## 1st Qu.:21.00 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.50   
## Median :24.00 Median :3.333 Median :3.667 Median :3.00   
## Mean :25.72 Mean :3.235 Mean :3.617 Mean :3.01   
## 3rd Qu.:30.00 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.75   
## Max. :46.00 Max. :5.000 Max. :5.000 Max. :5.00   
## NA's :12 NA's :81 NA's :84 NA's :96   
## JOBSAT2 COMMIT2 READY2 JOBSAT3   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:2.667 1st Qu.:3.000 1st Qu.:2.500 1st Qu.:3.000   
## Median :3.333 Median :3.667 Median :3.250 Median :3.333   
## Mean :3.246 Mean :3.468 Mean :3.109 Mean :3.338   
## 3rd Qu.:4.000 3rd Qu.:4.000 3rd Qu.:3.750 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :90 NA's :69 NA's :87 NA's :96   
## COMMIT3 READY3 JSAT COMMIT   
## Min. :1.000 Min. :1.000 Min. :1.000 Min. :1.000   
## 1st Qu.:3.000 1st Qu.:2.750 1st Qu.:2.667 1st Qu.:3.000   
## Median :3.667 Median :3.250 Median :3.333 Median :3.667   
## Mean :3.537 Mean :3.212 Mean :3.273 Mean :3.540   
## 3rd Qu.:4.000 3rd Qu.:3.750 3rd Qu.:4.000 3rd Qu.:4.000   
## Max. :5.000 Max. :5.000 Max. :5.000 Max. :5.000   
## NA's :84 NA's :105 NA's :89 NA's :79   
## READY   
## Min. :1.00   
## 1st Qu.:2.50   
## Median :3.25   
## Mean :3.11   
## 3rd Qu.:3.75   
## Max. :5.00   
## NA's :96

#when you have different columns in your data, you can use rbind.fill  
#first let's compute some extra variables and add them to dd1  
#Computing new variables in an existing data.frame  
dd1$STAY=dd1$JSAT+dd1$COMMIT  
#dd3=rbind(dd1,dd2) doesn't work because of differing colums  
?rbind.fill  
install.packages("plyr")  
library(plyr)

dd3=plyr::rbind.fill(dd1,dd2)  
head(dd3); tail(dd3)

## SUBNUM TIME BTN COMPANY MARITAL GENDER HOWLONG RANK EDUCATE AGE  
## 1 1 0 1022 HHC 1 1 2 12 2 20  
## 2 1 1 1022 HHC 1 1 2 12 2 20  
## 3 1 2 1022 HHC 1 1 2 12 2 20  
## 4 10 0 3066 C 1 1 3 13 2 22  
## 5 10 1 3066 C 1 1 3 13 2 22  
## 6 10 2 3066 C 1 1 3 13 2 22  
## JOBSAT1 COMMIT1 READY1 JOBSAT2 COMMIT2 READY2 JOBSAT3 COMMIT3 READY3  
## 1 1.666667 1.666667 2.75 1.000000 1.666667 1 3 3 3  
## 2 1.666667 1.666667 2.75 1.000000 1.666667 1 3 3 3  
## 3 1.666667 1.666667 2.75 1.000000 1.666667 1 3 3 3  
## 4 1.000000 3.666667 2.00 1.333333 3.333333 3 3 3 3  
## 5 1.000000 3.666667 2.00 1.333333 3.333333 3 3 3 3  
## 6 1.000000 3.666667 2.00 1.333333 3.333333 3 3 3 3  
## JSAT COMMIT READY  
## 1 1.666667 1.666667 2.75  
## 2 1.000000 1.666667 1.00  
## 3 3.000000 3.000000 3.00  
## 4 1.000000 3.666667 2.00  
## 5 1.333333 3.333333 3.00  
## 6 3.000000 3.000000 3.00

## SUBNUM TIME BTN COMPANY MARITAL GENDER HOWLONG RANK EDUCATE AGE  
## 1480 494 0 4042 B 1 1 0 11 2 22  
## 1481 494 1 4042 B 1 1 0 11 2 22  
## 1482 494 2 4042 B 1 1 0 11 2 22  
## 1483 495 0 1022 B 1 1 3 13 2 19  
## 1484 495 1 1022 B 1 1 3 13 2 19  
## 1485 495 2 1022 B 1 1 3 13 2 19  
## JOBSAT1 COMMIT1 READY1 JOBSAT2 COMMIT2 READY2 JOBSAT3 COMMIT3  
## 1480 3 4.333333 3.75 2.333333 3.333333 3.25 3.666667 4.000000  
## 1481 3 4.333333 3.75 2.333333 3.333333 3.25 3.666667 4.000000  
## 1482 3 4.333333 3.75 2.333333 3.333333 3.25 3.666667 4.000000  
## 1483 4 4.000000 3.75 4.000000 4.000000 4.00 3.000000 3.333333  
## 1484 4 4.000000 3.75 4.000000 4.000000 4.00 3.000000 3.333333  
## 1485 4 4.000000 3.75 4.000000 4.000000 4.00 3.000000 3.333333  
## READY3 JSAT COMMIT READY  
## 1480 4.00 3.000000 4.333333 3.75  
## 1481 4.00 2.333333 3.333333 3.25  
## 1482 4.00 3.666667 4.000000 4.00  
## 1483 3.25 4.000000 4.000000 3.75  
## 1484 3.25 4.000000 4.000000 4.00  
## 1485 3.25 3.000000 3.333333 3.25

### Deleting a variable from a data frame

#let's delete STAY from the previous dd3 data.frame  
names(dd3)

## [1] "SUBNUM" "TIME" "BTN" "COMPANY" "MARITAL" "GENDER" "HOWLONG"  
## [8] "RANK" "EDUCATE" "AGE" "JOBSAT1" "COMMIT1" "READY1" "JOBSAT2"  
## [15] "COMMIT2" "READY2" "JOBSAT3" "COMMIT3" "READY3" "JSAT" "COMMIT"   
## [22] "READY"

dd4=dd3[c(1,2,3:22)]  
names(dd4)

## [1] "SUBNUM" "TIME" "BTN" "COMPANY" "MARITAL" "GENDER" "HOWLONG"  
## [8] "RANK" "EDUCATE" "AGE" "JOBSAT1" "COMMIT1" "READY1" "JOBSAT2"  
## [15] "COMMIT2" "READY2" "JOBSAT3" "COMMIT3" "READY3" "JSAT" "COMMIT"   
## [22] "READY"

#Renaming a variable in a data.frame  
#let's rename HOWLONG to TENURE and MARITAL to STATUS  
dd4=plyr::rename(dd4, c(HOWLONG="TENURE", MARITAL="STATUS"))   
names(dd4)

## [1] "SUBNUM" "TIME" "BTN" "COMPANY" "STATUS" "GENDER" "TENURE"   
## [8] "RANK" "EDUCATE" "AGE" "JOBSAT1" "COMMIT1" "READY1" "JOBSAT2"  
## [15] "COMMIT2" "READY2" "JOBSAT3" "COMMIT3" "READY3" "JSAT" "COMMIT"   
## [22] "READY"

### Recoding variables

#Categorical Variables: recode sex into a different, dummy variable  
#Only “factor” type variables are assigned value labels  
dd4$GENDER2=plyr::revalue(as.factor(dd4$GENDER), c("1"="male","2"="female"))  
dd4$GENDER3=(dd4$GENDER-1)  
class(dd4$GENDER)

## [1] "numeric"

class(dd4$GENDER2)

## [1] "factor"

class(dd4$GENDER3)

## [1] "numeric"

#recode Likert-type items/scales  
###let's reverse the overall score on COMMIT so that high scores = more likely to leave  
dd4$LEAVE=6-dd4$COMMIT

## TOPIC 6: Summarizing & Visualizing Data Frames

### Central Tendency

mean(dd3$JSAT); median(dd3$JSAT)

## [1] NA

## [1] NA

mean(dd3$JSAT,na.rm=TRUE); median(dd3$JSAT,na.rm=TRUE)

## [1] 3.272923

## [1] 3.333333

#Dispersion  
var(dd3$JSAT,na.rm=T)

## [1] 0.8622181

sd(dd3$JSAT,na.rm=T)

## [1] 0.928557

min(dd3$JSAT, na.rm=T)

## [1] 1

max(dd3$JSAT,na.rm=T)

## [1] 5

summary(dd3$JSAT,na.rm=T)

## Min. 1st Qu. Median Mean 3rd Qu. Max. NA's   
## 1.000 2.667 3.333 3.273 4.000 5.000 89

quantile(dd3$JSAT,probs=c(.1,.2,.3,.4,.5,.6,.7,.8,.9),na.rm=T)

## 10% 20% 30% 40% 50% 60% 70% 80%   
## 2.000000 2.333333 3.000000 3.000000 3.333333 3.666667 4.000000 4.000000   
## 90%   
## 4.333333

### Alternative: Hmisc

install.packages("Hmisc")  
library("Hmisc")

Hmisc::describe(dd4)

## dd4   
##   
## 25 Variables 1485 Observations  
## ---------------------------------------------------------------------------  
## SUBNUM   
## n missing distinct Info Mean Gmd .05 .10   
## 1485 0 495 1 248 165.1 25.2 50.0   
## .25 .50 .75 .90 .95   
## 124.0 248.0 372.0 446.0 470.8   
##   
## lowest : 1 2 3 4 5, highest: 491 492 493 494 495  
## ---------------------------------------------------------------------------  
## TIME   
## n missing distinct Info Mean Gmd   
## 1485 0 3 0.889 1 0.8895   
##   
## Value 0 1 2  
## Frequency 495 495 495  
## Proportion 0.333 0.333 0.333  
## ---------------------------------------------------------------------------  
## BTN   
## n missing distinct Info Mean Gmd .05 .10   
## 1485 0 16 0.965 1819 1566 4 104   
## .25 .50 .75 .90 .95   
## 404 1022 3066 4042 4042   
##   
## Value 0 100 120 140 300 400 700 1000 1010 1020  
## Frequency 141 15 42 30 123 48 6 66 21 288  
## Proportion 0.095 0.010 0.028 0.020 0.083 0.032 0.004 0.044 0.014 0.194  
##   
## Value 2000 2010 3070 4000 4040  
## Frequency 36 51 435 18 165  
## Proportion 0.024 0.034 0.293 0.012 0.111  
## ---------------------------------------------------------------------------  
## COMPANY   
## n missing distinct   
## 1485 0 8   
##   
## Value A B C D F HHC REC SVC  
## Frequency 402 348 126 183 15 354 18 39  
## Proportion 0.271 0.234 0.085 0.123 0.010 0.238 0.012 0.026  
## ---------------------------------------------------------------------------  
## STATUS   
## n missing distinct Info Mean Gmd   
## 1473 12 5 0.79 1.729 0.745   
##   
## Value 1 2 3 4 5  
## Frequency 603 768 21 60 21  
## Proportion 0.409 0.521 0.014 0.041 0.014  
## ---------------------------------------------------------------------------  
## GENDER   
## n missing distinct Info Mean Gmd   
## 1383 102 2 0.094 1.033 0.063   
##   
## Value 1 2  
## Frequency 1338 45  
## Proportion 0.967 0.033  
## ---------------------------------------------------------------------------  
## TENURE   
## n missing distinct Info Mean Gmd   
## 1461 24 6 0.949 2.4 1.747   
##   
## Value 0 1 2 3 4 5  
## Frequency 216 159 495 225 147 219  
## Proportion 0.148 0.109 0.339 0.154 0.101 0.150  
## ---------------------------------------------------------------------------  
## RANK   
## n missing distinct Info Mean Gmd .05 .10   
## 1410 75 15 0.972 15.04 2.979 12 12   
## .25 .50 .75 .90 .95   
## 13 14 16 21 22   
##   
## Value 11 12 13 14 15 16 17 18 19 21  
## Frequency 21 147 324 264 279 114 84 18 3 54  
## Proportion 0.015 0.104 0.230 0.187 0.198 0.081 0.060 0.013 0.002 0.038  
##   
## Value 22 23 24 31 32  
## Frequency 51 42 3 3 3  
## Proportion 0.036 0.030 0.002 0.002 0.002  
## ---------------------------------------------------------------------------  
## EDUCATE   
## n missing distinct Info Mean Gmd   
## 1473 12 6 0.617 2.595 0.9586   
##   
## Value 1 2 3 4 5 6  
## Frequency 9 1068 99 117 168 12  
## Proportion 0.006 0.725 0.067 0.079 0.114 0.008  
## ---------------------------------------------------------------------------  
## AGE   
## n missing distinct Info Mean Gmd .05 .10   
## 1473 12 29 0.994 25.72 6.715 19 19   
## .25 .50 .75 .90 .95   
## 21 24 30 35 37   
##   
## lowest : 18 19 20 21 22, highest: 42 43 44 45 46  
## ---------------------------------------------------------------------------  
## JOBSAT1   
## n missing distinct Info Mean Gmd .05 .10   
## 1404 81 13 0.983 3.235 1.104 1.333 1.667   
## .25 .50 .75 .90 .95   
## 2.667 3.333 4.000 4.333 4.667   
##   
## Value 1.000000 1.333333 1.666667 2.000000 2.333333 2.666667 3.000000  
## Frequency 48 39 63 96 78 102 180  
## Proportion 0.034 0.028 0.045 0.068 0.056 0.073 0.128  
##   
## Value 3.333333 3.666667 4.000000 4.333333 4.666667 5.000000  
## Frequency 156 141 315 87 54 45  
## Proportion 0.111 0.100 0.224 0.062 0.038 0.032  
## ---------------------------------------------------------------------------  
## COMMIT1   
## n missing distinct Info Mean Gmd .05 .10   
## 1401 84 13 0.982 3.617 0.9408 2.000 2.333   
## .25 .50 .75 .90 .95   
## 3.000 3.667 4.000 4.667 5.000   
##   
## Value 1.000000 1.333333 1.666667 2.000000 2.333333 2.666667 3.000000  
## Frequency 12 9 21 45 57 75 165  
## Proportion 0.009 0.006 0.015 0.032 0.041 0.054 0.118  
##   
## Value 3.333333 3.666667 4.000000 4.333333 4.666667 5.000000  
## Frequency 189 222 282 102 102 120  
## Proportion 0.135 0.158 0.201 0.073 0.073 0.086  
## ---------------------------------------------------------------------------  
## READY1   
## n missing distinct Info Mean Gmd .05 .10   
## 1389 96 17 0.99 3.01 0.9286 1.50 1.75   
## .25 .50 .75 .90 .95   
## 2.50 3.00 3.75 4.00 4.00   
##   
## Value 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25  
## Frequency 36 33 33 45 66 78 108 141 177 204  
## Proportion 0.026 0.024 0.024 0.032 0.048 0.056 0.078 0.102 0.127 0.147  
##   
## Value 3.50 3.75 4.00 4.25 4.50 4.75 5.00  
## Frequency 105 117 183 36 18 6 3  
## Proportion 0.076 0.084 0.132 0.026 0.013 0.004 0.002  
## ---------------------------------------------------------------------------  
## JOBSAT2   
## n missing distinct Info Mean Gmd .05 .10   
## 1395 90 13 0.978 3.246 1.041 1.333 2.000   
## .25 .50 .75 .90 .95   
## 2.667 3.333 4.000 4.000 4.667   
##   
## Value 1.000000 1.333333 1.666667 2.000000 2.333333 2.666667 3.000000  
## Frequency 51 30 54 75 99 84 174  
## Proportion 0.037 0.022 0.039 0.054 0.071 0.060 0.125  
##   
## Value 3.333333 3.666667 4.000000 4.333333 4.666667 5.000000  
## Frequency 177 168 348 63 33 39  
## Proportion 0.127 0.120 0.249 0.045 0.024 0.028  
## ---------------------------------------------------------------------------  
## COMMIT2   
## n missing distinct Info Mean Gmd .05 .10   
## 1416 69 13 0.981 3.468 0.9529 1.667 2.333   
## .25 .50 .75 .90 .95   
## 3.000 3.667 4.000 4.667 5.000   
##   
## Value 1.000000 1.333333 1.666667 2.000000 2.333333 2.666667 3.000000  
## Frequency 39 18 30 18 57 93 207  
## Proportion 0.028 0.013 0.021 0.013 0.040 0.066 0.146  
##   
## Value 3.333333 3.666667 4.000000 4.333333 4.666667 5.000000  
## Frequency 213 207 291 96 75 72  
## Proportion 0.150 0.146 0.206 0.068 0.053 0.051  
## ---------------------------------------------------------------------------  
## READY2   
## n missing distinct Info Mean Gmd .05 .10   
## 1398 87 17 0.989 3.109 0.9311 1.50 2.00   
## .25 .50 .75 .90 .95   
## 2.50 3.25 3.75 4.00 4.25   
##   
## Value 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25  
## Frequency 24 30 30 39 69 75 105 75 216 162  
## Proportion 0.017 0.021 0.021 0.028 0.049 0.054 0.075 0.054 0.155 0.116  
##   
## Value 3.50 3.75 4.00 4.25 4.50 4.75 5.00  
## Frequency 162 162 156 39 18 15 21  
## Proportion 0.116 0.116 0.112 0.028 0.013 0.011 0.015  
## ---------------------------------------------------------------------------  
## JOBSAT3   
## n missing distinct Info Mean Gmd .05 .10   
## 1389 96 13 0.972 3.338 0.941 1.667 2.000   
## .25 .50 .75 .90 .95   
## 3.000 3.333 4.000 4.333 4.667   
##   
## Value 1.000000 1.333333 1.666667 2.000000 2.333333 2.666667 3.000000  
## Frequency 24 33 21 72 72 69 279  
## Proportion 0.017 0.024 0.015 0.052 0.052 0.050 0.201  
##   
## Value 3.333333 3.666667 4.000000 4.333333 4.666667 5.000000  
## Frequency 183 138 351 60 42 45  
## Proportion 0.132 0.099 0.253 0.043 0.030 0.032  
## ---------------------------------------------------------------------------  
## COMMIT3   
## n missing distinct Info Mean Gmd .05 .10   
## 1401 84 13 0.974 3.537 0.8182 2.000 2.667   
## .25 .50 .75 .90 .95   
## 3.000 3.667 4.000 4.333 4.667   
##   
## Value 1.000000 1.333333 1.666667 2.000000 2.333333 2.666667 3.000000  
## Frequency 9 9 21 33 42 54 261  
## Proportion 0.006 0.006 0.015 0.024 0.030 0.039 0.186  
##   
## Value 3.333333 3.666667 4.000000 4.333333 4.666667 5.000000  
## Frequency 204 234 315 102 48 69  
## Proportion 0.146 0.167 0.225 0.073 0.034 0.049  
## ---------------------------------------------------------------------------  
## READY3   
## n missing distinct Info Mean Gmd .05 .10   
## 1380 105 17 0.986 3.212 0.8964 1.50 2.00   
## .25 .50 .75 .90 .95   
## 2.75 3.25 3.75 4.00 4.25   
##   
## Value 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25  
## Frequency 12 24 42 36 36 39 87 102 237 144  
## Proportion 0.009 0.017 0.030 0.026 0.026 0.028 0.063 0.074 0.172 0.104  
##   
## Value 3.50 3.75 4.00 4.25 4.50 4.75 5.00  
## Frequency 168 114 231 48 21 21 18  
## Proportion 0.122 0.083 0.167 0.035 0.015 0.015 0.013  
## ---------------------------------------------------------------------------  
## JSAT   
## n missing distinct Info Mean Gmd .05 .10   
## 1396 89 13 0.978 3.273 1.032 1.333 2.000   
## .25 .50 .75 .90 .95   
## 2.667 3.333 4.000 4.333 4.667   
##   
## Value 1.000000 1.333333 1.666667 2.000000 2.333333 2.666667 3.000000  
## Frequency 41 34 46 81 83 85 211  
## Proportion 0.029 0.024 0.033 0.058 0.059 0.061 0.151  
##   
## Value 3.333333 3.666667 4.000000 4.333333 4.666667 5.000000  
## Frequency 172 149 338 70 43 43  
## Proportion 0.123 0.107 0.242 0.050 0.031 0.031  
## ---------------------------------------------------------------------------  
## COMMIT   
## n missing distinct Info Mean Gmd .05 .10   
## 1406 79 13 0.979 3.54 0.9079 2.000 2.667   
## .25 .50 .75 .90 .95   
## 3.000 3.667 4.000 4.667 5.000   
##   
## Value 1.000000 1.333333 1.666667 2.000000 2.333333 2.666667 3.000000  
## Frequency 20 12 24 32 52 74 211  
## Proportion 0.014 0.009 0.017 0.023 0.037 0.053 0.150  
##   
## Value 3.333333 3.666667 4.000000 4.333333 4.666667 5.000000  
## Frequency 202 221 296 100 75 87  
## Proportion 0.144 0.157 0.211 0.071 0.053 0.062  
## ---------------------------------------------------------------------------  
## READY   
## n missing distinct Info Mean Gmd .05 .10   
## 1389 96 17 0.989 3.11 0.924 1.50 2.00   
## .25 .50 .75 .90 .95   
## 2.50 3.25 3.75 4.00 4.25   
##   
## Value 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00 3.25  
## Frequency 24 29 35 40 57 64 100 106 210 170  
## Proportion 0.017 0.021 0.025 0.029 0.041 0.046 0.072 0.076 0.151 0.122  
##   
## Value 3.50 3.75 4.00 4.25 4.50 4.75 5.00  
## Frequency 145 131 190 41 19 14 14  
## Proportion 0.104 0.094 0.137 0.030 0.014 0.010 0.010  
## ---------------------------------------------------------------------------  
## GENDER2   
## n missing distinct   
## 1383 102 2   
##   
## Value male female  
## Frequency 1338 45  
## Proportion 0.967 0.033  
## ---------------------------------------------------------------------------  
## GENDER3   
## n missing distinct Info Sum Mean Gmd   
## 1383 102 2 0.094 45 0.03254 0.063   
##   
## ---------------------------------------------------------------------------  
## LEAVE   
## n missing distinct Info Mean Gmd .05 .10   
## 1406 79 13 0.979 2.46 0.9079 1.000 1.333   
## .25 .50 .75 .90 .95   
## 2.000 2.333 3.000 3.333 4.000   
##   
## Value 1.000000 1.333333 1.666667 2.000000 2.333333 2.666667 3.000000  
## Frequency 87 75 100 296 221 202 211  
## Proportion 0.062 0.053 0.071 0.211 0.157 0.144 0.150  
##   
## Value 3.333333 3.666667 4.000000 4.333333 4.666667 5.000000  
## Frequency 74 52 32 24 12 20  
## Proportion 0.053 0.037 0.023 0.017 0.009 0.014  
## ---------------------------------------------------------------------------

### Alternative: psych

detach("package:Hmisc")  
install.packages("psych")  
library(psych)

psych::describe(dd4,na.rm=T)

## vars n mean sd median trimmed mad min max range  
## SUBNUM 1 1485 248.00 142.94 248.00 248.00 183.84 1 495 494  
## TIME 2 1485 1.00 0.82 1.00 1.00 1.48 0 2 2  
## BTN 3 1485 1818.73 1403.35 1022.00 1767.29 1509.29 4 4042 4038  
## COMPANY\* 4 1485 3.26 2.10 2.00 3.12 1.48 1 8 7  
## STATUS 5 1473 1.73 0.80 2.00 1.61 0.00 1 5 4  
## GENDER 6 1383 1.03 0.18 1.00 1.00 0.00 1 2 1  
## TENURE 7 1461 2.40 1.56 2.00 2.38 1.48 0 5 5  
## RANK 8 1410 15.04 3.02 14.00 14.51 1.48 11 32 21  
## EDUCATE 9 1473 2.59 1.09 2.00 2.37 0.00 1 6 5  
## AGE 10 1473 25.72 6.12 24.00 25.01 5.93 18 46 28  
## JOBSAT1 11 1404 3.24 0.98 3.33 3.29 0.99 1 5 4  
## COMMIT1 12 1401 3.62 0.85 3.67 3.66 0.99 1 5 4  
## READY1 13 1389 3.01 0.83 3.00 3.07 0.74 1 5 4  
## JOBSAT2 14 1395 3.25 0.94 3.33 3.31 0.99 1 5 4  
## COMMIT2 15 1416 3.47 0.87 3.67 3.52 0.49 1 5 4  
## READY2 16 1398 3.11 0.83 3.25 3.15 0.74 1 5 4  
## JOBSAT3 17 1389 3.34 0.85 3.33 3.39 0.99 1 5 4  
## COMMIT3 18 1401 3.54 0.75 3.67 3.57 0.49 1 5 4  
## READY3 19 1380 3.21 0.81 3.25 3.27 0.74 1 5 4  
## JSAT 20 1396 3.27 0.93 3.33 3.33 0.99 1 5 4  
## COMMIT 21 1406 3.54 0.83 3.67 3.58 0.49 1 5 4  
## READY 22 1389 3.11 0.83 3.25 3.16 0.74 1 5 4  
## GENDER2\* 23 1383 1.03 0.18 1.00 1.00 0.00 1 2 1  
## GENDER3 24 1383 0.03 0.18 0.00 0.00 0.00 0 1 1  
## LEAVE 25 1406 2.46 0.83 2.33 2.42 0.49 1 5 4  
## skew kurtosis se  
## SUBNUM 0.00 -1.20 3.71  
## TIME 0.00 -1.50 0.02  
## BTN 0.20 -1.48 36.42  
## COMPANY\* 0.52 -1.11 0.05  
## STATUS 1.67 3.97 0.02  
## GENDER 5.26 25.73 0.00  
## TENURE 0.19 -0.85 0.04  
## RANK 1.84 4.18 0.08  
## EDUCATE 1.50 0.75 0.03  
## AGE 0.92 0.16 0.16  
## JOBSAT1 -0.47 -0.50 0.03  
## COMMIT1 -0.48 0.14 0.02  
## READY1 -0.47 -0.26 0.02  
## JOBSAT2 -0.60 -0.23 0.03  
## COMMIT2 -0.69 0.64 0.02  
## READY2 -0.41 -0.09 0.02  
## JOBSAT3 -0.55 0.16 0.02  
## COMMIT3 -0.48 0.69 0.02  
## READY3 -0.50 0.09 0.02  
## JSAT -0.55 -0.20 0.02  
## COMMIT -0.57 0.56 0.02  
## READY -0.46 -0.09 0.02  
## GENDER2\* 5.26 25.73 0.00  
## GENDER3 5.26 25.73 0.00  
## LEAVE 0.57 0.56 0.02

psych::describe(dd4,na.rm=F)

## vars n mean sd median trimmed mad min max range  
## SUBNUM 1 1032 249.52 143.06 248.50 250.14 182.36 1 495 494  
## TIME 2 1032 1.00 0.82 1.00 1.00 1.48 0 2 2  
## BTN 3 1032 1805.08 1400.20 1022.00 1750.15 1509.29 4 4042 4038  
## COMPANY\* 4 1032 3.29 2.08 2.50 3.16 2.22 1 8 7  
## STATUS 5 1032 1.75 0.81 2.00 1.63 0.00 1 5 4  
## GENDER 6 1032 1.03 0.16 1.00 1.00 0.00 1 2 1  
## TENURE 7 1032 2.42 1.58 2.00 2.41 1.48 0 5 5  
## RANK 8 1032 15.14 3.18 14.00 14.61 1.48 11 32 21  
## EDUCATE 9 1032 2.65 1.13 2.00 2.44 0.00 1 6 5  
## AGE 10 1032 25.68 6.03 24.00 24.99 5.93 18 45 27  
## JOBSAT1 11 1032 3.20 0.99 3.33 3.26 0.99 1 5 4  
## COMMIT1 12 1032 3.63 0.84 3.67 3.66 0.99 1 5 4  
## READY1 13 1032 3.02 0.79 3.00 3.08 0.74 1 5 4  
## JOBSAT2 14 1032 3.23 0.93 3.33 3.29 0.99 1 5 4  
## COMMIT2 15 1032 3.47 0.86 3.67 3.53 0.49 1 5 4  
## READY2 16 1032 3.13 0.83 3.25 3.18 0.74 1 5 4  
## JOBSAT3 17 1032 3.28 0.87 3.33 3.34 0.99 1 5 4  
## COMMIT3 18 1032 3.52 0.76 3.67 3.54 0.49 1 5 4  
## READY3 19 1032 3.21 0.81 3.25 3.26 0.74 1 5 4  
## JSAT 20 1032 3.24 0.93 3.33 3.30 0.99 1 5 4  
## COMMIT 21 1032 3.54 0.82 3.67 3.58 0.49 1 5 4  
## READY 22 1032 3.12 0.81 3.25 3.17 0.74 1 5 4  
## GENDER2\* 23 1032 1.03 0.16 1.00 1.00 0.00 1 2 1  
## GENDER3 24 1032 0.03 0.16 0.00 0.00 0.00 0 1 1  
## LEAVE 25 1032 2.46 0.82 2.33 2.42 0.49 1 5 4  
## skew kurtosis se  
## SUBNUM -0.04 -1.18 4.45  
## TIME 0.00 -1.50 0.03  
## BTN 0.24 -1.47 43.59  
## COMPANY\* 0.49 -1.17 0.06  
## STATUS 1.71 4.12 0.03  
## GENDER 5.93 33.18 0.00  
## TENURE 0.17 -0.90 0.05  
## RANK 1.83 4.08 0.10  
## EDUCATE 1.33 0.21 0.04  
## AGE 0.91 0.17 0.19  
## JOBSAT1 -0.46 -0.61 0.03  
## COMMIT1 -0.42 0.05 0.03  
## READY1 -0.47 -0.08 0.02  
## JOBSAT2 -0.55 -0.39 0.03  
## COMMIT2 -0.68 0.68 0.03  
## READY2 -0.41 -0.18 0.03  
## JOBSAT3 -0.54 0.06 0.03  
## COMMIT3 -0.46 0.70 0.02  
## READY3 -0.47 0.19 0.03  
## JSAT -0.52 -0.33 0.03  
## COMMIT -0.52 0.52 0.03  
## READY -0.44 -0.03 0.03  
## GENDER2\* 5.93 33.18 0.00  
## GENDER3 5.93 33.18 0.00  
## LEAVE 0.52 0.52 0.03

psych::describe(na.omit(dd4))

## vars n mean sd median trimmed mad min max range  
## SUBNUM 1 1032 249.52 143.06 248.50 250.14 182.36 1 495 494  
## TIME 2 1032 1.00 0.82 1.00 1.00 1.48 0 2 2  
## BTN 3 1032 1805.08 1400.20 1022.00 1750.15 1509.29 4 4042 4038  
## COMPANY\* 4 1032 3.29 2.08 2.50 3.16 2.22 1 8 7  
## STATUS 5 1032 1.75 0.81 2.00 1.63 0.00 1 5 4  
## GENDER 6 1032 1.03 0.16 1.00 1.00 0.00 1 2 1  
## TENURE 7 1032 2.42 1.58 2.00 2.41 1.48 0 5 5  
## RANK 8 1032 15.14 3.18 14.00 14.61 1.48 11 32 21  
## EDUCATE 9 1032 2.65 1.13 2.00 2.44 0.00 1 6 5  
## AGE 10 1032 25.68 6.03 24.00 24.99 5.93 18 45 27  
## JOBSAT1 11 1032 3.20 0.99 3.33 3.26 0.99 1 5 4  
## COMMIT1 12 1032 3.63 0.84 3.67 3.66 0.99 1 5 4  
## READY1 13 1032 3.02 0.79 3.00 3.08 0.74 1 5 4  
## JOBSAT2 14 1032 3.23 0.93 3.33 3.29 0.99 1 5 4  
## COMMIT2 15 1032 3.47 0.86 3.67 3.53 0.49 1 5 4  
## READY2 16 1032 3.13 0.83 3.25 3.18 0.74 1 5 4  
## JOBSAT3 17 1032 3.28 0.87 3.33 3.34 0.99 1 5 4  
## COMMIT3 18 1032 3.52 0.76 3.67 3.54 0.49 1 5 4  
## READY3 19 1032 3.21 0.81 3.25 3.26 0.74 1 5 4  
## JSAT 20 1032 3.24 0.93 3.33 3.30 0.99 1 5 4  
## COMMIT 21 1032 3.54 0.82 3.67 3.58 0.49 1 5 4  
## READY 22 1032 3.12 0.81 3.25 3.17 0.74 1 5 4  
## GENDER2\* 23 1032 1.03 0.16 1.00 1.00 0.00 1 2 1  
## GENDER3 24 1032 0.03 0.16 0.00 0.00 0.00 0 1 1  
## LEAVE 25 1032 2.46 0.82 2.33 2.42 0.49 1 5 4  
## skew kurtosis se  
## SUBNUM -0.04 -1.18 4.45  
## TIME 0.00 -1.50 0.03  
## BTN 0.24 -1.47 43.59  
## COMPANY\* 0.49 -1.17 0.06  
## STATUS 1.71 4.12 0.03  
## GENDER 5.93 33.18 0.00  
## TENURE 0.17 -0.90 0.05  
## RANK 1.83 4.08 0.10  
## EDUCATE 1.33 0.21 0.04  
## AGE 0.91 0.17 0.19  
## JOBSAT1 -0.46 -0.61 0.03  
## COMMIT1 -0.42 0.05 0.03  
## READY1 -0.47 -0.08 0.02  
## JOBSAT2 -0.55 -0.39 0.03  
## COMMIT2 -0.68 0.68 0.03  
## READY2 -0.41 -0.18 0.03  
## JOBSAT3 -0.54 0.06 0.03  
## COMMIT3 -0.46 0.70 0.02  
## READY3 -0.47 0.19 0.03  
## JSAT -0.52 -0.33 0.03  
## COMMIT -0.52 0.52 0.03  
## READY -0.44 -0.03 0.03  
## GENDER2\* 5.93 33.18 0.00  
## GENDER3 5.93 33.18 0.00  
## LEAVE 0.52 0.52 0.03

### Simple Distributions

#Frequency Counts  
table(dd4$COMPANY)

##   
## A B C D F HHC REC SVC   
## 402 348 126 183 15 354 18 39

#Proportions  
prop.table(table(dd4$COMPANY))

##   
## A B C D F HHC   
## 0.27070707 0.23434343 0.08484848 0.12323232 0.01010101 0.23838384   
## REC SVC   
## 0.01212121 0.02626263

#Rounding proportions to 3 decimals  
round(prop.table(table(dd4$COMPANY)),3)

##   
## A B C D F HHC REC SVC   
## 0.271 0.234 0.085 0.123 0.010 0.238 0.012 0.026

#Percentages  
100\*(prop.table(table(dd4$COMPANY)))

##   
## A B C D F HHC REC   
## 27.070707 23.434343 8.484848 12.323232 1.010101 23.838384 1.212121   
## SVC   
## 2.626263

#Cross Tabs & Simple Tables  
#install.packages("gmodels")  
library(gmodels)  
CrossTable(dd4$GENDER,dd4$COMPANY,chisq=TRUE,format="SPSS")

## Warning in chisq.test(t, correct = FALSE, ...): Chi-squared approximation  
## may be incorrect

##   
## Cell Contents  
## |-------------------------|  
## | Count |  
## | Chi-square contribution |  
## | Row Percent |  
## | Column Percent |  
## | Total Percent |  
## |-------------------------|  
##   
## Total Observations in Table: 1383   
##   
## | dd4$COMPANY   
## dd4$GENDER | A | B | C | D | F | HHC | REC | SVC | Row Total |   
## -------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|  
## 1 | 357 | 321 | 111 | 165 | 9 | 321 | 18 | 36 | 1338 |   
## | 0.023 | 0.181 | 0.042 | 0.037 | 0.010 | 0.148 | 0.020 | 0.039 | |   
## | 26.682% | 23.991% | 8.296% | 12.332% | 0.673% | 23.991% | 1.345% | 2.691% | 96.746% |   
## | 95.968% | 99.074% | 94.872% | 98.214% | 100.000% | 94.690% | 100.000% | 100.000% | |   
## | 25.813% | 23.210% | 8.026% | 11.931% | 0.651% | 23.210% | 1.302% | 2.603% | |   
## -------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|  
## 2 | 15 | 3 | 6 | 3 | 0 | 18 | 0 | 0 | 45 |   
## | 0.693 | 5.396 | 1.263 | 1.113 | 0.293 | 4.404 | 0.586 | 1.171 | |   
## | 33.333% | 6.667% | 13.333% | 6.667% | 0.000% | 40.000% | 0.000% | 0.000% | 3.254% |   
## | 4.032% | 0.926% | 5.128% | 1.786% | 0.000% | 5.310% | 0.000% | 0.000% | |   
## | 1.085% | 0.217% | 0.434% | 0.217% | 0.000% | 1.302% | 0.000% | 0.000% | |   
## -------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|  
## Column Total | 372 | 324 | 117 | 168 | 9 | 339 | 18 | 36 | 1383 |   
## | 26.898% | 23.427% | 8.460% | 12.148% | 0.651% | 24.512% | 1.302% | 2.603% | |   
## -------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|  
##   
##   
## Statistics for All Table Factors  
##   
##   
## Pearson's Chi-squared test   
## ------------------------------------------------------------  
## Chi^2 = 15.42045 d.f. = 7 p = 0.03097201   
##   
##   
##   
## Minimum expected frequency: 0.2928416   
## Cells with Expected Frequency < 5: 4 of 16 (25%)

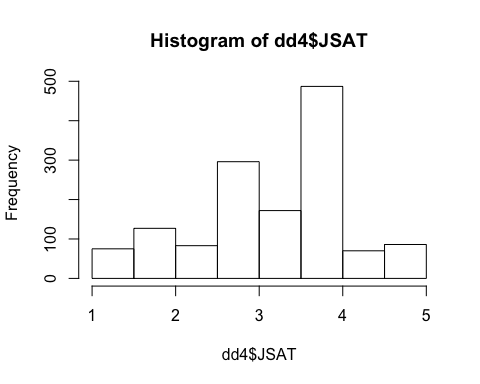
table(dd4$GENDER,dd4$COMPANY)

##   
## A B C D F HHC REC SVC  
## 1 357 321 111 165 9 321 18 36  
## 2 15 3 6 3 0 18 0 0

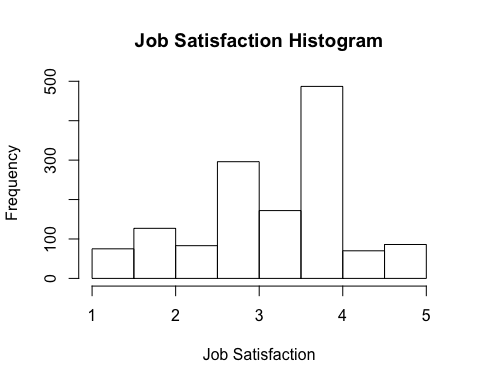
prop.table(table(dd4$GENDER,dd4$COMPANY))

##   
## A B C D F  
## 1 0.258134490 0.232104121 0.080260304 0.119305857 0.006507592  
## 2 0.010845987 0.002169197 0.004338395 0.002169197 0.000000000  
##   
## HHC REC SVC  
## 1 0.232104121 0.013015184 0.026030369  
## 2 0.013015184 0.000000000 0.000000000

#Histograms  
hist(dd4$JSAT)



hist(dd4$JSAT, main="Job Satisfaction Histogram",xlab="Job Satisfaction" )



### Correlations using cor (part of stats) or rcorr (part of Hmisc)

cor(dd4[,20:22],use="complete.obs")

## JSAT COMMIT READY  
## JSAT 1.0000000 0.5373179 0.5093204  
## COMMIT 0.5373179 1.0000000 0.4610560  
## READY 0.5093204 0.4610560 1.0000000

install.packages("Hmisc")  
library(Hmisc)

Hmisc::rcorr(as.matrix(dd4[,c(20:22)]))

## JSAT COMMIT READY  
## JSAT 1.00 0.54 0.51  
## COMMIT 0.54 1.00 0.46  
## READY 0.51 0.46 1.00  
##   
## n  
## JSAT COMMIT READY  
## JSAT 1396 1385 1369  
## COMMIT 1385 1406 1375  
## READY 1369 1375 1389  
##   
## P  
## JSAT COMMIT READY  
## JSAT 0 0   
## COMMIT 0 0   
## READY 0 0

## Popular Packages

### [multilevel](https://cran.r-project.org/web/packages/multilevel/multilevel.pdf)

### [lme4](https://cran.r-project.org/web/packages/lme4/lme4.pdf) & [nlme](https://cran.r-project.org/web/packages/nlme/nlme.pdf)

### [plyr](https://cran.r-project.org/web/packages/plyr/plyr.pdf)

### [ggplot2](http://ggplot2.org/)

### [reshape2](https://cran.r-project.org/web/packages/reshape2/reshape2.pdf)

### [Rcmdr](https://cran.r-project.org/web/packages/Rcmdr/Rcmdr.pdf)

### [Hmisc](https://cran.r-project.org/web/packages/Hmisc/Hmisc.pdf)