R-Workshop-James

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2017-08-11 12:35:13

# PART 1: INSTALLATION, SETTINGS, AND DATA MANAGEMENT

## TOPIC 1: Projects & Directories in R Studio

getwd() #get the current working directory  
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

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")  
??sear

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

## TOPIC 3: Data Types & Structures in R

### Numbers

x <- 2  
x  
y = c(1:3); y  
z = c("Porsche 911", "Porsche 944", "Porsche 911", "BMW 335xi")  
z  
g=sqrt(x); g  
  
is.numeric(x)  
is.numeric(z)

### Strings

#String Data as character:  
z  
#String Data as factor:  
z2=factor(z)  
z2  
  
#Compute the Length of a String (or Numeric) Variable:  
nchar(x)  
nchar(y)  
nchar(y)  
nchar(z)  
#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  
sqrt(TRUE)  
t=TRUE  
# you can test if a variable type is logical using:  
is.logical(x)  
is.logical(t)  
# Logical data types also used as input to functions (see Day 2 examples)  
2==2  
2==3

### Vectors

#Vectors - 1 dimensional collections of same type data  
v1=1:5; v1 #creating vector of numbers  
v2=c(1,2,3,4,5); v2  
v3=c("Porsche 911", "Ford Mustang GT", "Plymouth Baracuda", "Chevrolet Camaro", "Honda Pilot LX")  
v1; v2; v3  
#Matrices - 2 dimensional collections of same type data  
m=matrix(1:20, nrow=5); m

### Arrays & Data Frames

#Arrays - multidimensional collection of same type data  
#example of 3D array  
a=array(1:20, dim=c(2,5,2)); a  
  
#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  
  
# Obtain a list of the variable names in a data frame   
names(data1)

# 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  
data2  
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

rm(list=ls()) #Clear the Global Environment  
  
##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)

### 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 = "d2.csv",sep=",",row.names=F)  
write.table(d,"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="univbct.csv",  
 codefile="univbct.sps",  
 package="SPSS")  
file.show("univbct.csv")  
file.show("univbct.sps")

### Reading data from SPSS

library("foreign")  
demo1=read.spss(file="../data/demo1.sav",   
 use.value.labels=TRUE,   
 to.data.frame=TRUE,  
 use.missings=TRUE)  
summary(demo1)  
demo2=read.spss(file="../data/demo2.sav",  
 use.value.labels=T,  
 to.data.frame=T,  
 use.missings=FALSE)  
summary(demo2) #oops, GENDER = 999 was a missing values code  
demo2=read.spss(file="../data/demo2.sav",  
 use.value.labels=T,  
 to.data.frame=T,  
 use.missings=T)  
names(demo1); names(demo2)  
#Reading data (csv)  
data1=read.csv("../data/data1.csv", header=T)  
data2=read.csv("../data/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  
tail(data1) # display last 6 cases  
summary(data1) # display summary  
summary(data2)

### 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)  
summary(data2)

#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("../data/data1.csv", na.strings=c(".", "999","9","-9"))  
summary(data1)  
#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("../data/data1.csv") #reread data1 as a data.frame with missing data   
names(data1)  
summary(data1)  
data1[3:5]=lapply(data1[3:5],my999isNA)  
summary(data1)

## 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)  
summary(dd2)

### 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)  
dd3=rbind(dd1,dd2)  
summary(dd3)  
  
#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  
dd3=rbind.fill(dd1,dd2)  
head(dd3); tail(dd3)

### Deleting a variable from a data frame

#let's delete STAY from the previous dd3 data.frame  
names(dd3)  
dd4=dd3[c(1,2,3:22)]  
names(dd4)  
  
#Renaming a variable in a data.frame  
#let's rename HOWLONG to TENURE and MARITAL to STATUS  
dd4=rename(dd4, c(HOWLONG="TENURE", MARITAL="STATUS"))   
names(dd4)

### Recoding variables

#Categorical Variables: recode sex into a different, dummy variable  
#Only “factor” type variables are assigned value labels  
dd4$GENDER2=revalue(as.factor(dd4$GENDER), c("1"="male","2"="female"))  
dd4$GENDER3=(dd4$GENDER-1)  
class(dd4$GENDER)  
class(dd4$GENDER2)  
class(dd4$GENDER3)  
  
#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)  
mean(dd3$JSAT,na.rm=TRUE); median(dd3$JSAT,na.rm=TRUE)  
#Dispersion  
var(dd3$JSAT,na.rm=T)  
sd(dd3$JSAT,na.rm=T)  
min(dd3$JSAT, na.rm=T)  
max(dd3$JSAT,na.rm=T)  
summary(dd3$JSAT,na.rm=T)  
quantile(dd3$JSAT,probs=c(.1,.2,.3,.4,.5,.6,.7,.8,.9),na.rm=T)

### Alternative: Hmisc

#install.packages("Hmisc")  
library("Hmisc")  
describe(dd4)

### Alternative: psych

detach("package:Hmisc")  
#install.packages("psych")  
library(psych)  
describe(dd4,na.rm=T)  
describe(dd4,na.rm=F)  
describe(na.omit(dd4))

### Simple Distributions

#Frequency Counts  
table(dd4$COMPANY)  
#Proportions  
prop.table(table(dd4$COMPANY))  
#Rounding proportions to 3 decimals  
round(prop.table(table(dd4$COMPANY)),3)  
#Percentages  
100\*(prop.table(table(dd4$COMPANY)))

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

#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")  
#install.packages("Hmisc")  
library(Hmisc)  
rcorr(as.matrix(dd4[,c(20:22)]))

## 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)