GOVT PhD Math Camp Coding Lab Day 2

Theodore Landsman

Georgetown University

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  - It's the standard software for quantitative political science (and other social science) research.

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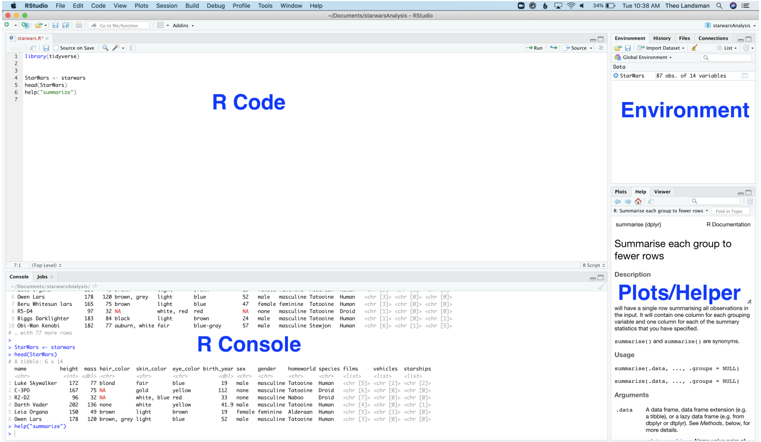
5. Statistical analysis
6. Summarizing/Visualizing the results

Understanding RStudio



```r
library(tidyverse)


StarWars <- starwars
head(StarWars)
help("summarize")
```

Data

StarWars 87 obs. of 14 variables

```
 6 Owen Lars             178   120 brown, grey   light       blue             52 male   masculine Tatooine  Human   <chr [3]> <chr [0]> <chr [0]>
 7 Beru Whitesun lars    165    75 brown         light       blue             47 female feminine  Tatooine  Human   <chr [3]> <chr [0]> <chr [0]>
 8 R5-D4                  97    32 NA            white, red  red              NA none   masculine Tatooine  Droid   <chr [1]> <chr [0]> <chr [0]>
 9 Biggs Darklighter     183    84 black         light       brown            24 male   masculine Tatooine  Human   <chr [1]> <chr [0]> <chr [1]>
10 Obi-Wan Kenobi        182    77 auburn, white fair        blue-gray        57 male   masculine Stewjon   Human   <chr [6]> <chr [1]> <chr [5]>
# … with 77 more rows
>
> StarWars <- starwars
> head(StarWars)
# A tibble: 6 x 14
  name           height  mass hair_color  skin_color  eye_color birth_year sex    gender    homeworld species films     vehicles  starships
  <chr>           <int> <dbl> <chr>       <chr>       <chr>          <dbl> <chr>  <chr>     <chr>     <chr>   <list>    <list>    <list>
1 Luke Skywalker    172    77 blond       fair        blue            19   male   masculine Tatooine  Human   <chr [5]> <chr [2]> <chr [2]>
2 C-3PO             167    75 NA          gold        yellow         112   none   masculine Tatooine  Droid   <chr [6]> <chr [0]> <chr [0]>
3 R2-D2              96    32 NA          white, blue red             33   none   masculine Naboo     Droid   <chr [7]> <chr [0]> <chr [0]>
4 Darth Vader       202   136 none        white       yellow          41.9 male   masculine Tatooine  Human   <chr [4]> <chr [0]> <chr [1]>
5 Leia Organa       150    49 brown       light       brown           19   female feminine  Alderaan  Human   <chr [5]> <chr [1]> <chr [0]>
6 Owen Lars         178   120 brown, grey light       blue            52   male   masculine Tatooine  Human   <chr [3]> <chr [0]> <chr [0]>
> help("summarize")
>
```

summarise {dplyr} R Documentation

Summarise each group to fewer rows

Description

…ut will have a single row summarising all observations in the input. It will contain one column for each grouping variable and one column for each of the summary statistics that you have specified.

`summarise()` and `summarize()` are synonyms.

Usage

```r
summarise(.data, ..., .groups = NULL)

summarize(.data, ..., .groups = NULL)
```

Arguments

`.data` A data frame, data frame extension (e.g. a tibble), or a lazy data frame (e.g. from dbplyr or dtplyr). See *Methods*, below, for more details.

Figure: 1: RStudio

Tips for Learning/Programming R

1. Keep Records

    - Don't directly type your code into the R console. Store your R code as .R, .Rmd, or .Rnw files.

    - Save your workspace to projects, go to Tools - Global Options and uncheck "Restore most recently opened project at startup" to prevent yourself from accidentally overwriting old projects.

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2. Make your Code Easy to Understand
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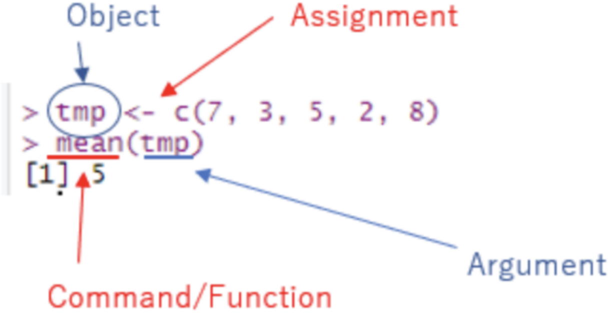
3. Practice Makes Perfect!

Glossary

- Object: Named “box”/“container” that we store values/data etc. in R
- Assignment: The process of creating/modifying objects
- Command/Function: We use a command/function to perform some tasks on an object/objects
- Argument: The definitions, directions, or objects that are passed to a command/function
- Package: A collection of functions, data, and documentations which is publicly shared to enhance the functionality of R.

Example



```
> tmp <- c(7, 3, 5, 2, 8)
> mean(tmp)
[1] 5
```

Figure: 2: Example

Today's Exercise

- Using R as a calculator.
- Object Classes/Types

Using R as a Calculator

```r
5 + 3 # summation
```

```
## [1] 8
```

```r
4 - 7 # subtration
```

```
## [1] -3
```

```r
5 * 6 # product
```

```
## [1] 30
```

```r
7 / 3 # division
```

```
## [1] 2.333333
```

Using R as a Calculator Continued

```r
7 %% 3 # modular (residual)
```

```
## [1] 1
```

```r
2 ^ 6 # power
```

```
## [1] 64
```

```r
(2 + 5) * 4 + 2 ^ 3 # note the order of calculation
```

```
## [1] 36
```

Objects

- In R, we store information as an object. Once we create an object, we can refer to it by its name.
- We assign values to an object using the assignment operator <-
    - Some R packages (tidyverse) also use the = symbol as an assignment operator, do not do this for now.
- Object class/type
    - what kind of information is stored in the object and how it is stored
    - typeof() or class() command to see the object type

Object Class/Type

- Data Types:
  - **Character**: character strings
  - **Numeric**: numbers
  - **Logical**: Boolean data (`TRUE/FALSE`)
  - *Factor*

Object Class/Type Continued

- Data Structures:
  - **Vector**: a single-dimension sequence of data of the same type
  - **Matrix**: a two-dimension sequence of data of the same type
  - **Data Frame:**: a two-dimension structure of data of varying data types
  - *List*
- In R, **Data Frames** and **Matrices** are composed of **Vectors** denoted by a $ in front of their names, thus for the data frame `starwars`, a dataset on star wars characters, the species is denoted by `starwars$species`.

Objects Example

```
# Numeric vector
num.1 <- c(4, -2, -7, 6, 8, 5, -3, 6, -4)
num.2 <- c(4, 6, 5, 2, 3)
# Character vector
program.lang <- c("R", "Python", "C", "Java")
# Logical vector
comparison <- (num.1 >= 5)
comparison
```

```
## [1] FALSE FALSE FALSE  TRUE  TRUE  TRUE FALSE  TRUE FALSE
```

Objects Example Continued

```r
# Object class/type
class(num.1)
```

```
## [1] "numeric"
```

```r
class(num.2)
```

```
## [1] "numeric"
```

```r
class(program.lang)
```

```
## [1] "character"
```

```r
class(comparison)
```

```
## [1] "logical"
```

Logical Operators

Operator	Meaning
>	greater than
<	less than
>=	greater than or equal to
<=	less than or equal to
==	equal to
!=	not equal to
|	or
&	and
is.na()	TRUE if missing
!is.na()	FALSE if missing

Logical Operators Example

```r
7 < 5
```

```
## [1] FALSE
```

```r
(6 > 4) | (8 < 5)
```

```
## [1] TRUE
```

```r
(7 > 3) & (9 <= 11)
```

```
## [1] TRUE
```

Exercises!

- Perform the following calculations:
  - 0.0098 * 0.005
  - 9 * (log(3) - $\sqrt{2}) + 7$
  - Create a vector of Star Wars characters with missing homeworlds in the star wars dataset.
  - Assign a new vector to the `starwars` data frame `'density'` composed of character `height` divided by character `mass`.