Welcome!

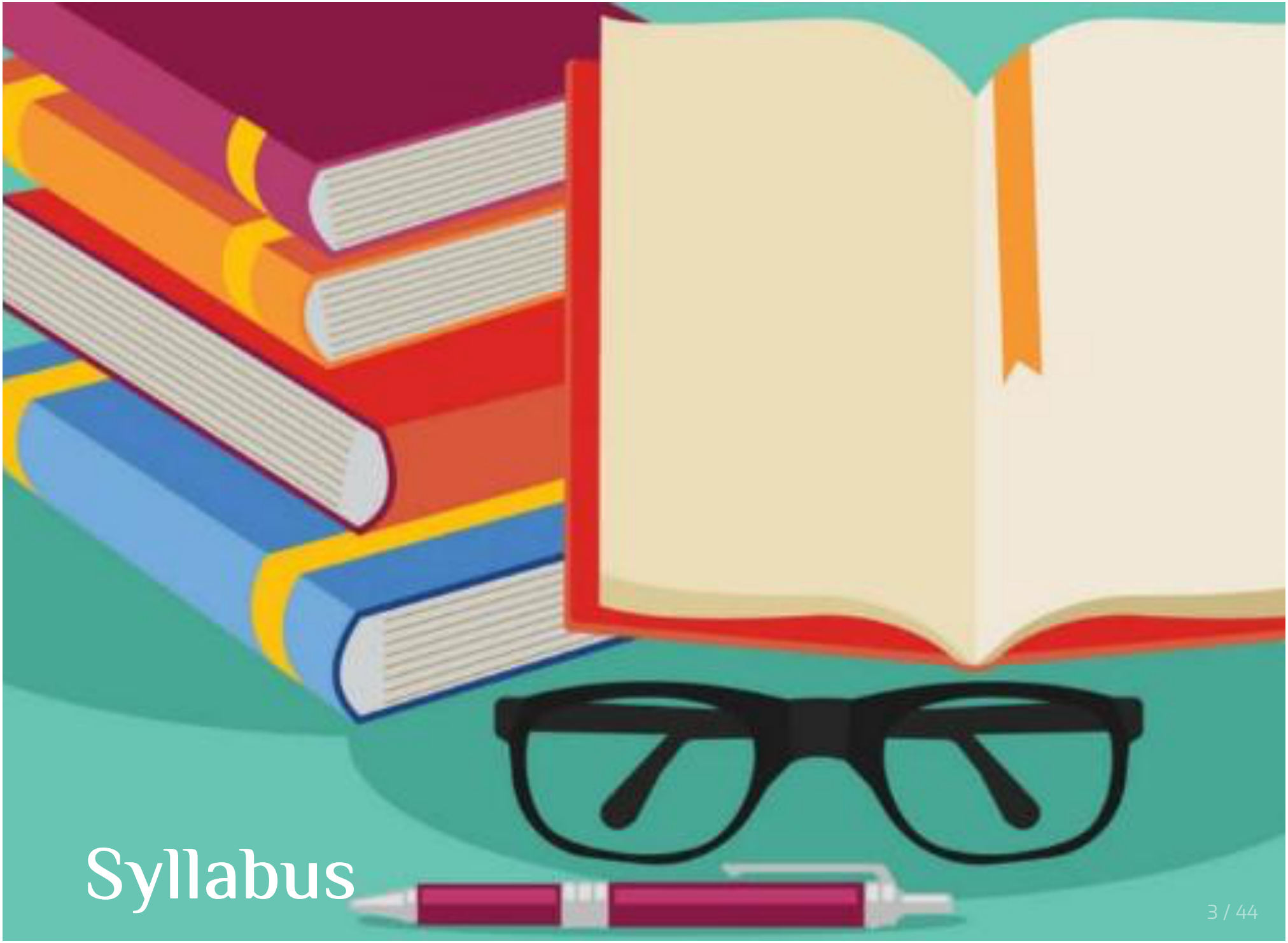
An overview of the course

Daniel Anderson
Week 1, Class 1

UNIVERSITY OF
OREGON

Agenda

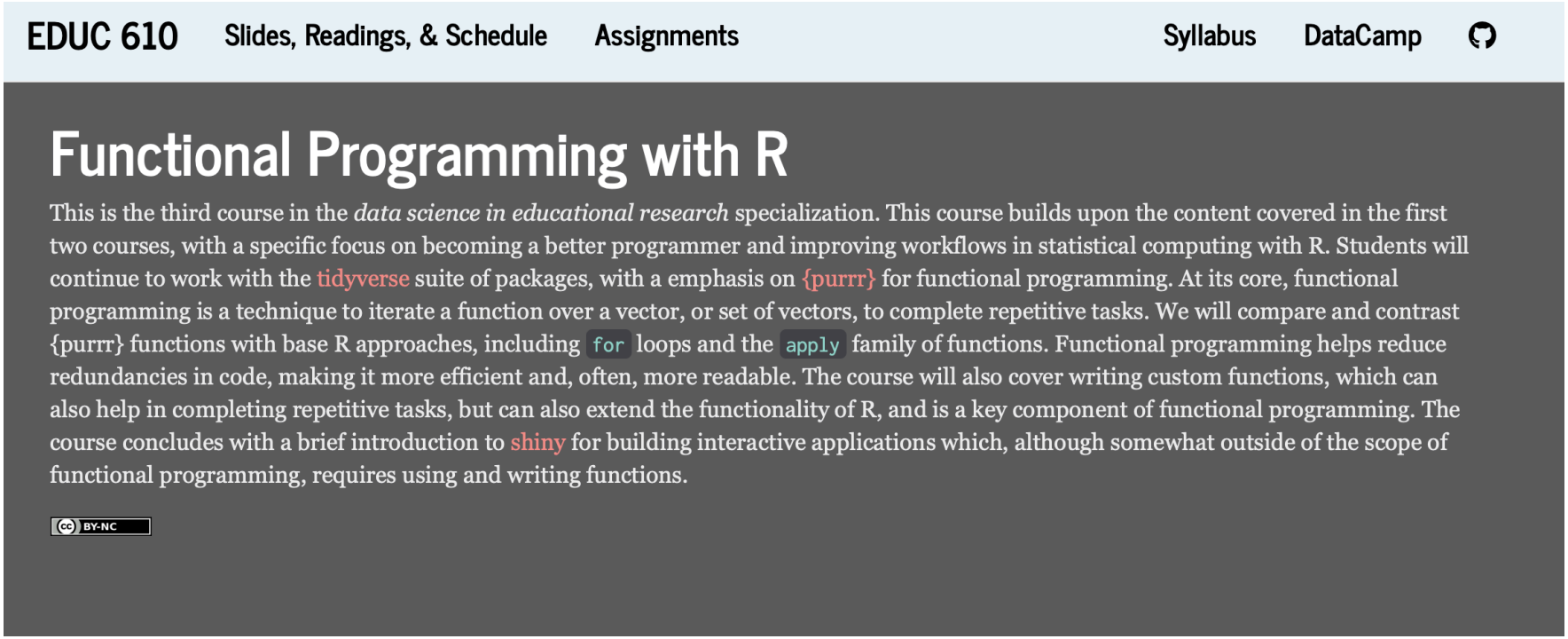
- Getting on the same page
- Syllabus
- Intro to data types



Syllabus

Course Website(s)

website repo



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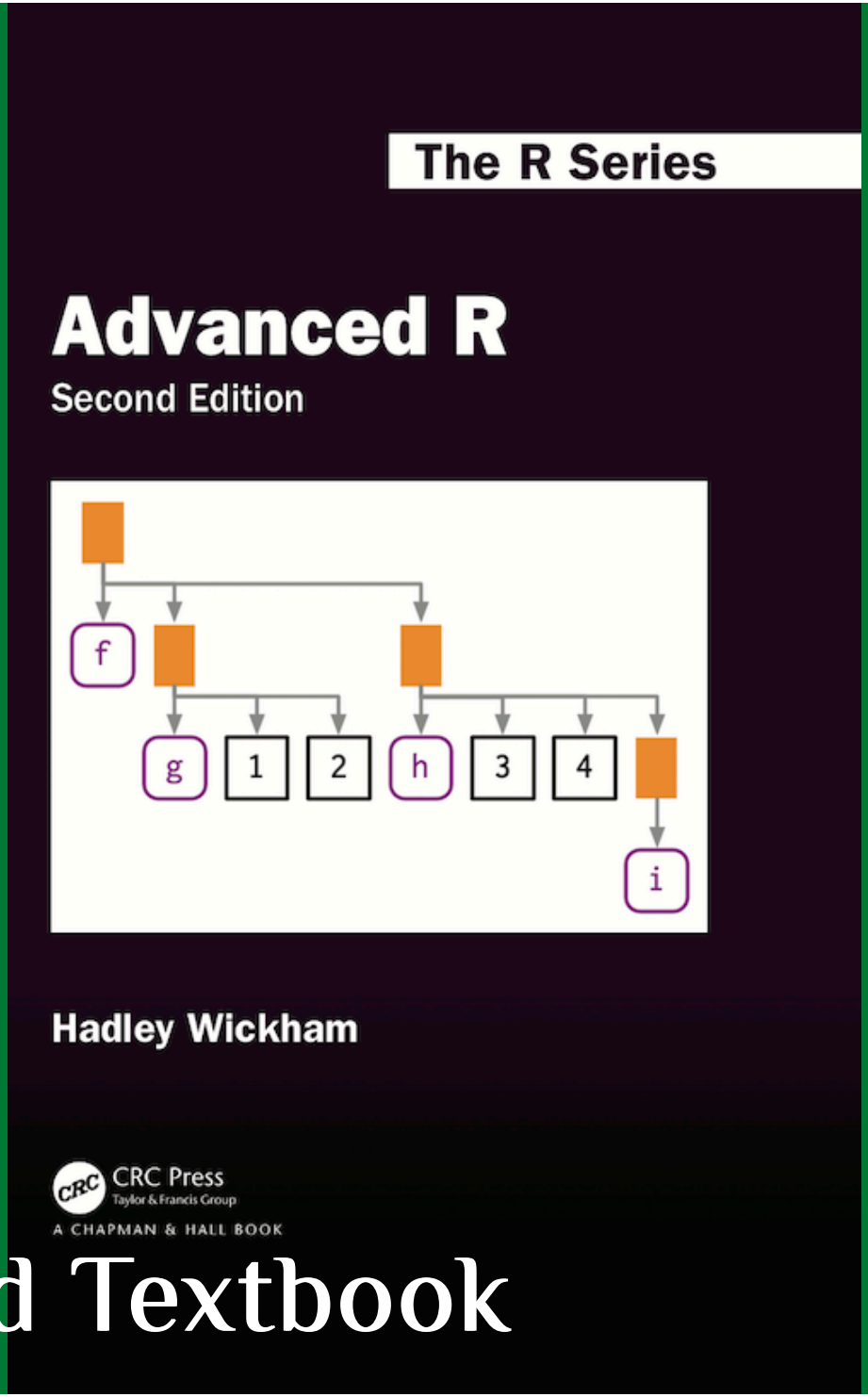
- Understand elements of good functions, and things to avoid
- Write effective and clear functions to continue with the mantra of "Don't Repeat Yourself"

This Week's learning objectives

- Understand the requirements of the course
- Understand the requirements of the final project

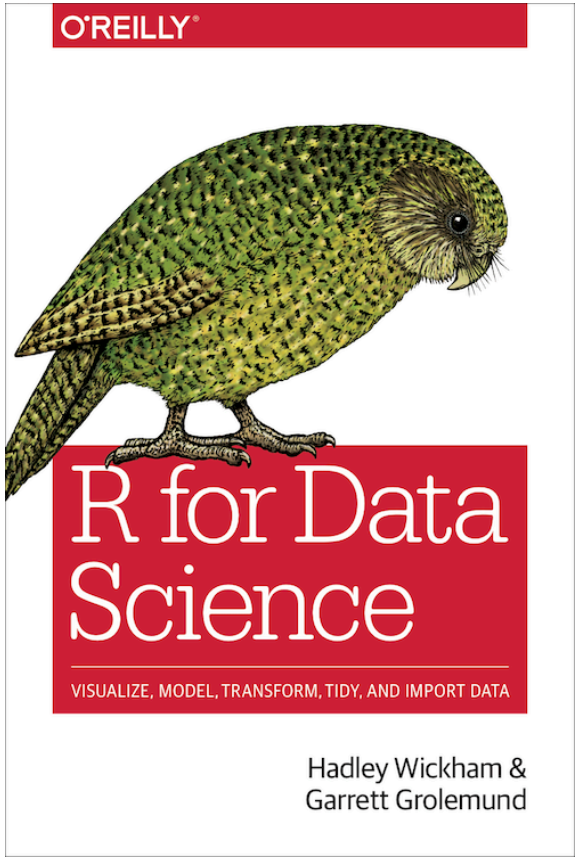


Required Textbook

Other books (also free)

Bryan (http://happygitwithr.com)

Wickham & Grolemund (https://r4ds.had.co.nz)



Structure of the course

- First 5 weeks - mostly iteration
    - Data types
    - Base R iterations
    - {purrr}
    - Batching processes and working with list columns
    - Parallel iterations (and a few extras)

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- Second 5 weeks - mostly writing functions
    - Writing functions 1
    - Writing functions 2
    - Shiny 1
    - Shiny 2
    - Code performance & packages (briefly)

Labs

16%

4 @ 10 points each

Two labs during each 5 week segment

- Iteration w/Base R
  - Mostly `for` loops
- Iteration w/{purrr}
  - Mostly `map_*`
- Writing functions 1
  - Basic functions
- Writing functions 2
  - Making functions "pure"
  - Building up functionality (one function calling another)

DataCamp

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One required module (10 points)

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One module available for extra credit (5 points)

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Split by 5 week sections

Must complete one (due dates differ by section)

If you want the extra credit, one must come from each section

First 5 week DataCamp courses

Due by 11:59 PM, 5/6/19

- Intermediate R
- Foundations of functional programming with purrr
- Intermediate functional programming with purrr
- Machine learning in the tidyverse

Second 5 week DataCamp courses

Due by 11:59 PM, 6/12/19

- Writing functions in R
- Building web applications in R with Shiny
- Building web applications in R with Shiny: Case studies
- Developing R packages
- Writing efficient R code

Midterm

50 points (20%)

- Final format still yet to be determined - happy to take input on what it should look like

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- **Will** include you writing new code
- **May** include you
  - Identifying bugs in code
  - Automating an existing approach
  - Multiple choice/fill-in the blank questions

Final Project

150 points total (60%)

5 parts

Component	Points	Due
Groups Finalized	0	4/10/19
Outline	10	5/1/19
Draft	20	5/27/19
Peer review	20	6/3/19
Product	100	6/12/19 (11:59 pm)

What is it?

Two basic options

What is it?

Two basic options

Data Product

Similar to first class

- Brief research manuscript (can be APA or not, I don't really care 🤷‍♀️)
- Shiny app
- Dashboard
    - Probably unlikely to work well though, unless you make it a shiny dashboard
- Blog post
- For the ambitious - a documented R package

Tutorial

- Probably best done through a blog post or series of blog posts
- Approach as if you're teaching others about the content I'll ask you to cover
- BONUS: You can actually release the blog post(s) and may get some traffic 🎉👏🥳


Make it your own

What you have to have

- Everything on GitHub
- Publicly available dataset
- Team of 2-4

What you have to cover

Unfortunately, this still is a class assignment. I have to be able to evaluate that you can actually apply the content within a messy, real-world setting.

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The grading criteria (which follow) may force you into some use cases that are a bit artificial. This is okay.

Grading criteria

- No code is used repetitively (no more than twice) 10 points

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  10 points
- At least one use case of `purrr::nest %>% mutate()` 10 points

- At least two custom functions 20 points; 10 points each
  - Each function must be "pure" unless it is clear that it should have side effects (e.g., a plotting function)
  - Each function must do exactly one thing
  - The functions **may** replicate the behavior of a base function - as noted above this is about practicing the skills you learn in class

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- Code is fully reproducible and housed on GitHub 10 points
- No obvious errors in chosen output format 10 points
- Deployed on the web and shareable through a link 10 points

Outline

Due 5/1/19

Four components:

- Description of data source (must be publicly available)
- Purpose (tutorial or substantive)
- Chosen format
- Lingering questions
    - How can I help?

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Due 5/1/19

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- Lingering questions
    - How can I help?

Please include all components - including the question(s) section!

Draft

Due 5/27/19, before class

- Expected to still be a work in progress
    - This means some of your code may be rough and/or incomplete. However:
- Direction should be obvious
- Most, if not all, grading elements should be present
- Provided to your peers so they can learn from you as much as you can learn from their feedback

Peer Review

- Exact same process we've used before
- It has always gone very well - let's keep it going
- If, during your peer review, you find grading elements not present, definitely note them

Utilizing GitHub (required)

- You'll be assigned two groups to review (10 points each)
- Fork their repo
- Embed comments, suggest changes to their code
- Submit a PR
    - Summarize your overall review in the PR
- I WILL cover this this term, barring a tornado or similar

Grading

250 points total

- 4 labs at 10 points each (40 points; 16%)
- 1 DataCamp modules (10 points; 4%)
- Midterm (50 points; 20%)
- Final Project (150 points; 60%)
  - Proposal (10 points; 4%)
  - Draft (20 points; 8%)
  - Peer review (20 points; 8%)
  - Product (100 points; 40%)

Grading

Lower percent	Lower point range	Grade	Upper point range	Upper percent
0.97	(242 pts)	A+	(250 pts)	
0.93	(232 pts)	A	(242 pts)	0.97
0.90	(225 pts)	A-	(232 pts)	0.93
0.87	(218 pts)	B+	(225 pts)	0.90
0.83	(208 pts)	B	(218 pts)	0.87
0.80	(200 pts)	B-	(208 pts)	0.83
0.77	(192 pts)	C+	(200 pts)	0.80
0.73	(182 pts)	C	(192 pts)	0.77
0.70	(175 pts)	C-	(182 pts)	0.73
		F	(175 pts)	0.70


COMMUNICATION

Missing class

I will be out Monday next week

- Trying to get a guest speaker
- May end up having to adjust the schedule a bit

Any time left?

Any time left?

Basic data types

Vectors

Pop quiz

Discuss with your neighbor

- What are the four basic types of atomic vectors?
- What function creates a vector?
- T/F: A list (an R list) is not a vector.
- What is the fundamental difference between a matrix and a data frame?
- What does *coercion* mean, and when does it come into play?

Vector types

4 basic types

Note there are two others (complex and raw), but we don't care about them (I've never even seen them used).

- Integer
- Double
- Logical
- Character

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- Integer
- Double
- Logical
- Character

Integer and double vectors are both numeric.

Creating vectors

Vectors are created with `c`. Below are examples of each of the four main types of vectors.

```
integer <- c(5L, 7L, 3L, 94L) # L explicitly an integer, not double
double <- c(3.27, 8.41, Inf, -Inf)
logical <- c(TRUE, TRUE, TRUE, FALSE, TRUE, FALSE, FALSE)
character <- c("red", "orange", "yellow", "green", "blue", "violet", "rainbo
```

Coercion

- Vectors **must** be of the same type.
- If you try to mix types, implicit coercion will occur
- Implicit coercion defaults to the most flexible type
    - which is... ?

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```
c(7L, 3.25)
```

```
## [1] 7.00 3.25
```

```
c(3.24, TRUE, "April")
```

```
## [1] "3.24"  "TRUE"  "April"
```

```
c(TRUE, 5)
```

```
## [1] 1 5
```

Explicit coercion

- You can alternatively define the coercion to occur

```
as.integer(c(7L, 3.25))
```

```
## [1] 7 3
```

```
as.logical(c(3.24, TRUE, "April"))
```

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

```
as.character(c(TRUE, 5))
```

```
## [1] "1" "5"
```

Checking types

- Use `typeof` to verify the type of vector

```
typeof(c(7L, 3.25))
```

```
## [1] "double"
```

```
typeof(as.integer(c(7L, 3.25)))
```

```
## [1] "integer"
```

Piping

- Although traditionally used within the tidyverse (not what we're doing here), it can still be useful. The following are equivalent

```
library(magrittr)

typeof(as.integer(c(7L, 3.25)))
```

```
## [1] "integer"
```

```
c(7L, 3.25) %>%
  as.integer() %>%
  typeof()
```

```
## [1] "integer"
```

Pop quiz

Without actually running the code, talk with your neighbor: Which will each of the following coerce to?

```
c(1.25, TRUE, 4L)
c(1L, FALSE)
c(7L, 6.23, "eight")
c(TRUE, 1L, 0L, "False")
```

Answers

```
typeof(c(1.25, TRUE, 4L))
```

```
## [1] "double"
```

```
typeof(c(1L, FALSE))
```

```
## [1] "integer"
```

```
typeof(c(7L, 6.23, "eight"))
```

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

```
typeof(c(TRUE, 1L, 0L, "False"))
```

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

Missing values

- Missing values breed missing values

```
NA > 5
```

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

```
NA * 7
```

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

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```
NA > 5
```

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

```
NA * 7
```

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

- But this one may surprise you

```
NA == NA
```

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

Missing values

- Missing values breed missing values

```
NA > 5
```

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

```
NA * 7
```

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

- But this one may surprise you

```
NA == NA
```

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

It is correct, however, because there's no reason to presume that one missing value is equal to another missing value.

When missing values don't propagate

```
NA & FALSE
```

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

```
NA | TRUE
```

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

```
x <- c(NA, 3, NA, 5)
any(x > 4)
```

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

How to test missingness?

- We've already seen the following doesn't work

```
x == NA
```

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

How to test missingness?

- We've already seen the following doesn't work

```
x == NA
```

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

- Instead, use `is.na`

```
is.na(x)
```

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

Next time

- More on data types
  - Subsetting
  - Attributes
  - More on coercion (good to be fluent)
- Lists

Any lingering questions?