

Variables

Basic R

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Getting Started

- ▶ You should have the latest version of R installed!
- ▶ Open R Studio
- ▶ Files -> New -> R Script
- ▶ Save the blank R script as “day1.R” in a directory of your choosing
- ▶ Add a comment header

Commenting in Scripts

Add a comment header to day1.R :# is the comment symbol

```
#####  
# Title: Demo R Script  
# Author: Andrew Jaffe  
# Date: 6/15/2015  
# Purpose: Demonstrate comments in R  
#####  
  
# nothing to its right is evaluated  
  
# this # is still a comment  
### you can use many #'s as you want  
  
# sometimes you have a really long comment,  
#   like explaining what you are doing  
#   for a step in analysis.  
# Take it to another line
```

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.

R as a calculator

```
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.

R as a calculator

- ▶ 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

R as a calculator

```
2 + (2 * 3)^2
```

```
[1] 38
```

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

```
[1] 47
```

R as a calculator

Try evaluating the following:

▶ $2 + 2 * 3 / 4 - 3$

▶ $2 * 3 / 4 * 2$

▶ $2^4 - 1$

- ▶ You can create variables from within the R environment and from files on your computer
- ▶ R uses “=” or “<-” to assign values to a variable name
- ▶ Variable names are case-sensitive, i.e. X and x are different

```
x = 2 # Same as: x <- 2  
x
```

```
[1] 2
```

```
x * 4
```

```
[1] 8
```

```
x + 2
```

```
[1] 4
```

R variables

- ▶ The most comfortable and familiar class/data type for many of you will be `data.frame`
- ▶ You can think of these as essentially Excel spreadsheets with rows (usually subjects or observations) and columns (usually variables)
- ▶ Go to RStudio -> Tools -> Import Dataset -> From Web URL then paste

`http://www.aejaffe.com/summerR_2015/data/Charm_City_Circulator_Ridership.csv`

R variables

- We can display the top of the data with head:

```
head(Charm_City_Circulator_Ridership)
```

	day	date	orangeBoardings	orangeAlightings	orangeAverage	purpleBoardings	purpleAlightings	purpleAverage	greenBoardings	greenAlightings	greenAverage
1	Monday	01/11/2010	877	1027	952	NA	NA	NA	NA	NA	NA
2	Tuesday	01/12/2010	777	815	796	NA	NA	NA	NA	NA	NA
3	Wednesday	01/13/2010	1203	1220	1211	NA	NA	NA	NA	NA	NA
4	Thursday	01/14/2010	1194	1233	1213	NA	NA	NA	NA	NA	NA
5	Friday	01/15/2010	1645	1643	1644	NA	NA	NA	NA	NA	NA
6	Saturday	01/16/2010	1457	1524	1490	NA	NA	NA	NA	NA	NA

R variables

- ▶ `data.frames` are somewhat advanced objects in R; we will start with simpler objects;
- ▶ Here we introduce “1 dimensional” classes; these are often referred to as ‘vectors’
- ▶ Vectors can have multiple sets of observations, but each observation has to be the same class.

```
class(x)
```

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

```
y = "hello world!"  
print(y)
```

```
[1] "hello world!"
```

```
class(y)
```

R variables

Try assigning your full name to an R variable called `name`

R variables

Try assigning your full name to an R variable called `name`

```
name = "Andrew Jaffe"  
name
```

```
[1] "Andrew Jaffe"
```

The 'combine' function

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"
```

The 'combine' function

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

The 'combine' function

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

```
name2 = c("Andrew", "Jaffe")  
name2
```

```
[1] "Andrew" "Jaffe"
```

R variables

`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
```

R variables

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

What are the lengths of each?

R variables

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

What are the lengths of each?

```
length(name)
```

```
[1] 1
```

```
length(name2)
```

```
[1] 2
```

R variables

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
```

R variables

But things like algebra can only be performed on numbers.

```
> name2 + 4  
[1] Error in name2 * 4 : non-numeric argument  
to binary operator
```

R variables

And save these modified vectors as a new vector.

```
y = x + c(1, 2, 3, 4)  
y
```

```
[1]  2  6  9 12
```

Note that the R object `y` is no longer “Hello World!” - It has effectively been overwritten by assigning new data to the variable

R variables

- ▶ 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.

Basic Summarization

Here are some simple functions for making calculations on data.

`sum()`: takes the sum of all numeric variables in a vector

`mean()`: takes the mean of all numeric variables in a vector

`median()`: takes the median of all numeric variables in a vector

Back to our data.frame example

- Let's see what the structure of our data.frame is:

```
str(Charm_City_Circulator_Ridership)
```

```
'data.frame':    1146 obs. of  15 variables:
 $ day          : Factor w/ 7 levels "Friday","Monday",...
 $ date         : Factor w/ 1146 levels "01/01/2011","01/02/2011",...
 $ orangeBoardings : int  877 777 1203 1194 1645 1457 839 9...
 $ orangeAlightings: int  1027 815 1220 1233 1643 1524 938 9...
 $ orangeAverage   : num  952 796 1212 1214 1644 ...
 $ purpleBoardings : int  NA NA NA NA NA NA NA NA NA NA NA ...
 $ purpleAlightings: int  NA NA NA NA NA NA NA NA NA NA NA ...
 $ purpleAverage   : num  NA NA NA NA NA NA NA NA NA NA NA ...
 $ greenBoardings  : int  NA NA NA NA NA NA NA NA NA NA NA ...
 $ greenAlightings : int  NA NA NA NA NA NA NA NA NA NA NA ...
 $ greenAverage    : num  NA NA NA NA NA NA NA NA NA NA NA ...
 $ bannerBoardings : int  NA NA NA NA NA NA NA NA NA NA NA ...
 $ bannerAlightings: int  NA NA NA NA NA NA NA NA NA NA NA ...
```

Review

- ▶ Creating a new script
- ▶ Using R as a calculator
- ▶ Assigning values to variables
- ▶ Performing algebra on numeric variables