Econometrics 1 *Applied Econometrics with R*

Lecture 2: Basics of R

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R installation

See http://huangjp.szu.edu.cn/Rinstall.html

1. Download and install R

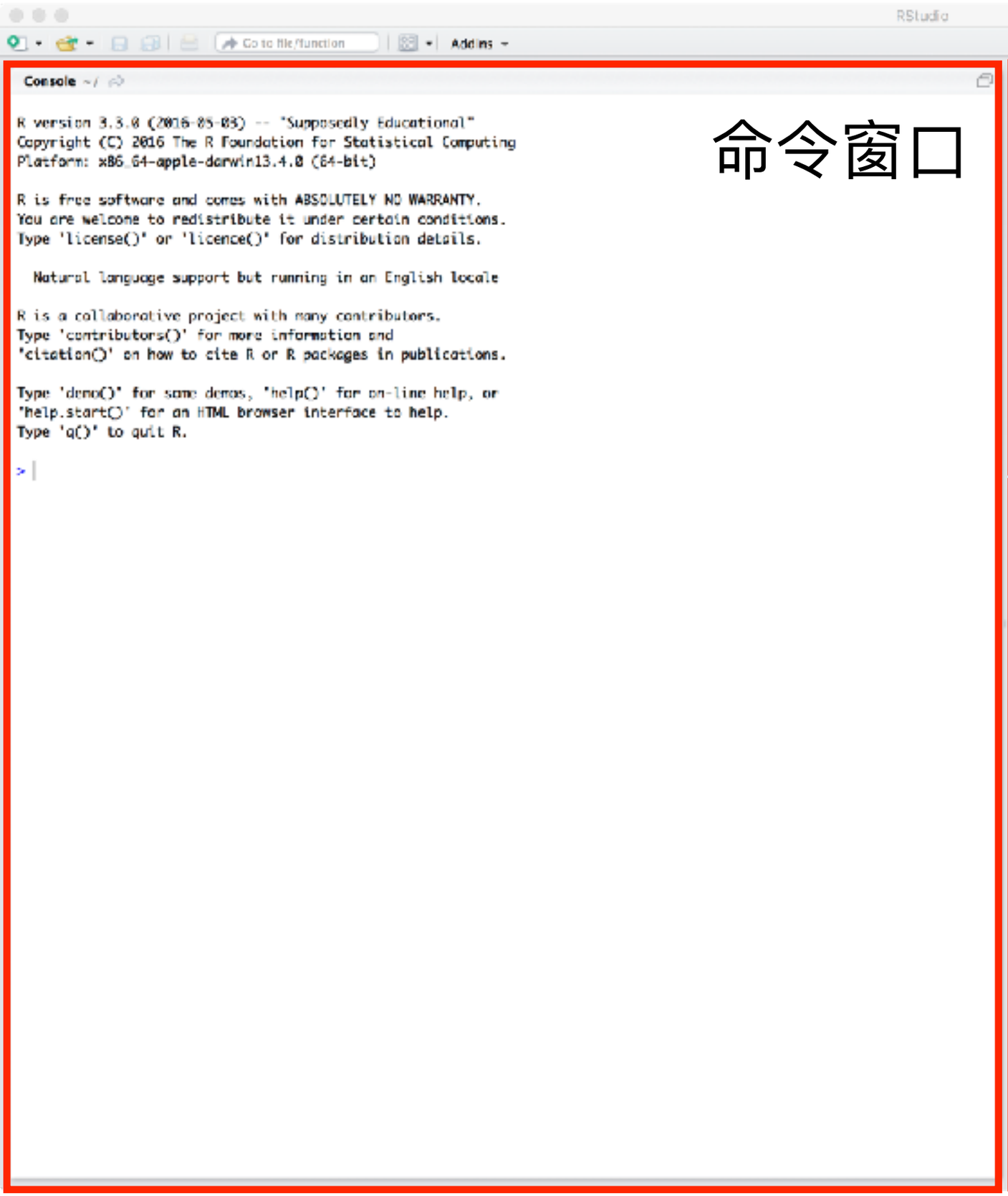
2. Download and install RStudio

3. Install packages

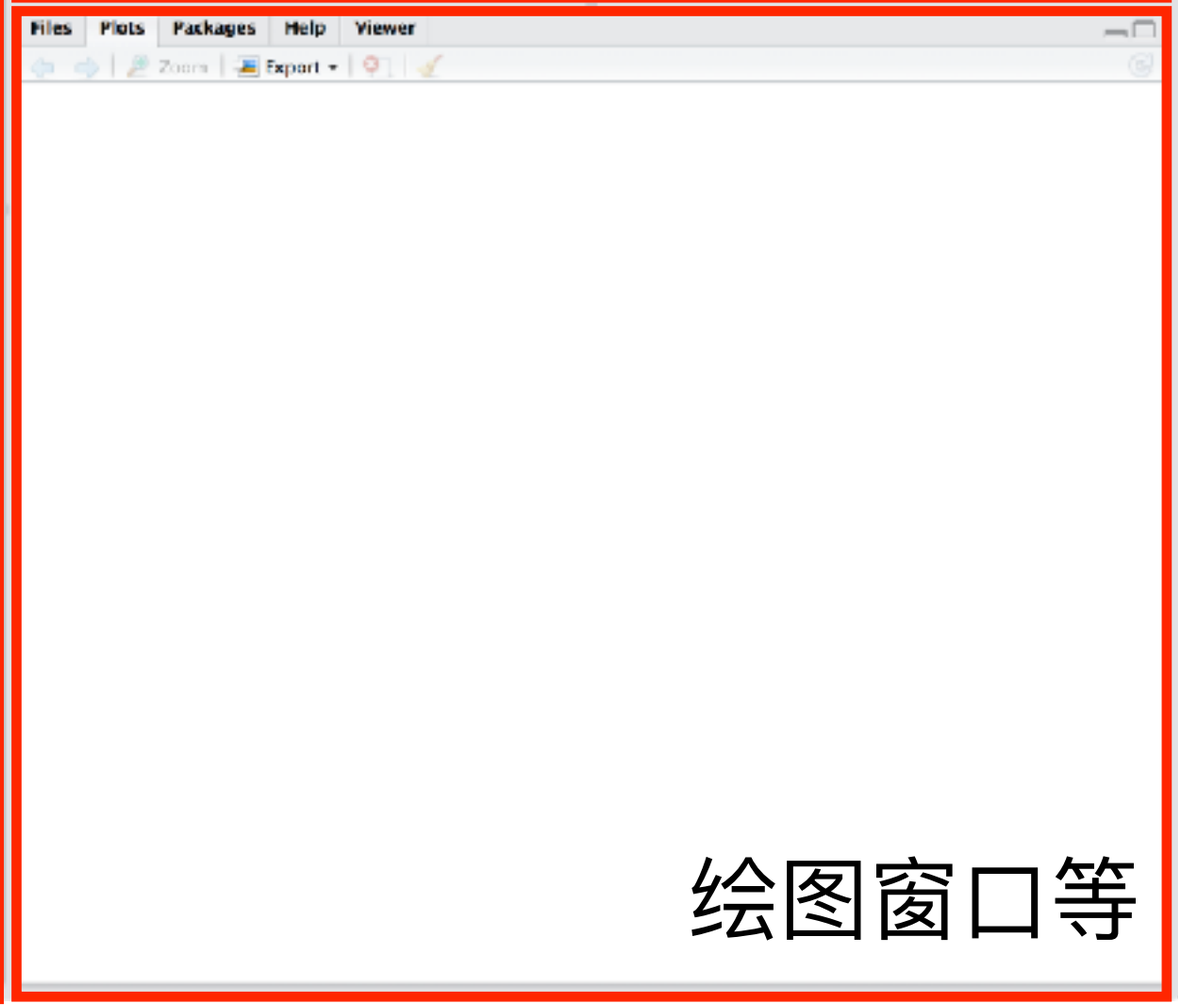
An introduction to R

R: A Language and Environment for Statistical Computing and Graphics

- https://www.r-project.org/
- R is free to use (open source under GNU license)
- R can be run on Windows/MacOS/Unix systems
- R is interactive
- R has many packages that are ready for use
- You can develop your own tools with R


RStudio
Go to file/function
Addins
Project: (None)
Console ~/
R version 3.3.0 (2016-05-03) -- "Supposedly Educational"
Copyright (C) 2016 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin13.4.0 (64-bit)
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.
>
命令窗口


Environment
History
Import Dataset
List
Global Environment
Environment is empty
变量窗口


Files
Plots
Packages
Help
Viewer
Zoom
Export
绘图窗口等

Play with R

R is a high level calculator

```
> 1 + 2
[1] 3
```

```
> 2^24
[1] 16777216

> factorial(5)
[1] 120

> log(exp(sin(pi/4)^2) * exp(cos(pi/4)^2))
[1] 1
```

- Try the following commands (functions):

  `log(), exp(), sin(), cos(), tan(), sign(), sqrt(), abs(), min(), max()`

- Use `?` or `help()` to see help documents of commands, for example

  `?sign, help(sign)`

- Calculate the value of $\phi(2.5)$, where

$$\phi(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x^2}$$

Variable

- Assignment operator “<-”

```
> x <- 25
> y <- 3
> x * y
```

- Characters that can be used in a variable name:
  A~Z, a~z, 0~9, _

- A variable name should start with a letter

Vector

- `c()`

  ```
  > x <- c(2, 3.5, -3, 6.4, 21.9)
  ```

- The i-th element of a vector

  ```
  > x[3]
  ```

- The length of a vector

  ```
  > length(x)
  ```

Understand the difference between "`( )`" and "`[ ]`":

- "`( )`" is used with a function
- "`[ ]`" is used with a variable (vector or matrix)

Try arithmetic with vectors

- `+, -, *, /, ^, sqrt(), exp(), log()`
- `mean(), var(), prod()`
- `sort(), order()`

- Calculate unbiased sample variance using

$$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \overline{x})^2$$

and compare your result with that of `var()`

Generating patterned vectors

- How to generate a vector (1, 2, 3, 4, …, 20)

```
> x <- c(1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
11, 12, 13, 14, 15, 16, 17, 18, 19, 20)
```

```
> x <- 1:20
```

- Use `seq()`, `rep()`

```
> x <- seq(from = 1, to = 2, by = 0.1)
> y <- rep(x, times = 5)
```

Matrix

- Create a matrix from a vector

```
> x <- 1:12
> y <- matrix(x, nrow = 3, ncol = 4)
```

- Elements of a matrix

```
> y[2, 3]
> y[2,]
> y[, 4]
> y[3, c(1,3)]
```

Basic matrix algebra

- Try `+, -, *, /, ^, sqrt(), exp(), log()` with a matrix
- Create a matrix $z = \begin{pmatrix} 1 & 5 \\ 2 & 6 \end{pmatrix}$
- Matrix multiplication

```
> z %*% z
```

- Transpose

```
> t(z)
```