

POL 345: Quantitative Analysis and Politics

Information Session

5 – 6pm, Corwin 127 on September 21

Week 1 (Verzani Chapter 1: Sections 1.2.1-1.2.3)

The attendance to the information session is not required but *strongly* encouraged. You should bring your own laptop to the session if you have one. Regardless of your attendance, you must try out all the commands in this document on your own during the first week. Simply installing **R** without opening the program and completing the handout will leave you under-prepared for the first precept.

In this handout, we will cover the following materials:

- Downloading and installing **R**
- Using **R** as a Calculator
- Creating and using objects in **R**
- Using **RStudio** as a text editor
- Mapping the network drive so that you do not lose your work

1 What is R and Why Use It?

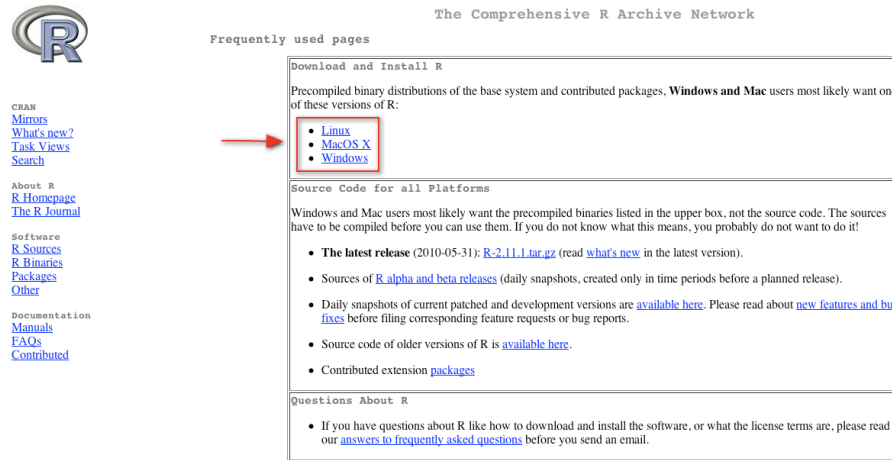
- Widely-used in academia and industries
- Open-source and Free
- Power and flexibility
- Graphical capabilities
- Learning R = learning basic programming

The *New York Times* described **R** as

a popular programming language used by a growing number of data analysts inside corporations and academia. It is becoming their lingua franca [...] whether being used to set ad prices, find new drugs more quickly or fine-tune financial models. Companies as diverse as Google, Pfizer, Merck, Bank of America, the InterContinental Hotels Group and Shell use it. [...] “The great beauty of R is that you can modify it to do all sorts of things,” said Hal Varian, chief economist at Google. “And you have a lot of prepackaged stuff that’s already available, so you’re standing on the shoulders of giants.”

2 Downloading and Installing R

1. Go to <http://cran.r-project.org/> and select the link that matches your operating system.



The Comprehensive R Archive Network

Frequently used pages

Download and Install R

Precompiled binary distributions of the base system and contributed packages. **Windows and Mac** users most likely want one of these versions of R:

- [Linux](#)
- [MacOS X](#)
- [Windows](#)

Source Code for all Platforms

Windows and Mac users most likely want the precompiled binaries listed in the upper box, not the source code. The sources have to be compiled before you can use them. If you do not know what this means, you probably do not want to do it!

- The latest release (2010-05-31): [R-2.11.1.tar.gz](#) (read [what's new](#) in the latest version).
- Sources of [R alpha and beta releases](#) (daily snapshots, created only in time periods before a planned release).
- Daily snapshots of current patched and development versions are [available here](#). Please read about [new features and bug fixes](#) before filing corresponding feature requests or bug reports.
- Source code of older versions of R is [available here](#).
- Contributed extension [packages](#)

Questions About R

- If you have questions about R like how to download and install the software, or what the license terms are, please read our [answers to frequently asked questions](#) before you send an email.

2.1 Windows

2. Choose the **base** installation and then click on the link for **R-2.13.1**.



R for Windows

This directory contains 32-bit binaries for a base distribution and packages to run on i386/x64 Windows. See [here](#) for a 64-bit Windows port.

Note: CRAN does not have Windows systems and cannot check these binaries for viruses. Use the normal precautions with downloaded executables.

Subdirectories:

- [base](#)
- [contrib](#)

Binaries for base distribution (managed by Duncan Murdoch)
Binaries of contributed packages (managed by Uwe Ligges)

Please do not submit binaries to CRAN. Package developers might want to contact Duncan Murdoch or Uwe Ligges directly in case of questions / suggestions related to Windows binaries.

You may also want to read the [R FAQ](#) and [R for Windows FAQ](#).

Last modified: April 4, 2004, by Friedrich Leisch

R-2.13.1 for Windows (32/64 bit)

[Download R 2.13.1 for Windows \(39 megabytes, 32/64 bit\)](#)

[Installation and other instructions](#)
New features in this version: [Windows specific](#), [all platforms](#).

If you want to double-check that the package you have downloaded exactly matches the package distributed by R, you can compare the [md5sum](#) of the .exe [fingerprint](#). You will need a version of md5sum for windows: both [graphical](#) and [command line versions](#) are available.

Frequently asked questions

- [How do I install R when using Windows Vista?](#)
- [How do I update packages in my previous version of R?](#)
- [Should I run 32-bit or 64-bit R?](#)

Please see the [R FAQ](#) for general information about R and the [R Windows FAQ](#) for Windows-specific information.

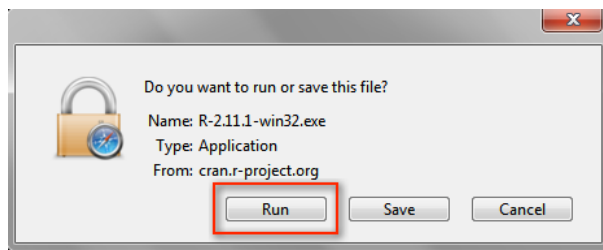
Other builds

- Patches to this release are incorporated in the [r-patched snapshot build](#).
- A build of the development version (which will eventually become the next major release of R) is available in the [r-devel snapshot build](#).
- [Previous releases](#)

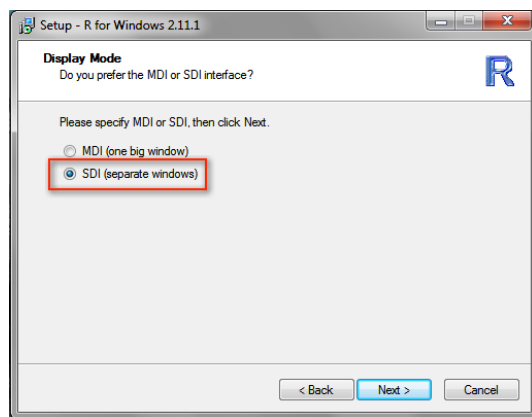
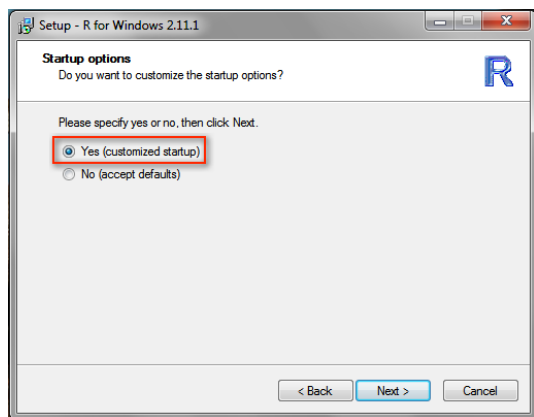
Note to webmasters: A stable link which will redirect to the current Windows binary release is [<CRAN MIRROR>/bin/windows/base/release.htm](#).

Last change: 2011-07-08, by Duncan Murdoch

3. To install **R** on Windows, select the option to **Run** the R-2.13.1-win32.exe file.




During the installation process, Windows users will be given a an option to **customize** the startup. Make sure to choose **Yes** for the customized startup, followed by the **SDI** option for separate windows.



The remainder of the installation process may be completed by simply following the Windows Setup Wizard Prompts. Once the installation is complete, an icon to open the **R** software will be added to the desktop. You may open the **R** console by double clicking on the icon.

2.2 MacOS X

2. Click on the link for **R-2.13.1.pkg** and select the option to **Save File** for the R-2.13.1.pkg.



CRAN
[Mirrors](#)
[What's new?](#)
[Task Views](#)
[Search](#)

About R
[R Homepage](#)
[The R Journal](#)

Software
[R Sources](#)
[R Binaries](#)
[Packages](#)
[Other](#)

Documentation
[Manuals](#)
[FAQs](#)
[Contributed](#)

R for Mac OS

This directory contains binaries for a base distribution and packages to run on Mac OS X (release 10 supported but you can find the last supported release of R for these systems (which is R 1.7.1) [here](#). the [old](#) directory.

Note: CRAN does not have Mac OS X systems and cannot check these binaries for viruses. Although precautions with downloaded executables.

Universal R 2.13.1 released on 2011/07/08

This binary distribution of R and the GUI supports PowerPC (32-bit) and Intel (32-bit and 64-bit) bi

Please check the MD5 checksum of the downloaded image to ensure that it has not been tampered v
md5 R-2.13.1.pkg
in the *Terminal* application to print the MD5 checksum for the R-2.13.1.pkg image.

Files:

R-2.13.1.pkg (latest version)
XMD5-hash: 300734f226d8e0a0572a31c0a0200ac
(aka: R0X.R0)

Three-way universal binary of R 2.13.1 for Mac O
framework, R.app GUI 1.41 in 32-bit and 64-bit. 1
by double-clicking. Depending on your browser, yo
download the file.

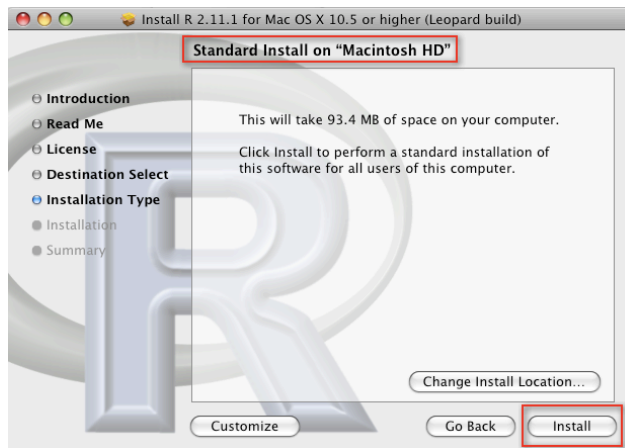
This package **only** contains the R framework, 32-b
libraries (needed if you want to use **iclib**) and **C**
from sources that contain **FORTTRAN** code) pl

NOTE: Mac OS X 10.7 (Lion) users please up d
[R-2.13-patched](#) since Lion has changed code comp
completion to work properly in the GUI.

[Mac-GUI-1.41.tar.gz](#)
XMD5-hash: c28966620e18100665d09ec9f02

Sources for the R.app GUI 1.41 for Mac OS X. Th
the GUI, it is not intended for regular users. Read th

3. Follow the standard installation of the Mac Installer.

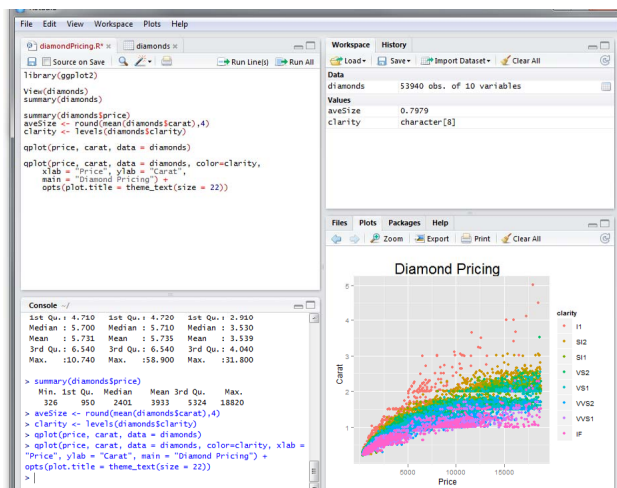


Once the installation is complete, an **R** icon will be added to the Applications folder. Double-clicking the **R** icon opens the console.

3 R Studio

Unless you have prior programming experience (and have a preference for another text editor such as WinEdt and Emacs), we require that you download and use **RStudio**. **RStudio** is an open-source and free program that greatly facilitates the use of **R**, especially for users new to programming. In one window, **RStudio** gives users a text editor, graph viewer, **R** console viewer, a help section plus many other features. It may look complicated at first, but **RStudio** should make learning how to use **R** much easier. **RStudio** can be downloaded at <http://rstudio.org/> and the installation should be straightforward.

After installing both **R** and **RStudio**, open **RStudio** whose screenshot is given here:



In **RStudio**, click on **File**, **New**, and then **R script**. This will open a blank document for text editing in the upper left of the **RStudio** window. This is where you keep all of your commands. The **R** console will be in the lower left where the commands will be executed. The upper right will show a history of commands that you have sent from the text editor to the **R** console. The lower right will show graphs, help documents and other features.

When using **RStudio**, you have the option to either enter commands in the text editor (upper left), or directly into the **R** console (lower left). If you just want to see what a command does, or quickly calculate some quantity, go ahead and enter it directly into the **R** console. However, for more involved programming, it is always better to use the text editor. This way you can see the history of code you have used. To run your code from the text editor, simply highlight the code and press **Run**. Alternately, in Windows, **ctrl+Enter** works as a shortcut.

Another reason to use the text editor in **RStudio** is that you will need to submit code for your problem sets, final exam and research projects. The text editor code from **RStudio** can be saved as a **.R** file—i.e. save your code as **XXX.R** where **XXX** should be replaced with an informative file name, such as **Pset1.R**. This code can later be opened and read by **RStudio**, or any other text editor.

4 Using R

You can learn computer programming only by doing. Please try out the following commands on your own. Open up **RStudio** and enter the commands directly into the **R** console on the left side of the screen.

4.1 R as a Calculator

R may be used as a calculator with standard operators.

```
> 5 + 3
```

```
[1] 8
```

```
> 5 - 3
```

```
[1] 2
```

```
> 5 / 3
```

```
[1] 1.66667
```

```
> 5^3
```

```
[1] 125
```

4.2 Creating and Using an Object

In **R**, one can store various information as an *object* with a name of your choice. We use **<-** to assign a name to an object. Note that object names cannot begin with numbers and no spacing is allowed either. In general, you should avoid special characters such as **%** and **\$**, which have specific meanings in **R**. You should also use intuitive object names, avoiding such names as **foo**. In **RStudio**, you will see the objects you created in the upper right window called **Workspace**.

- For example, we can store the result of the above calculation as an object named **kosuke**, and once this is done you can access to this information using this object name.

```
> kosuke <- 5 + 3  
> kosuke
```

```
[1] 8
```

- If you use the same object name, then the information will be overwritten.

```
> kosuke
```

```
[1] 8
```

```
> kosuke <- 5 - 3
```

```
> kosuke
```

```
[1] 2
```

- The information can be a character string, in which case you need to use quotation marks.

```
> kosuke <- "professor"
```

```
> kosuke
```

```
[1] "professor"
```

For character strings, spacing is allowed.

```
> kosuke <- "statistics professor"
```

```
> kosuke
```

```
[1] "statistics professor"
```

- **#** allows for annotation behind commands or on a separate line. Everything that follows **#** will be ignored by **R**. You should annotate your own code so that you and others can understand what each part of the code is trying to do. See the next example

- **R** is CaSe SeNsItIvE. Hello \neq hello \neq HELLO

```
> alex <- "preceptor" # character string
```

```
> Alex # if you type this you will get an error
```

```
> ## let's get it right this time
```

```
> alex
```

```
[1] "preceptor"
```

- With the above basic rules in mind, we can conduct various calculations. Here, we calculate the percent increase in China's holdings of U.S. Treasury Securities from 2008 (727.4 billion USD) to 2009 (894.8 billion USD).

```
> ## China example
```

```
> china2009 <- 894.8 * (10^6) # create object with informative label
```

```
> china2008 <- 727.4 * (10^6)
```

```
> increase <- china2009 - china2008
```

```
> increase
```

```
[1] 167400000
```

```
> percent.increase <- increase / china2008 * 100  
> percent.increase
```

```
[1] 23.0135
```

```
> ## we can combine the above operations into one line  
> percent.increase2 <- (china2009 - china2008) / china2008 * 100  
> percent.increase2
```

```
[1] 23.0135
```

5 Mapping the Network (H:) Drive

Princeton provides server space for all students. When logged into a University computer, this space appears as the H: drive. Aside from always having your work backed up (in case of theft/computer breaking), an advantage of using the H: drive is that you can access your files wherever you go. You can work on the Friend computers (when precepts are held) and then easily access your saved files on your personal computer later.

For those interested, here are a couple useful links.

- <http://helpdesk.princeton.edu/kb/display.plx?id=8474>
- <http://helpdesk.princeton.edu/kb/display.plx?ID=9347>

6 A Practice Question

You should be able to answer the following question if you understand the materials of this handout. You do not need to submit your answers, but we strongly encourage you to try it out. It should not take you more than 10 minutes.

U.S. Treasury Securities held by foreign countries increased from 3708.8 billion in January of 2010 to 4009.2 billion in June of 2010. In January, China held 889.0 billion in U.S. Treasury Securities. By the close of June, Chinese holdings decreased to 843.7 billion. In contrast, Japanese holdings increased from 765.4 billion in January to 803.6 billion in June. Calculate the *percentage point change* for China and Japan in terms of the percentage points of total U.S. Treasury Securities held by foreign countries (this is different from *percent change* calculated above). Be sure to assign informative labels to object names and to briefly annotate your code. Save your code as `China.R` under a new folder titled `Rinfosession`.