Econometrics 1 *Applied Econometrics with R*

Lecture 4: Programming with R

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Review

- Save your code in a script file

- Data management
  data frame, csv files, data import/export
  `data.frame()`, `read.csv()`, `write.csv()`

- Graphics
  `plot()`, `barplot()`, `hist()`, `curve()`

Work with “project”

RStudio

Go to file/function | Addins | Project: (None)

Console ~/

```
R version 3.5.1 (2018-07-02) -- "Feather Spray"
Copyright (C) 2018 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin15.6.0 (64-bit)

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  Natural language support but running in an English locale

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'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.

>
```

Environment | **History**

Import Dataset | Global Environment

Environment is empty

- New Project...
- Open Project...
- Open Project in New Session...
- Close Project
- Teaching_AE
- Clear Project List
- Project Options... ⇧⌘,

Files | **Plots** | **Packages** | **Help** | **Viewer**

New Folder | Delete | Rename | More

Home

Name	Size	Modified
.Rhistory	11.6 KB	Oct 29, 2017, 4:57 PM
Applications		
Desktop		
Documents		
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Movies		
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Public		

RStudio

Go to file/function | Addins | Project: (None)

Console ~/

```
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>
```

Environment | **History**

Import Dataset | List

Global Environment

Environment is empty

Viewer

Rename | More

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Public

New Project

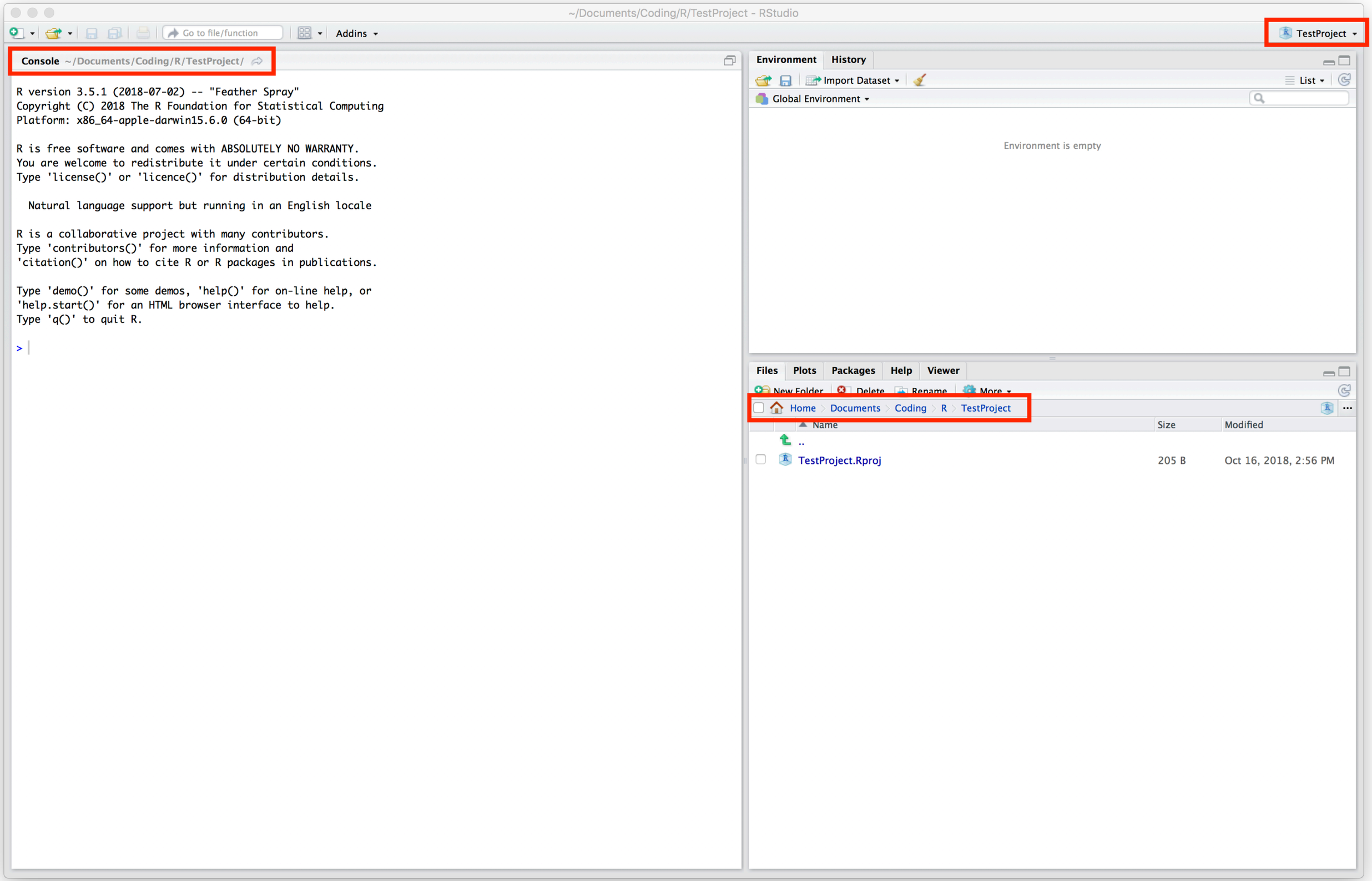
Create Project

New Directory
Start a project in a brand new working directory

Existing Directory
Associate a project with an existing working directory

Version Control
Checkout a project from a version control repository

Cancel


~/Documents/Coding/R/TestProject - RStudio
Go to file/function
Addins
TestProject
Console ~/Documents/Coding/R/TestProject/
R version 3.5.1 (2018-07-02) -- "Feather Spray"
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>
Environment
History
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Environment is empty
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Home
Documents
Coding
R
TestProject
Name
Size
Modified
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TestProject.Rproj
205 B
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Functions

Define an R function

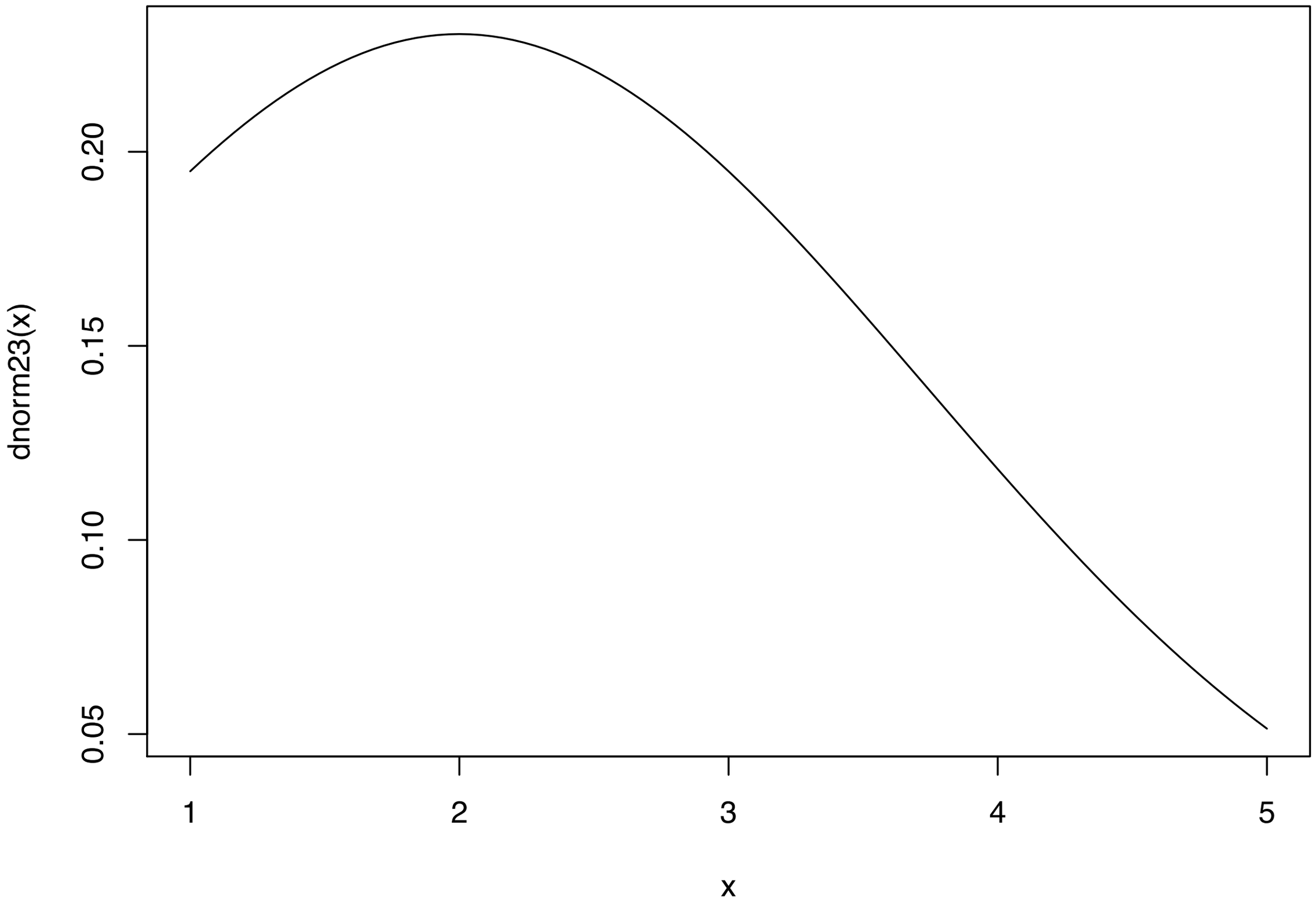
- You can define your own functions.

- For example, the density of the normal distribution with mean 2 and variance 3 under the name `dnorm23` can be defined as

```
> dnorm23 <- function (x) {exp(- (x-2)^2 /
(2*3)) / sqrt(2 * 3 * pi)}↩
```

- Plot a curve with `dnorm23` on domain $[1, 5]$

```
> curve(dnorm23, 1, 5)↩
```


dnorm23(x)
0.05
0.10
0.15
0.20
1
2
3
4
5
x

Function

- General expression of a function

defined by user

```
function_name <- function (x) {
   ……
   return(…)
}
```

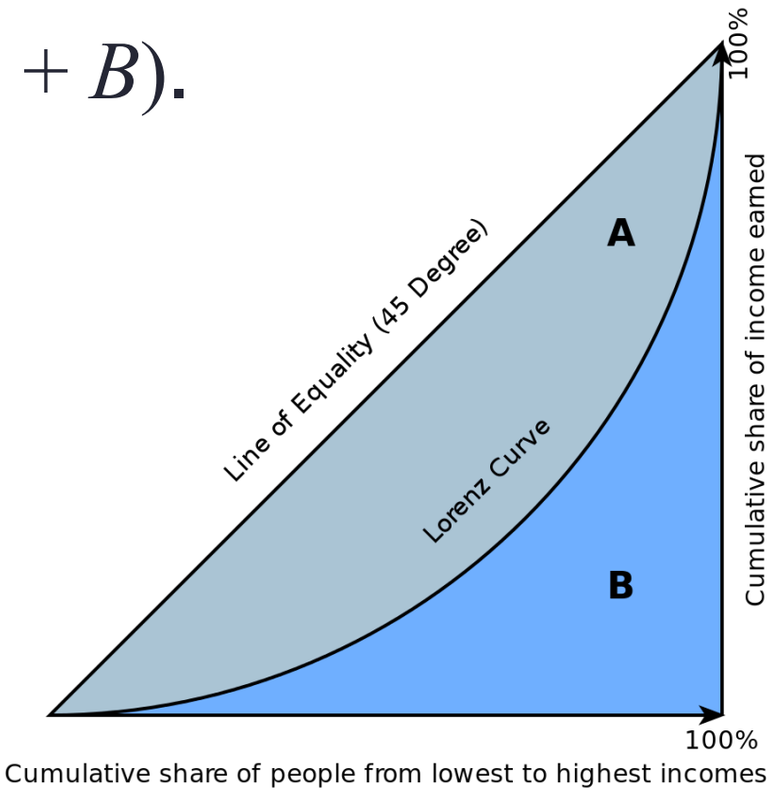
- If the `return` statement is missing, the value of the last evaluated expression is returned.

Practice: Gini coefficient

- The Gini coefficient is defined by $G = A / (A + B)$. Given a set of data y of size n,

$$G = \frac{1}{n}\left[n + 1 - 2\left(\frac{\sum_{i=1}^{n}(n+1-i)y_i}{\sum_{i=1}^{n} y_i}\right)\right]$$

if y is sorted in non-decreasing order.



- Write a function ‘gini’ which takes an arbitrary sequence of non-negative real numbers (not necessarily sorted) as input, and returns the Gini coefficient as output.

- Apply ‘gini’ to data (2, 3, 1, 2, 5, 1, 1, 3, 2)

Practice: Gini coefficient

```
gini <- function (x) {
  y <- sort(x)
  n <- length(y)
  d <- 1:n
  G <- 1 / n * (n + 1 - 2 * ( sum((n+1-d)
* y) / sum(y) ) )
  return(G)
}

x <- c(2, 3, 1, 2, 5, 1, 1, 3, 2)
gx <- gini(x)
```

Programming with R

What is a program?

- One line command is a program, e.g.

```
> fractal(10)↩
> 1 / sqrt(2 * pi) * exp(- 0.5^2 / 2)↩
```

- More complicated programs are combinations of basic commands, plus some *controlling* statements, e.g., `if`, `for`, etc.

Conditional: the `if` statement

- Relational operators: `<, <=, >, >=, ==, !=`
  Logical operators: `!, &, |`
  not and or

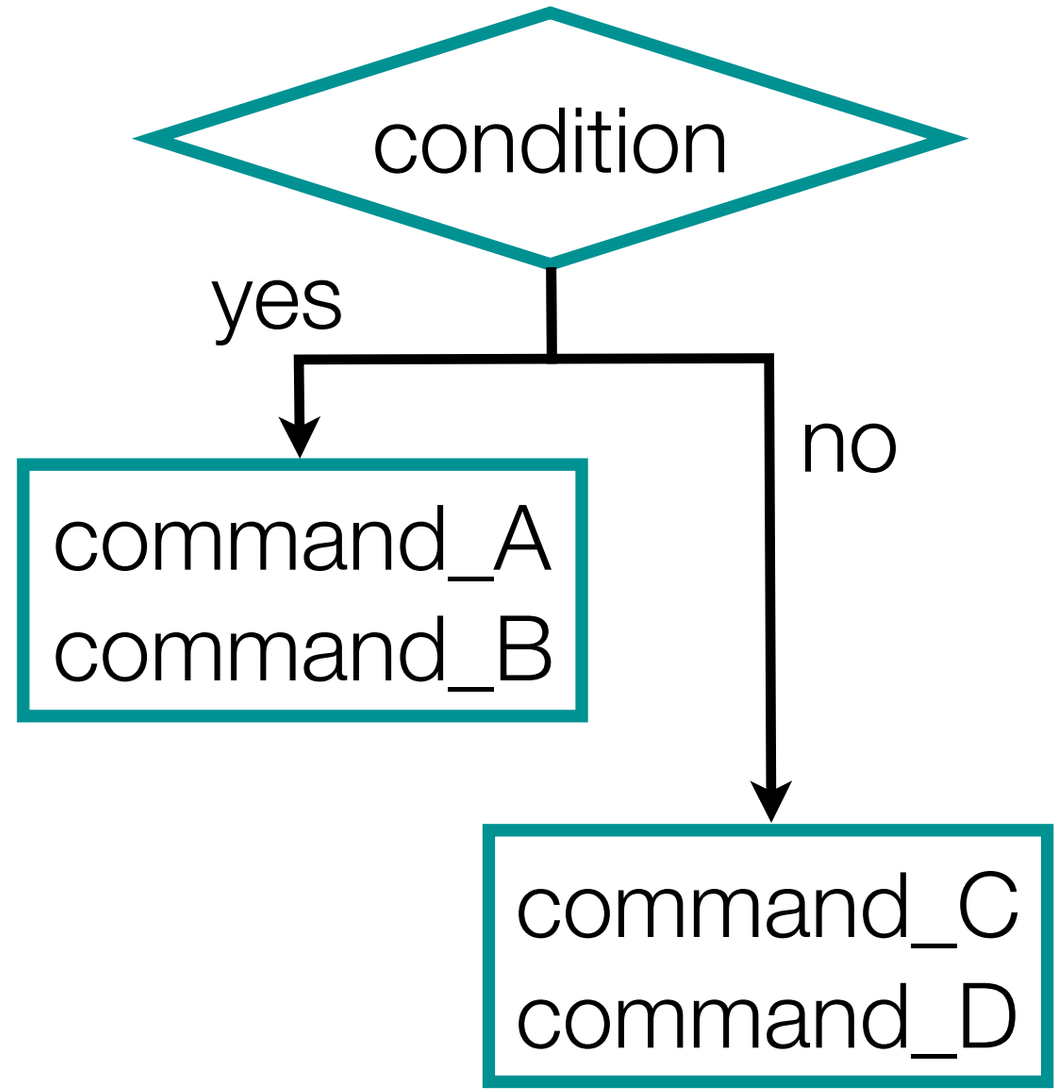
```
> 3 < 5↩
> class(3 < 5)↩
```

- `if (`*condition*`)` *command_A*
  `if (`*condition*`)` *command_A* `else` *command_B*

```
> x <- rbinom(1, 1, 0.5)↩
> if (x == 0) y <- 1 else y <- 0↩
```

- `if` with commands in multiple lines (in a script file)

```
if (condition) {
     command_A
     command_B
     ……
} else {
     command_C
     command_D
     ……
}
```



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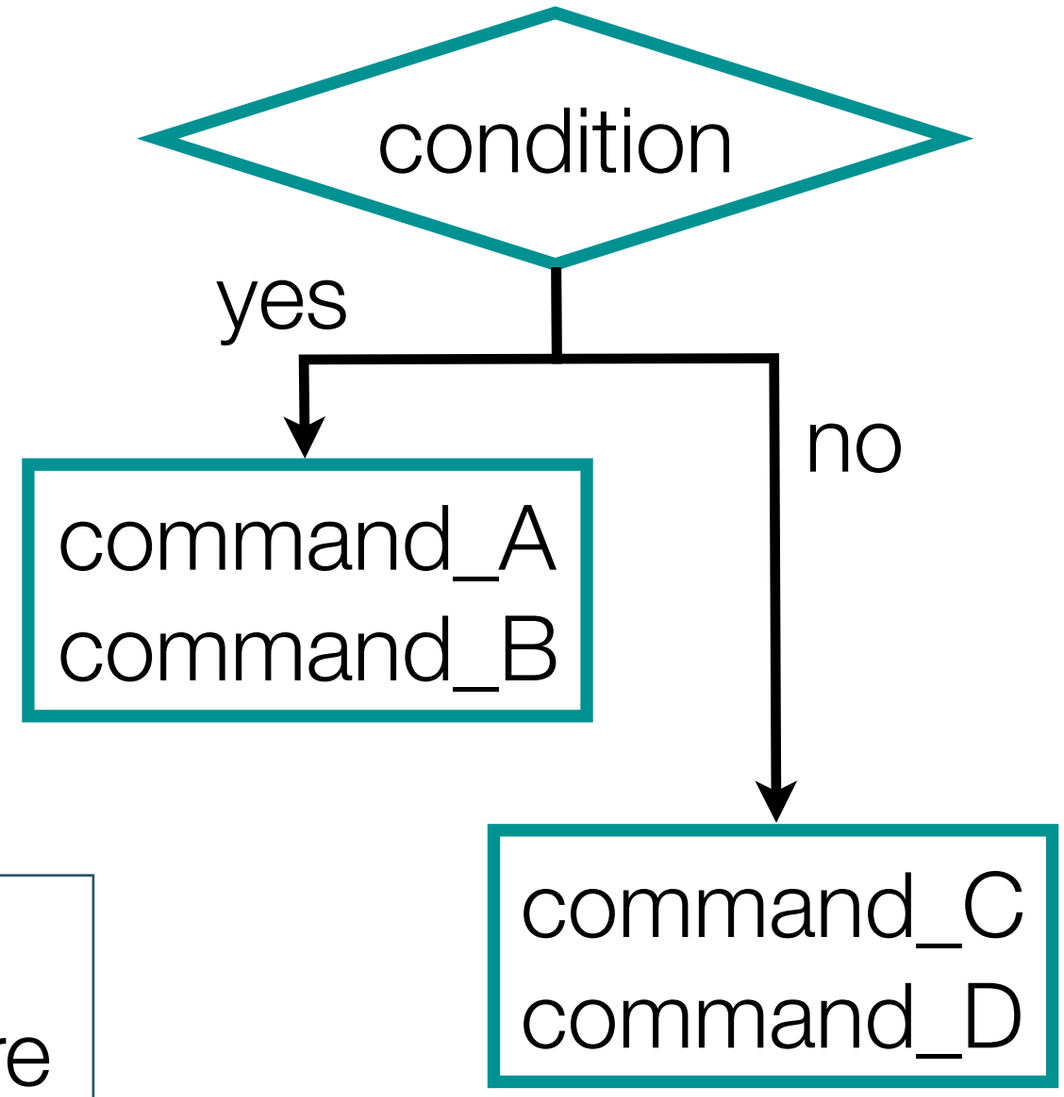

Indentation:
Use *tab* or *space* here to make your program readable (automatically added in RStudio).

Practice: the absolute value

- Define a function named `absvalue` that calculates the absolute value of a real number.
- Use `if` statement in your function.

Practice: the absolute value

- Define a function named `absvalue` that calculates the absolute value of a real number.
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```
absvalue <- function (x) {
  if (x > 0) x else -x
}
```

Practice: the real cube root

- Define a function named `rcbrt` which always returns the real cube root of a real number (either positive or negative).

- For example, you may expect `rcbrt(8)` returns 2, and `rcbrt(-8)` returns -2.

- Use `if` statement in your function.