PRINCETON UNIVERSITY

Getting Started in R~Stata Notes on Exploring Data

(ver. 0.3-*Draft*)

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What is R/Stata?

What is R?

- "R is a language and environment for statistical computing and graphics"*
- R is offered as open source (i.e. free)

What is Stata?

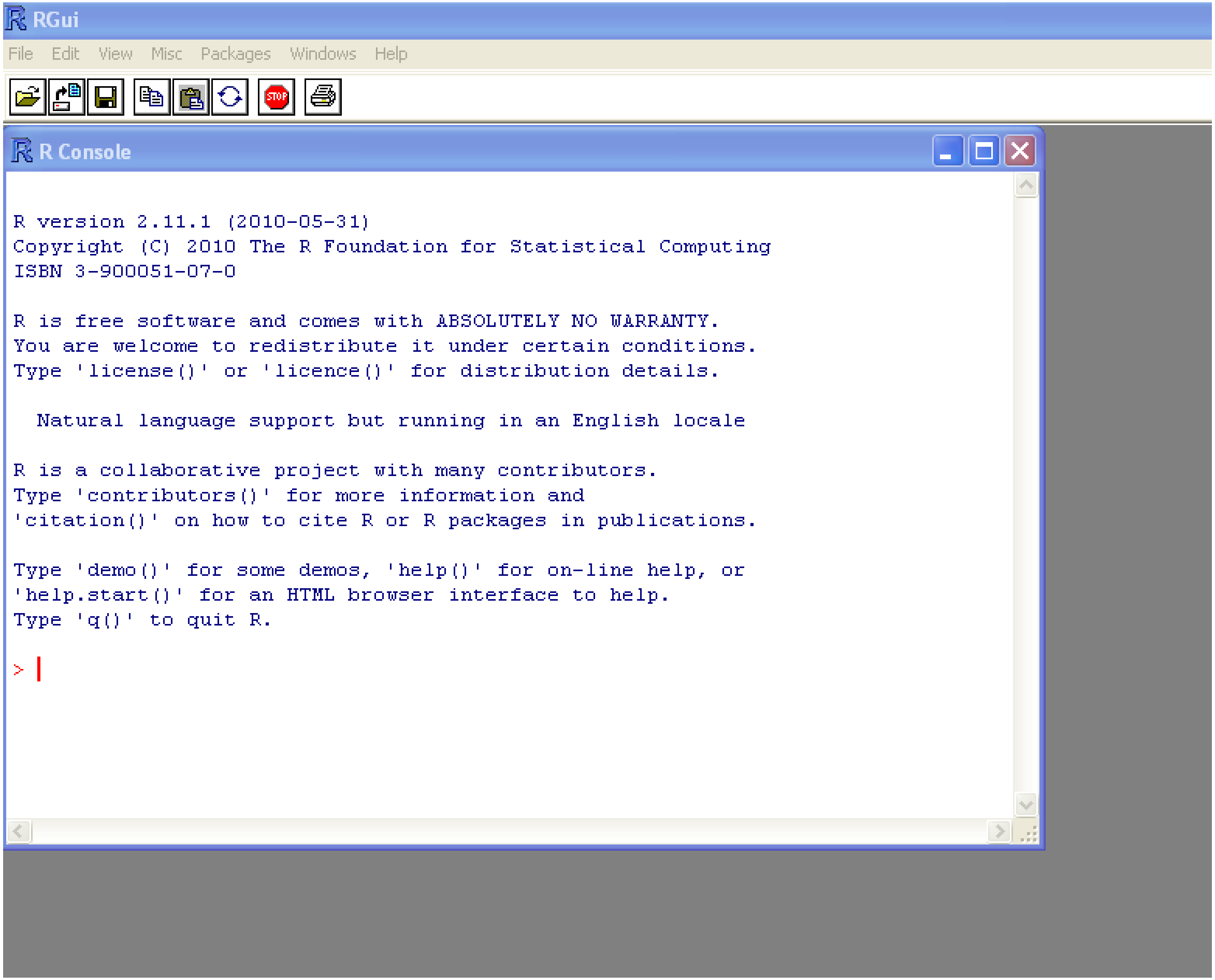
- It is a multi-purpose statistical package to help you explore, summarize and analyze datasets.
- A dataset is a collection of several pieces of information called variables (usually arranged by columns). A variable can have one or several values (information for one or several cases).
- Other statistical packages are SPSS and SAS.

Features	Stata	SPSS	SAS	R
Learning curve	Steep/gradual	Gradual/flat	Pretty steep	Pretty steep
User interface	Programming/point-and-click	Mostly point-and-click	Programming	Programming
Data manipulation	Very strong	Moderate	Very strong	Very strong
Data analysis	Powerful	Powerful	Powerful/versatile	Powerful/versatile
Graphics	Very good	Very good	Good	Excellent
Cost	Affordable (perpetual licenses, renew only when upgrade)	Expensive (but not need to renew until upgrade, long term licenses)	Expensive (yearly renewal)	Open source

NOTE: The R content presented in this document is mostly based on an early version of Fox, J. and Weisberg, S. (2011) *An R Companion to Applied Regression*, Second Edition, Sage; and from class notes from the ICPSR's workshop *Introduction to the R Statistical Computing Environment* taught by John Fox during the summer of 2010.

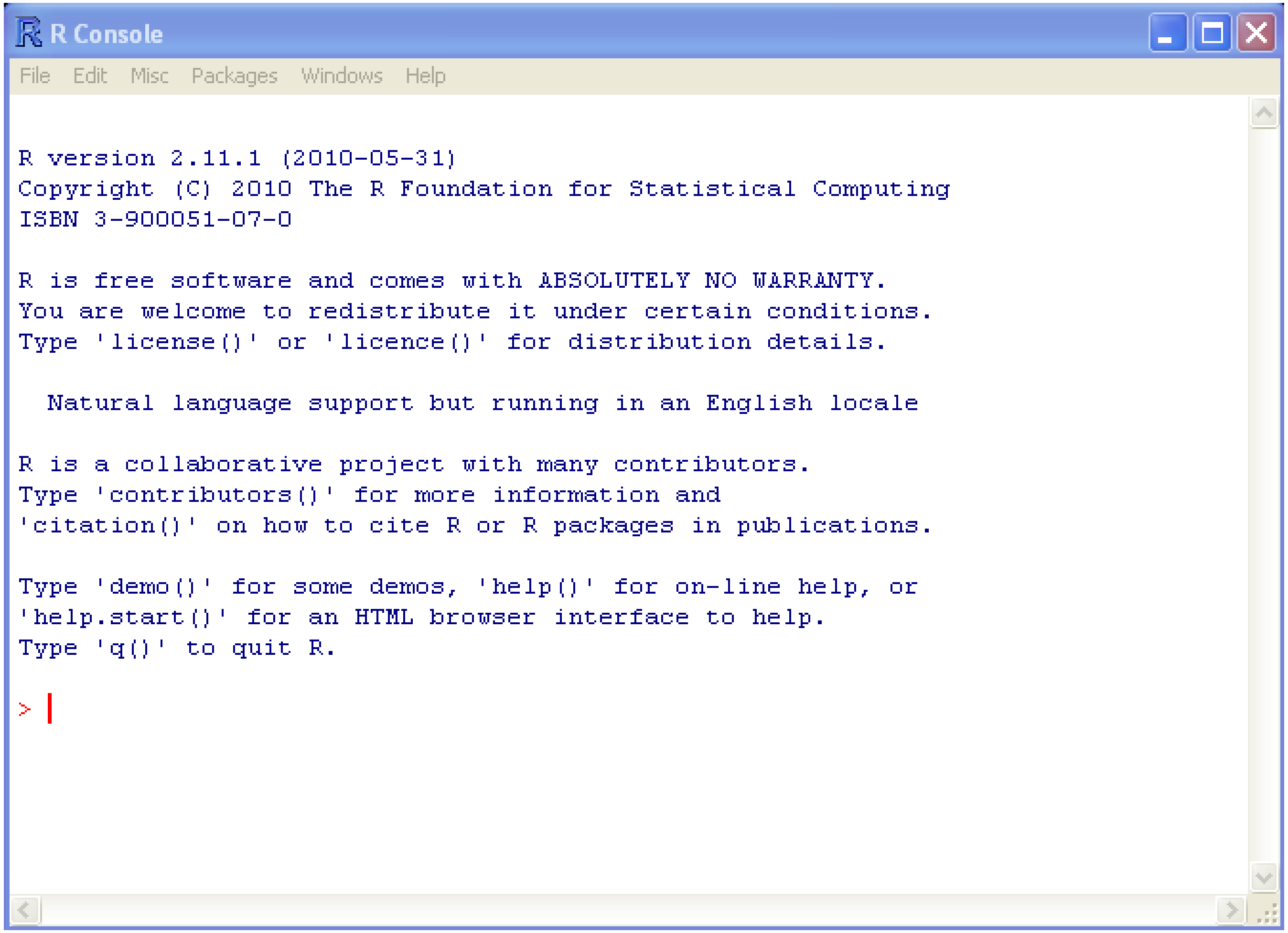
* http://www.r-project.org/index.html

This is the R screen in Multiple-Document Interface (MDI)…



```
R version 2.11.1 (2010-05-31)
Copyright (C) 2010 The R Foundation for Statistical Computing
ISBN 3-900051-07-0

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

  Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> 
```

This is the R screen in Single-Document Interface (SDI)…



```
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'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> 
```
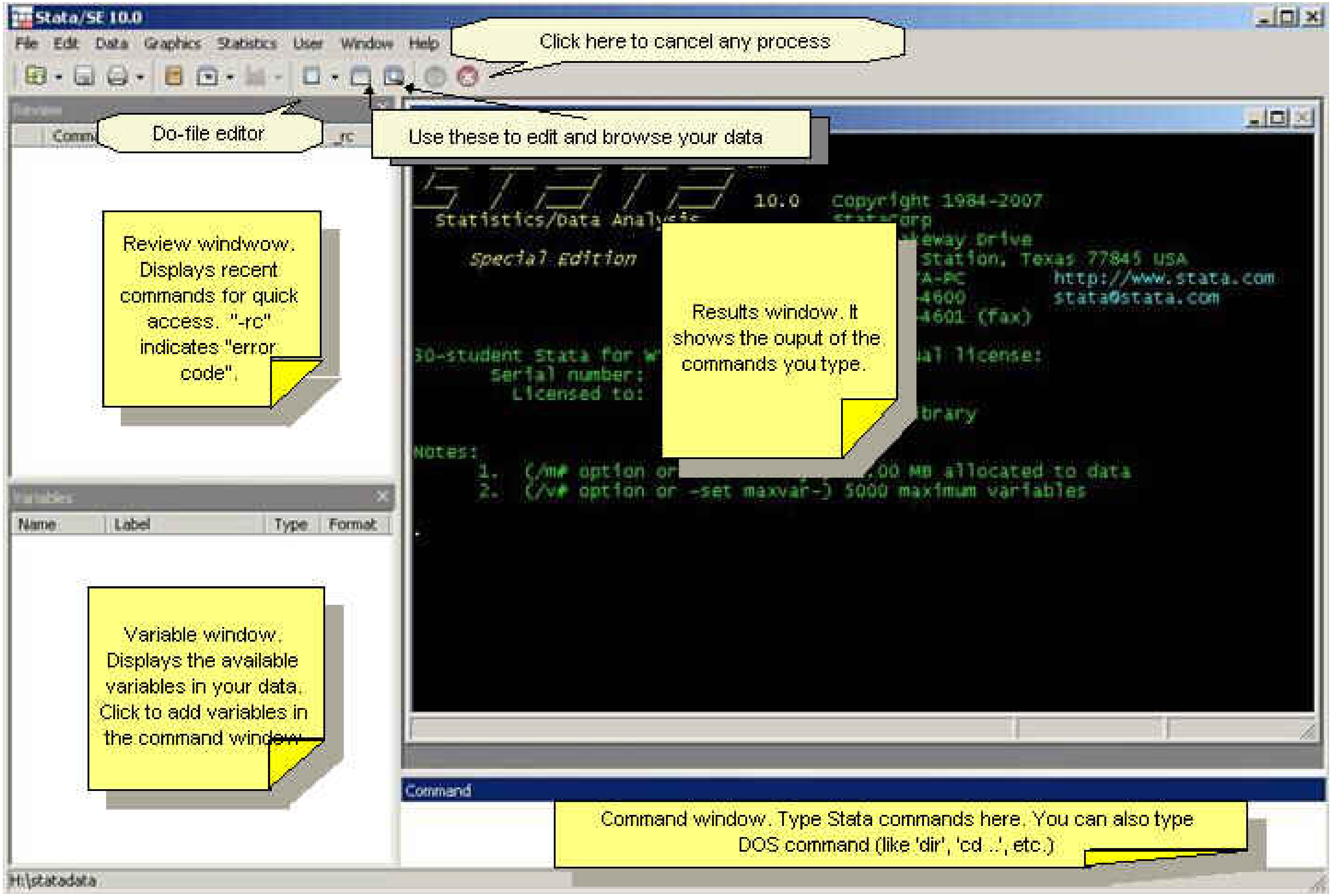

Stata’s screen (10.x version)

See here for more info http://dss.princeton.edu/training/StataTutorial.pdf



Click here to cancel any process

Do-file editor

Use these to edit and browse your data

Review windwow. Displays recent commands for quick access. "-rc" indicates "error code".

Variable window. Displays the available variables in your data. Click to add variables in the command window

Results window. It shows the ouput of the commands you type.

Command window. Type Stata commands here. You can also type DOS command (like 'dir', 'cd ..', etc.)

```
                   10.0   Copyright 1984-2007
  Statistics/Data Analysis   StataCorp
                              keway Drive
     Special Edition          Station, Texas 77845 USA
                              A-PC          http://www.stata.com
                              4600          stata@stata.com
                              4601 (fax)

30-student Stata for W                 al license:
       Serial number:
         Licensed to:
                              brary

Notes:
      1.  (/m# option or              .00 MB allocated to data
      2.  (/v# option or -set maxvar-) 5000 maximum variables

.
```

R	Stata
Working directory	
getwd() # Shows the working directory (wd) setwd("C:/myfolder/data") # Changes the wd setwd("H:\\myfolder\\data") # Changes the wd	pwd /*Shows the working directory*/ cd c:\myfolder\data /*Changes the wd*/ cd “c:\myfolder\stata data” /*Notice the spaces*/
Installing packages/user-written programs	
install.packages("ABC") # This will install the package --ABC--. A window will pop-up, select a mirror site to download from (the closest to where you are) and click ok. library(ABC) # Load the package --ABC-- to your workspace in R	ssc install abc /*Will install the user-defined program ‘abc’. It will be ready to run. findit abc /*Will do an online search for program ‘abc’ or programs that include ‘abc’. It also searcher your computer.
Getting help	
?plot # Get help for an object, in this case for the --plot- function. You can also type: help(plot) ??regression # Search the help pages for anything that has the word "regression". You can also type: help.search("regression") apropos("age") # Search the word "age" in the objects available in the current R session. help(package=car) # View documentation in package ‘car’. You can also type: library(help="car“) help(DataABC) # Access codebook for a dataset called ‘DataABC’ in the package ABC	help tab /* Get help on the command ‘tab’*/ search regression /* Search the keywords for the word ‘regression’*/ hsearch regression /* Search the help files for the work ‘regression’. It provides more options than ‘search’*/

R	Stata
Data from *.csv (copy-and-paste)	
# Select the table from the excel file, copy, go to the R Console and type: mydata <- read.table("clipboard", header=TRUE, sep="\t")	/* Select the table from the excel file, copy, go to Stata, in the command line type: edit /*The data editor will pop-up and paste the data (Ctrl-V). Select the link for to include variable names
Data from *.csv	

# Reading the data directly 	
 	
mydata <- read.csv("c:\mydata\mydatafile.csv", header=TRUE)
 	
# The will open a window to search for the *.csv file. 	
 	
mydata <- read.csv(file.choose(), header = TRUE)
	/* In the command line type */
	
	insheet using "c:\mydata\mydatafile.csv"
	
	/* Using the menu */
	
	Go to File->Import->”ASCII data created by spreadsheet”. Click on ‘Browse’ to find the file and then OK.

Data from/to *.txt (space , tab, comma-separated)	

# In the example above, variables have spaces and missing data is coded as ‘-9’ 	
 	
mydata <- read.table(("C:/myfolder/abc.txt", header=TRUE, sep="\t", na.strings = "-9")
 	
# Export the data 	
 	
write.table(mydata, file = "test.txt", sep = "\t")
	/* See insheet above */
	
	infile var1 var2 **str7** var3 using abc.raw
	
	/* Variables with embedded spaces must be enclosed in quotes */
	# Export data
	
	outsheet using "c:\mydata\abc.csv"

R	Stata
Data from/to SPSS	
library(foreign) # Load package --foreign-- mydata.spss <- read.spss("http://dss.princeton.edu/training/mydata.sav", to.data.frame = TRUE, use.value.labels=TRUE, use.missings = to.data.frame) # Where: # # ‘to.data.frame’ return a data frame. # # ‘use.value.labels’ Convert variables with value labels into R factors with those levels. # # ‘use.missings’ logical: should information on user-defined missing values be used to set the corresponding values to NA. Source: type ?read.spss -- write.foreign(mydata, codefile="test2.sps", datafile="test2.raw", package=“SPSS") # Provides a syntax file (*.sps) to read the *.raw data file	/* Need to install the program ‘usespss’ (you do this only once) */ ssc install usespss /* To read the *.sav type (in one line): usespss using http://dss.princeton.edu/training/mydata.sav /* For additional information type */ help usespss Note: This does not work with SPSS portable files (*.por) -- /* Stata does not convert files to SPSS. You need to save the data file as a Stata file version 9 that can be read by SPSS v15.0 or later*/ /* From Stata type: */ saveold mydata.dta /* Saves data to v.9 for SPSS

R	Stata
Data from/to SAS	
# To read SAS XPORT format (*.xpt) library(foreign) # Load package --foreign-- mydata.sas <- read.xport("http://dss.princeton.edu/training/mydata.xpt") # Does not work for files online mydata.sas <- read.xport("c:/myfolder/mydata.xpt") # Using package --Hmisc— library(Hmisc) mydata <- sasxport.get(http://dss.princeton.edu/training/mydata.xpt) # It works -- write.foreign(mydata, codefile="test2.sas", datafile="test2.raw", package=“SAS") # Provide a syntax file (*.sas) to read the *.raw data	/*If you have a file in SAS XPORT format (*.xpt) you can use ‘fdause’ (or go to File->Import). */ fdause "c:/myfolder/mydata.xpt“ /* Type help fdause for more details */ /* If you have SAS installed in your computer you can use the program ‘usesas’, which you can install by typing: */ ssc install usesas /* To read the *.sas7bcat type (in one line): */ usesas using "c:\mydata.sas7bdat” --- /* You can export a dataset as SAS XPORT by menu (go to File->Export) or by typing */ fdasave "c:/myfolder/mydata1.xpt“ /* Type help fdasave for more details */
NOTE: As an alternative, you can use SAS Universal Viewer (freeware from SAS) to read SAS files and save them as *.csv. Saving the file as *.csv removes variable/value labels, make sure you have the codebook available.	

Data from/to Stata

R

```
library(foreign) # Load package --foreign--

mydata <-
read.dta("http://dss.princeton.edu/training/studen
ts.dta")

mydata.dta <-
read.dta("http://dss.princeton.edu/training/mydata
.dta",
     convert.factors=TRUE,
     convert.dates=TRUE,
     convert.underscore=TRUE,
     warn.missing.labels=TRUE)

# Where (source: type ?read.dta)
# convert.dates. Convert Stata dates to Date class
# convert.factors. Use Stata value labels to
create factors? (version 6.0 or later).
# convert.underscore. Convert "_" in Stata
variable names to "." in R names?
# warn.missing.labels. Warn if a variable is
specified with value labels and those value labels
are not present in the file.
---------------------------------------------
write.dta(mydata, file = "test.dta") # Direct
export to Stata

write.foreign(mydata, codefile="test1.do",
datafile="test1.raw", package="Stata") # Provide a
do-file to read the *.raw data
```

Stata

```
/* To open a Stata file go to File -> Open, or
type: */

use "c:\myfolder\mydata.dta"

Or

use "http://dss.princeton.edu/training/mydata.dta"

/* If you need to load a subset of a Stata data
file type */

use var1 var2 using "c:\myfolder\mydata.dta"

use id city state gender using
"H:\Work\Marshall\Fall10\Session1-
2\Stata\Students.dta", clear

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


/* To save a dataset as Stata file got File ->
Save As, or type: */

save mydata, replace   /*If the fist time*/

save, replace    /*If already saved as Stata
                file*/
```

R	Stata
Data from/to R	
load("mydata.RData") load("mydata.rda") /* Add path to data if necessary */ --- save.image("mywork.RData") # Saving all objects to file *.RData save(object1, object2, file=“mywork.rda") # Saving selected objects	/* Stata can’t read R data files */

R	Stata

Data from ACII Record form

```
mydata.dat <-
read.fwf(file="http://dss.princeton.edu/training/m
ydata.dat",
       width=c(7, -16, 2, 2, -4, 2, -10, 2, -110,
3, -6, 2),
       col.names=c("w","y","x1","x2","x3", "age",
"sex"),
       n=1090)

# Reading ASCII record form, numbers represent the
width of variables, negative sign excludes
variables not wanted (you must include these).

# To get the width of the variables you must have
a codebook for the data set available (see an
example below).

# To get the widths for unwanted spaces use the
formula:

Start of var(t+1) – End of var(t) - 1
```

*Thank you to Scott Kostyshak for useful advice/code.

```
/* Using infix */

infix var1 1-7 var2 24-25 str2 var3 26-27 var4 32-
33 str2 var5 44-45 var6 156-158 var7 165-166 using
"http://dss.princeton.edu/trainingmydata.dat"

---------------------------------------------------
/* Using infile */

dictionary using c:\data\mydata.dat {
       _column(1)         var1      %7.2f     " Label for var1 "
       _column(24)        var2      %2f       " Label for var2 "
       _column(26)   str2 var3      %2s       " Label for var3 "
       _column(32)        var4      %2f       " Label for var4 "
       _column(44)   str2 var5      %2s       " Label for var5 "
       _column(156)  str3 var5      %3s       " Label for var6 "
       _column(165)  str2 var5      %2s       " Label for var7 "
   }

/*Do not forget to close the brackets and press enter after the last
bracket*/

Save it as mydata.dct

With infile we run the dictionary by typing:

infile using c:\data\mydata
```

For other options check http://dss.princeton.edu/training/DataPrep101.pdf

Data locations usually available in codebooks

Var	Rec	Start	End	Format
var1	1	1	7	F7.2
var2	1	24	25	F2.0
var3	1	26	27	A2
var4	1	32	33	F2.0
var5	1	44	45	A2
var6	1	156	158	A3
var7	1	165	166	A2

R	Stata
## Exploring data	
str(mydata) # Provides the structure of the dataset summary(mydata) # Provides basic descriptive statistics and frequencies names(mydata) # Lists variables in the dataset head(mydata) # First 6 rows of dataset head(mydata, n=10)# First 10 rows of dataset head(mydata, n= -10) # All rows but the last 10 tail(mydata) # Last 6 rows tail(mydata, n=10) # Last 10 rows tail(mydata, n= -10) # All rows but the first 10 mydata[1:10,] # First 10 rows of the mydata[1:10,1:3] # First 10 rows of data of the first 3 variables edit(mydata) # Open data editor	describe /* Provides the structure of the dataset*/ summarize /* Provides basic descriptive statistics for numeric data*/ ds /* Lists variables in the dataset */ list in 1/6 /* First 6 rows */ edit /* Open data editor (double-click to edit*/ browse /* Browse data */
## Missing data	

sum(is.na(mydata))# Number of missing in dataset
rowSums(is.na(data))# Number of missing per variable
rowMeans(is.na(data))*length(data)# No. of missing per row
mydata[mydata$age=="& ","age"] <- NA   # NOTE: Notice hidden spaces.
mydata[mydata$age==999,"age"] <- NA
The function **complete.cases()** returns a logical vector indicating which cases are complete.
# list rows of data that have missing values 	
mydata[!complete.cases(mydata),]
The function **na.omit()** returns the object with listwise deletion of missing values.
# create new dataset without missing data 	
newdata <- na.omit(mydata)
	tabmiss /* # of missing. Need to install, type scc install tabmiss. Also try findit tabmiss and follow instructions */
	
	/* For missing values per observation see the function ‘rowmiss’ and the ‘egen’ command*/

R	Stata
Renaming variables	

#Using base commands
 	
fix(mydata)   # Rename interactively.
names(mydata)[3] <- "First"
 	
# Using library --reshape-- 	
 	
library(reshape)
 	
mydata <- rename(mydata, c(Last.Name="Last"))
mydata <- rename(mydata, c(First.Name="First"))
mydata <- rename(mydata,
   c(Student.Status="Status"))
mydata <- rename(mydata,
   c(Average.score..grade.="Score"))
mydata <- rename(mydata, c(Height..in.="Height"))
mydata <- rename(mydata,
   c(Newspaper.readership..times.wk.="Read"))
	edit /* Open data editor (double-click to edit)
	
	rename oldname newname
	
	rename lastname last
	rename firstname first
	rename studentstatus status
	rename averagescoregrade score
	rename heightin height
	rename newspaperreadershiptimeswk read

Variable labels	
Use variable names as variable labels	/* Adding labels to variables */ label variable w "Weight" label variable y "Output" label variable x1 "Predictor 1" label variable x2 "Predictor 2" label variable x3 "Predictor 3" label variable age "Age" label variable sex "Gender"

Value labels

R

```
# Use factor() for nominal data

mydata$sex <- factor(mydata$sex, levels = c(1,2),
      labels = c("male", "female"))


# Use ordered() for ordinal data

mydata$var2 <- ordered(mydata$var2, levels =
      c(1,2,3,4), labels = c("Strongly agree",
      "Somewhat agree", "Somewhat disagree",
      "Strongly disagree"))


mydata$var8 <- ordered(mydata$var2, levels =
      c(1,2,3,4), labels = c("Strongly agree",
      "Somewhat agree", "Somewhat disagree",
      "Strongly disagree"))       # Making a copy
      of the same variable
```

Stata

```
/* Step 1 defining labels */

label define approve 1 "Approve strongly" 2
"Approve somewhat" 3 "Disapprove somewhat" 4
"Disapprove strongly" 5 "Not sure" 6 "Refused"

label define well 1 "Very well" 2 "Fairly well" 3
"Fairly badly" 4 "Very badly" 5 "Not sure" 6
"Refused"

label define partyid 1 "Party A" 2 "Party B" 3
"Equally party A/B" 4 "Third party candidates" 5
"Not sure" 6 "Refused"

label define gender 1 "Male" 2 "Female`

/* Step 2 applying labels */

label values y approve
label values x1 approve
tab x1
d x1
destring x1, replace
label values x1 approve
label values x2 well
label values x3 partyid
tab x3
destring x3, replace ignore(&)
label values x3 partyid
tab x3
label values sex gender

tab1 y x1 x2 x3 age sex
```

R	Stata
Creating ids/sequence of numbers	
# Creating a variable with a sequence of numbers or to index	**/* Creating a variable with a sequence of numbers or to index */**
# Creating a variable with a sequence of numbers from 1 to n (where 'n' is the total number of observations)	/* Creating a variable with a sequence of numbers from 1 to n (where 'n' is the total number of observations) */
`mydata$id <- seq(dim(mydata)[1])`	`gen id = _n`
# Creating a variable with the total number of observations	/* Creating a variable with the total number of observations */
`mydata$total <- dim(mydata)[1]`	`gen total = _N`
/* Creating a variable with a sequence of numbers from 1 to n per category (where 'n' is the total number of observations in each category)(1) */	/* Creating a variable with a sequence of numbers from 1 to n per category (where 'n' is the total number of observations in each category) */

`mydata <- mydata[order(mydata$group),]`
`idgroup <- tapply(mydata$group, mydata$group,`
`           function(x) seq(1,length(x),1))`
`mydata$idgroup <- unlist(idgroup)`
	`bysort group: gen id = _n`

(1) Thanks to Alex Acs for the code	For more info see: http://www.stata.com/help.cgi?_n http://dss.princeton.edu/training/StataTutorial.pdf

R	Stata
Recoding variables	

`library(car)`
`mydata$Age.rec <- recode(mydata$Age,`
`"18:19='18to19';`
`20:29='20to29';`
`30:39='30to39'")`
 	
`mydata$Age.rec <- as.factor(mydata$Age.rec)`
	`recode age (18 19 = 1 "18 to 19") ///`
	`(20/28 = 2 "20 to 29") ///`
	`(30/39 = 3 "30 to 39") (else=.),`
	`generate(agegroups) label(agegroups)`

Dropping variables	

`mydata$Age.rec <- NULL`
`mydata$var1 <- mydata$var2 <- NULL`
	`drop var1`
	`drop var1-var10`

Keeping track of your work	

`# Save the commands used during the session`
 	
`savehistory(file="mylog.Rhistory")`
 	
`# Load the commands used in a previous session`
 	
`loadhistory(file="mylog.Rhistory")`
 	
`# Display the last 25 commands`
 	
`history()`
 	
`# You can read mylog.Rhistory with any word processor. Notice that the file has to have the extension *.Rhistory`
	`/* A log file helps you save commands and output to a text file (*.log) or to a Stata read-only file (*.smcl). The best way is to save it as a text file (*.log)*/`
	
	`log using mylog.log   /*Start the log*/`
	`log close             /*Close the log*/`
	`log using mylog.log, append  /*Add to an existing log*/`
	`log using mylog.log, replace  /*Replace an existing log*/`
	
	`/*You can read mylog.log using any word processor*/`

R	Stata
Categorical data: Frequencies/Crosstab s	

table(mydata$Gender)
table(mydata$Read)
readgender <- table(mydata$Read,mydata$Gender)
prop.table(readgender,1)   # Row proportions
prop.table(readgender,2)   # Col proportions
prop.table(readgender)   # Tot proportions
chisq.test(readgender)   # Do chisq test Ho: no relathionship
fisher.test(readgender)   # Do fisher'exact test Ho: no relationship
round(prop.table(readgender,2), 2)   # Round col prop to 2 digits
round(prop.table(readgender,2), 2)   # Round col prop to 2 digits
round(100* prop.table(readgender,2), 2)   # Round col % to 2 digits
round(100* prop.table(readgender,2))   # Round col % to whole numbers
addmargins(readgender)   # Adding row/col margins
 	
#install.packages("vcd")
library(vcd)
assocstats(majorgender)
 	
# NOTE: Chi-sqr = sum (obs-exp)^2/exp 	
Degrees of freedom for Chi-sqr are (r-1)*(c-1)
 	
# NOTE: Chi-sqr contribution = (obs-exp)^2/exp 	
 	
# Cramer's V = sqrt(Chi-sqr/N*min) 	
Where N is sample size and min is a the minimun of (r-1) or (c-1)
	tab gender /*Frequencies*/
	tab read
	
	tab read gender, col row /*Crosstabs*/
	
	tab read gender, col row chi2 V
	
	/*Crosstabs where chi2 (The null hypothesis (Ho) is that there is no relationship) and V (measure of association goes from 0 to 1)*/
	
	bysort studentstatus: tab read gender, colum row

R	Stata
Categorical data: Frequencies/Crosstab s	

install.packages("gmodels")
library(gmodels)
mydata$ones <- 1 # Create a new variable of ones
 	
CrossTable(mydata$Major,digits=2)
 	
CrossTable(mydata$Major,mydata$ones, digits=2)
 	
CrossTable(mydata$Gender,mydata$ones, digits=2)
 	
CrossTable(mydata$Major,mydata$Gender,digits=2, expected=TRUE,dnn=c("Major","Gender"))
 	
CrossTable(mydata$Major,mydata$Gender,digits=2, dnn=c("Major","Gender"))
 	
chisq.test(mydata$Major,mydata$Gender) # Null hipothesis: no association
 	
# 3-way crosstabs 	
 	
test <- xtabs(~Read+Major+Gender, data=mydata)
 	
#install.packages("vcd")
library(vcd)
assocstats(majorgender)
	tab gender /*Frequencies*/
	tab major
	
	tab major gender, col row /*Crosstabs*/
	
	tab major gender, col row chi2 V
	
	/*Crosstabs which chi2 (The null hypothesis (Ho) is that there is no relationship) and V (measure of association goes from 0 to 1)*/
	
	bysort studentstatus: tab gender major, colum row

R	Stata
Descriptive Statistics	

install.packages("pastecs")
library(pastecs)
stat.desc(mydata)
stat.desc(mydata[,c("Age","SAT","Score","Height", "Read")])
stat.desc(mydata[,c("Age","SAT","Score")], basic=TRUE, desc=TRUE, norm=TRUE, p=0.95)
stat.desc(mydata[10:14], basic=TRUE, desc=TRUE, norm=TRUE, p=0.95)
-- 	
# Selecting the first 30 observations and first 14 variables 	
mydata2 <- mydata2[1:30,1:14]
# Selection using the --subset— 	
mydata3 <- subset(mydata2, Age >= 20 & Age <= 30)
mydata4 <- subset(mydata2, Age >= 20 & Age <= 30, select=c(ID, First, Last, Age))
mydata5 <- subset(mydata2, Gender=="Female" & Status=="Graduate" & Age >= 30)
mydata6 <- subset(mydata2, Gender=="Female" & Status=="Graduate" & Age == 30)
	summarize /*N, mean, sd, min, max*/
	summarize, detail /*N, mean, sd, min, max, variance, skewness, kurtosis, percentiles*/
	summarize age, detail
	summarize sat, detail
	-- 	
	tabstat age sat score heightin read /*Gives the mean only*/
	tabstat age sat score heightin read, statistics(n, mean, median, sd, var, min, max)
	tabstat age sat score heightin read, by(gender)
	tabstat age sat score heightin read, statistics(mean, median) by(gender)
	/*Type help tabstat for a list of all statistics*/
	-- 	
	table gender, contents(freq mean age mean score)
	tab gender major, sum(sat) /*Categorical and continuous*/
	bysort studentstatus: tab gender major, sum(sat)

R

Stata

Descriptive Statistics

R

```
mean(mydata) # Mean of all numeric variables, same
using --sapply--('s' for simplify)
mean(mydata$SAT)
with(mydata, mean(SAT))
median(mydata$SAT)

table(mydata$Country) # Mode by frequencies ->
max(table(mydata$Country)) / names(sort(-
table(mydata$Country)))[1]

var(mydata$SAT)  # Variance
sd(mydata$SAT)  # Standard deviation
max(mydata$SAT)  # Max value
min(mydata$SAT)  # Min value
range(mydata$SAT)  # Range
quantile(mydata$SAT)
quantile(mydata$SAT, c(.3,.6,.9))
fivenum(mydata$SAT)   # Boxplot elements. From
   help: "Returns Tukey's five number summary
   (minimum, lower-hinge, median, upper-hinge,
   maximum) for the input data ~ boxplot"
length(mydata$SAT)    # Num of observations when a
                        variable is specify
length(mydata)        # Number of variables when a
                  dataset is specify
which.max(mydata$SAT) # From help: "Determines the
   location, i.e., index of the (first) minimum or
   maximum of a numeric vector"
which.min(mydata$SAT) # From help: "Determines the
   location, i.e., index of the (first) minimum or
   maximum of a numeric vector”
stderr <- function(x) sqrt(var(x)/length(x))
incster <- tapply(incomes, statef, stderr)
```

Stata

```
summarize   /*N, mean, sd, min, max*/
summarize, detail /*N, mean, sd, min, max,
             variance, skewness, kurtosis,
             percentiles*/
summarize age, detail
summarize sat, detail
tabstat  age sat score heightin read  /*Gives the
             mean only*/
tabstat  age sat score heightin read,
             statistics(n, mean, median, sd, var,
             min, max)
/*Type help tabstat for a list of all statistics*/

tabstat  age sat score heightin read, by(gender)
tabstat  age sat score heightin read,
             statistics(mean, median) by(gender)

table gender, contents(freq mean age mean score)

tab gender major, sum(sat)   /*Categorical and
             continuous*/

bysort studentstatus: tab gender major, sum(sat)
```

R	Stata
Descriptive Statistics	

# Descriptive statiscs by groups using --tapply-- 	
 	
mean <- tapply(mydata$SAT,mydata$Gender, mean)
# Add na.rm=TRUE to remove missing values in the estimation 	
sd <- tapply(mydata$SAT,mydata$Gender, sd)
median <- tapply(mydata$SAT,mydata$Gender, median)
max <- tapply(mydata$SAT,mydata$Gender, max)
cbind(mean, median, sd, max)
round(cbind(mean, median, sd, max),digits=1)
t1 <- round(cbind(mean, median, sd, max),digits=1)
t1
 	
# Descriptive statistics by groups using --aggregate— 	
 	
aggregate(mydata[c("Age","SAT")],by=list(sex=mydata$Gender), mean, na.rm=TRUE)
aggregate(mydata[c("Age","SAT")],mydata["Gender"], mean, na.rm=TRUE)
aggregate(mydata,by=list(sex=mydata$Gender), mean, na.rm=TRUE)
aggregate(mydata,by=list(sex=mydata$Gender, major=mydata$Major, status=mydata$Status), mean, na.rm=TRUE)
aggregate(mydata$SAT,by=list(sex=mydata$Gender, major=mydata$Major, status=mydata$Status), mean, na.rm=TRUE)
aggregate(mydata[c("SAT")],by=list(sex=mydata$Gender, major=mydata$Major, status=mydata$Status), mean, na.rm=TRUE)
	summarize /*N, mean, sd, min, max*/
	summarize, detail /*N, mean, sd, min, max, variance, skewness, kurtosis, percentiles*/
	summarize age, detail
	summarize sat, detail
	tabstat age sat score heightin read /*Gives the mean only*/
	tabstat age sat score heightin read, statistics(n, mean, median, sd, var, min, max)
	/*Type help tabstat for a list of all statistics*/
	
	tabstat age sat score heightin read, by(gender)
	tabstat age sat score heightin read, statistics(mean, median) by(gender)
	
	table gender, contents(freq mean age mean score)
	
	tab gender major, sum(sat) /*Categorical and continuous*/
	
	bysort studentstatus: tab gender major, sum(sat)

R

Stata

Histograms

```
library(car)
head(Prestige)
hist(Prestige$income)
hist(Prestige$income, col="green")
with(Prestige, hist(income)) # Histogram of income
                  with a nicer title.
with(Prestige, hist(income, breaks="FD",
  col="green")) # Applying Freedman/Diaconis rule
  p.120 ("Algorithm that chooses bin widths and
  locations automatically, based on the sample
  size and the spread of the data"
  http://www.mathworks.com/help/toolbox/stats/bquc
  g6n.html)
box()
hist(Prestige$income, breaks="FD")
# Conditional histograms
par(mfrow=c(1, 2))
hist(mydata$SAT[mydata$Gender=="Female"],
                  breaks="FD", main="Female",
                  xlab="SAT",col="green")
hist(mydata$SAT[mydata$Gender=="Male"],
                  breaks="FD", main="Male",
                  xlab="SAT", col="green")
    # Braces indicate a compound command allowing
                  several commands with 'with'
                  command
par(mfrow=c(1, 1))
with(Prestige, {
                  hist(income, breaks="FD",
                  freq=FALSE, col="green")
                  lines(density(income), lwd=2)
                  lines(density(income,
                  adjust=0.5),lwd=1)
                  rug(income)
})
```

```
hist sat
hist sat, normal
hist sat, by(gender)
```

R	Stata
Histograms	

# Histograms overlaid 	
 	
hist(mydata$SAT, breaks="FD", col="green")
hist(mydata$SAT[mydata$Gender=="Male"],
                  breaks="FD", col="gray",
                  add=TRUE)
legend("topright", c("Female","Male"),
                  fill=c("green","gray"))
	hist sat
	hist sat, normal
	hist sat, by(gender)

Scatterplots

R

```
# Scatterplots. Useful to 1) study the mean and
variance functions in the regression of y on x
p.128; 2)to identify outliers and leverage points.

# plot(x,y)

plot(mydata$SAT) # Index plot
plot(mydata$Age, mydata$SAT)
plot(mydata$Age, mydata$SAT, main=“Age/SAT",
        xlab=“Age", ylab=“SAT", col="red")
abline(lm(mydata$SAT~mydata$Age), col="blue")
        # regression line (y~x)
lines(lowess(mydata$Age, mydata$SAT), col="green")
        # lowess line (x,y)
identify(mydata$Age, mydata$SAT,
        row.names(mydata))

# On row.names to identify. "All data frames have
a row names attribute, a character vector of
length the number of rows with no duplicates nor
missing values." (source link below).
# "Use attr(x, "row.names") if you need an integer
value.)" http://stat.ethz.ch/R-manual/R-
devel/library/base/html/row.names.html

mydata$Names <- paste(mydata$Last, mydata$First)
row.names(mydata) <- mydata$Names
plot(mydata$SAT, mydata$Age)
identify(mydata$SAT, mydata$Age,
                 row.names(mydata))
```

Stata

```
twoway scatter y x

twoway scatter sat age, title("Figure 1. SAT/Age")

twoway scatter sat age, mlabel(last)

twoway scatter sat age, mlabel(last) || lfit sat age

twoway scatter sat age, mlabel(last) || lfit sat age
               || lowess sat age /* locally weighted
               scatterplot smoothing */

twoway scatter sat age, mlabel(last) || lfit sat age,
               yline(1800) xline(30)

twoway scatter sat age, mlabel(last) by(major, total)

twoway scatter sat age, mlabel(last) by(major, total)
               || lfit sat age

/* Adding confidence intervals */

twoway (lfitci sat age) || (scatter sat age)
      /*Reverse order shaded area cover dots*/

twoway (lfitci sat age) || (scatter sat age,
               mlabel(last))

twoway (lfitci sat age) || (scatter sat age,
               mlabel(last)), title("SAT scores by
               age") ytitle("SAT")

twoway scatter sat age, mlabel(last) by(gender,
               total)
```

Scatterplots

R

```
# Rule on span for lowess, big sample smaller
(~0.3), small sample bigger (~0.7)

library(car)

scatterplot(SAT~Age, data=mydata)

scatterplot(SAT~Age, id.method="identify",
                  data=mydata)

scatterplot(SAT~Age, id.method="identify",
                  boxplots= FALSE, data=mydata)

scatterplot(prestige~income, span=0.6, lwd=3,
                  id.n=4, data=Prestige)

# By groups

scatterplot(SAT~Age|Gender, data=mydata)

scatterplot(SAT~Age|Gender, id.method="identify",
                  data=mydata)

scatterplot(prestige~income|type, boxplots=FALSE,
                  span=0.75, data=Prestige)

scatterplot(prestige~income|type, boxplots=FALSE,
                  span=0.75,
                  col=gray(c(0,0.5,0.7)),
                  data=Prestige)
```

Stata

```
twoway scatter y x

twoway scatter sat age, title("Figure 1. SAT/Age")

twoway scatter sat age, mlabel(last)

twoway scatter sat age, mlabel(last) || lfit sat age

twoway scatter sat age, mlabel(last) || lfit sat age
             || lowess sat age /* locally weighted
             scatterplot smoothing */

twoway scatter sat age, mlabel(last) || lfit sat age,
             yline(1800) xline(30)

twoway scatter sat age, mlabel(last) by(major, total)

twoway scatter sat age, mlabel(last) by(major, total)
             || lfit sat age

/* Adding confidence intervals */

twoway (lfitci sat age) || (scatter sat age)
      /*Reverse order shaded area cover dots*/

twoway (lfitci sat age) || (scatter sat age,
             mlabel(last))

twoway (lfitci sat age) || (scatter sat age,
             mlabel(last)), title("SAT scores by
             age") ytitle("SAT")

twoway scatter sat age, mlabel(last) by(gender,
             total)
```

R	Stata
Scatterplots (multiple)	

`scatterplotMatrix(~ prestige + income + education + women, span=0.7, id.n=0, data=Prestige)`
 	
`pairs(Prestige)   # Pariwise plots. Scatterplots of all variables in the dataset`
`pairs(Prestige, gap=0, cex.labels=0.9) # gap controls the space between subplot and cex.labels the font size (Dalgaard:186)`
	`graph matrix  sat age score heightin read`
	`graph matrix  sat age score heightin read, half`

3D Scatterplots	

`library(car)`
 	
`scatter3d(prestige ~ income + education, id.n=3, data=Duncan)`	

R	Stata
Scatterplots (for categorical data)	

plot(vocabulary ~ education, data=Vocab)
 	
plot(jitter(vocabulary) ~ jitter(education),
                  data=Vocab)
 	
plot(jitter(vocabulary, factor=2) ~
                  jitter(education, factor=2),
                  data=Vocab)
 	
# cex makes the point half the size, p. 134 	
 	
plot(jitter(vocabulary, factor=2) ~
                  jitter(education, factor=2),
                  col="gray", cex=0.5, data=Vocab)
with(Vocab, {
                  abline(lm(vocabulary ~
                  education), lwd=3, lty="dashed")
                  lines(lowess(education,
                  vocabulary, f=0.2), lwd=3)
})
	/*Categorical data using mydata.dat and the jitter option*/
	
	/*"scatter will add spherical random noise to your data before plotting if you specify jitter(#), where # represents the size of the noise as a percentage of the graphical area. This can be useful for creating graphs of categorical data when the data not jittered, many of the points would be on top of each other, making it impossible to tell whether the plotted point represented one or 1,000 observations.” Source: Stata’s help page, type: help scatter*/
	
	/*Use mydata.dat*/
	
	graph matrix y x1 x2 x3
	scatter y x1, jitter(7) title(xyz)
	scatter y x1, jitter(7) msize(0.5)
	scatter y x1, jitter(13) msize(0.5)
	twoway scatter y x1, jitter(13) msize(0.5) || lfit
	             y x1
	graph matrix x1 x1 x2 x3, jitter(5)
	graph matrix y x1 x2 x3, jitter(13) msize(0.5)
	graph matrix y x1 x2 x3, jitter(13) msize(0.5)
	             half

References/Useful links

- DSS Online Training Section http://dss.princeton.edu/training/
- Princeton DSS Libguides http://libguides.princeton.edu/dss
- John Fox’s site http://socserv.mcmaster.ca/jfox/
- Quick-R http://www.statmethods.net/
- UCLA Resources to learn and use R http://www.ats.ucla.edu/stat/R/
- UCLA Resources to learn and use Stata http://www.ats.ucla.edu/stat/stata/
- DSS - Stata http://dss/online_help/stats_packages/stata/
- DSS - R http://dss.princeton.edu/online_help/stats_packages/r

References/Recommended books

- *An R Companion to Applied Regression*, Second Edition / John Fox , Sanford Weisberg, Sage Publications, 2011
- *Data Manipulation with R* / Phil Spector, Springer, 2008
- *Applied Econometrics with R* / Christian Kleiber, Achim Zeileis, Springer, 2008
- *Introductory Statistics with R* / Peter Dalgaard, Springer, 2008
- *Complex Surveys. A guide to Analysis Using R* / Thomas Lumley, Wiley, 2010
- *Applied Regression Analysis and Generalized Linear Models* / John Fox, Sage, 2008
- *R for Stata Users* / Robert A. Muenchen, Joseph Hilbe, Springer, 2010
- *Introduction to econometrics* / James H. Stock, Mark W. Watson. 2nd ed., Boston: Pearson Addison Wesley, 2007.
- *Data analysis using regression and multilevel/hierarchical models* / Andrew Gelman, Jennifer Hill. Cambridge ; New York : Cambridge University Press, 2007.
- *Econometric analysis* / William H. Greene. 6th ed., Upper Saddle River, N.J. : Prentice Hall, 2008.
- *Designing Social Inquiry: Scientific Inference in Qualitative Research / Gary King, Robert O. Keohane, Sidney Verba, Princeton University Press*, 1994.
- *Unifying Political Methodology: The Likelihood Theory of Statistical Inference* / Gary King, Cambridge University Press, 1989
- *Statistical Analysis: an interdisciplinary introduction to univariate & multivariate methods /* Sam

  Kachigan, New York : Radius Press, c1986
- *Statistics with Stata (updated for version 9) /* Lawrence Hamilton, Thomson Books/Cole, 2006