# Basic R

#### Common new users frustrations

- 1. Different versions of software
- 2. Data type problems (is that a character or a number?)
- 3. Working directory problems: trying to read files that R "can't find"
  - · RStudio can help, and so do RStudio Projects
  - discuss in Data Input/Output lecture
- 4. Typos (R is **case sensitive**, x and X are different)
  - RStudio helps with "tab completion"
  - discussed throughout

#### Explaining output on slides

In slides, a command (we'll also call them code or a code chunk) will look like this

```
print("I'm code")
[1] "I'm code"
And then directly after it, will be the output of the code.
So print("I'm code") is the code chunk and [1] "I'm code" is the output.
```

- 2 + 2
- [1] 4
- 2 \* 4
- [1] 8
- 2^3
- [1] 8

Note: when you type your command, R inherently thinks you want to print the result.

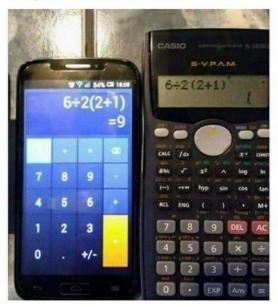
- The R console is a full calculator
- Try to play around with it:
  - +, -, /, \* are add, subtract, divide and multiply
  - ^ or \*\* is power
  - parentheses ( and ) work with order of operations
  - %% finds the remainder

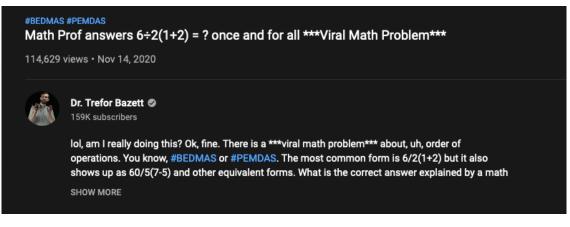
$$2 + (2 * 3)^2$$

$$(1 + 3) / 2 + 45$$

- [1] 47
- 6 / 2 \* (1 + 2)
- [1] 9

#### Why I have trust issues





Try evaluating the following:

- · 2 + 2 \* 3 / 4 -3
- . 2 \* 3 / 4 \* 2
- · 2^4 1

#### Commenting in Scripts

```
# creates a comment in R code

# this is a comment
# nothing to its right is evaluated

# this # is still a comment
### you can use many #'s as you want

1 + 2 # Can be the right of code

[1] 3
In an .Rmd file, you can write notes outside the R chunks.
```

#### Assigning values to objects

- You can create objects from within the R environment and from files on your computer
- R uses <- to assign values to an object name (you might also see = used, but this is not best practice)
- · Object names are case-sensitive, i.e. X and x are different

x <- 2 x

[1] 2

x \* 4

[1] 8

x + 2

[1] 4

#### Assigning values to objects

- The most comfortable and familiar class/data type for many of you will be data.frame
- You can think of these as essentially spreadsheets with rows (usually subjects or observations) and columns (usually variables)
- data.frames are somewhat advanced objects in R; we will start with simpler objects

#### Assigning values to objects

- Here we introduce "1 dimensional" classes; often referred to as 'vectors'
- Vectors can have multiple sets of observations, but each observation has to be the same class.
- Use the class() function to check the class of an object.

```
class(x)
[1] "numeric"

y <- "hello world!"
print(y)

[1] "hello world!"

class(y)

[1] "character"</pre>
```

# Simple object practice

Try assigning your full name to an R object called name

## Simple object practice

Try assigning your full name to an R object called name

```
name <- "Ava Hoffman" name
```

[1] "Ava Hoffman"

#### The 'combine' function c()

The function **c()** collects/combines/joins single R objects into a vector of R objects. It is mostly used for creating vectors of numbers, character strings, and other data types.

```
x <- c(1, 4, 6, 8)
x

[1] 1 4 6 8
class(x)
[1] "numeric"</pre>
```

## The 'combine' function c()

Try assigning your first and last name as 2 separate character strings into a single vector called name2

#### The 'combine' function c()

Try assigning your first and last name as 2 separate character strings into a length-2 vector called name2

```
name2 <- c("Ava", "Hoffman")
name2
[1] "Ava" "Hoffman"</pre>
```

#### Arguments inside R functions

- The contents you give to an R function are called "arguments"
- · Here, R assumes all arguments should be objects contained in the vector
- We will talk more about arguments as we use more complicated functions!

#### length of R objects

length(): Get or set the length of vectors (including lists) and factors, and of any other R object for which a method has been defined.

```
length(x)
[1] 4
y
[1] "hello world!"
length(y)
[1] 1
```

## length of R objects

What do you expect for the length of the name object? What about the name2 object?

What are the lengths of each?

#### length of R objects

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What are the lengths of each?

length(name)

[1] 1

length(name2)

[1] 2

#### Math + vector objects

You can perform functions to entire vectors of numbers very easily.

```
x + 2
[1] 3 6 8 10
x * 3
[1] 3 12 18 24
x + c(1, 2, 3, 4)
[1] 2 6 9 12
```

# Lab Part 1

Lab

#### Math + vector objects

But things like algebra can only be performed on numbers.

name2 + 4

Error in name2 + 4: non-numeric argument to binary operator

#### Reassigning to a new object

Save these modified vectors as a new vector called y.

Note that the R object y is no longer "hello world!" - It has been overwritten by assigning new data to the same name.

#### Reassigning to a new object

Reassigning allows you to make changes "in place"

```
# results not stored:

x + c(1, 2, 3, 4)

# x remains unchanged, results stored in `y`:

y <- x + c(1, 2, 3, 4)

# replace `x` in place

x <- x + c(1, 2, 3, 4)
```

#### R objects

You can get more attributes than just class. The function str() gives you the structure of the object.

```
str(x)

num [1:4] 1 4 6 8

str(y)

num [1:4] 2 6 9 12
```

This tells you that x is a numeric vector and tells you the length.

## R objects

This is handy when we start dealing with bigger / more complex objects.

```
str(z)
num [1:100] 9 12 9 9 2 6 2 6 6 9 ...
```

## Lab Part 2

Lab

#### Useful functions to create vectors seq()

For numeric: seq() can be very useful- both integer and double.

The from argument says what number to start on.

The to argument says what number to not go above.

The by argument says how much to increment by.

The length.out argument says how long the vector should be overall.

```
seq(from = 0, to = 1, by = 0.2)
[1] 0.0 0.2 0.4 0.6 0.8 1.0
seq(from = 0, to = 10, by = 1)
[1] 0 1 2 3 4 5 6 7 8 9 10
seq(from = -5, to = 5, length.out = 10)
[1] -5.00000000 -3.8888889 -2.7777778 -1.6666667 -0.5555556 0.5555556
[7] 1.6666667 2.7777778 3.8888889 5.00000000
```

#### Useful functions to create vectors rep()

For character: rep() can create very long vectors. Works for creating character and numeric vectors.

The each argument specifies how many of each item you want repeated. The times argument specifies how many times you want the vector repeated.

```
rep(WHAT_TO_REPEAT, arguments)

rep(c("black", "white"), each = 3)

[1] "black" "black" "black" "white" "white" "white"

rep(c("black", "white"), times = 3)

[1] "black" "white" "black" "white" "black" "white"

rep(c("black", "white"), each = 2, times = 2)

[1] "black" "black" "white" "white" "black" "black" "white"
```

#### Creating numeric vectors sample()

You can use the sample() function to make a random sequence. The x argument specifies what you are sampling from. The size argument specifies how many values there should be. The replace argument specifies if values should be replaced or not.

```
seq_hun < - seq(from = 0, to = 100, by = 1)
seq_hun
                                                   10
                                                            12
                                                                13
                                                                     14
                                                                         15
                                                                             16
                                                                                  17
  [1]
                                  6
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  19]
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  731
                                                            84
 [91]
       90
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                92
                    93
                         94
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                                 96
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                                          98
                                               99 100
y < - sample(x = seq_hun, size = 5, replace = TRUE)
У
[1] 84 84 31 76 16
```

#### Summary

- R functions as a calculator
- Use <- to save (assign) values to objects</li>
- Use c() to combine vectors
- length(), class(), and str() tell you information about an object
- The sequence seq() function helps you create numeric vectors (from, to, by, and length.out arguments)
- The repeat rep() function helps you create vectors with the each and times arguments
- sample() makes random vectors
- Class Website
- Basic R Lab