🔨 Tools for Integrating Data Science in the Statistics Classroom

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August 6, 2022

you...

- know R
- are familiar with R Markdown
- are interested in integrating R into your course(s)

Tools

1. RStudio Cloud
2. learnr Tutorials

https://bit.ly/ptt2022-tools4ds

RStudio Cloud

Lots of Friction

- Install R
- Install RStudio
- Install the following packages: rmarkdown, tidyverse, ...
- Load these packages
- Install git
- Install MiKteX

Less Friction

- Go to rstudio.cloud
- Log in

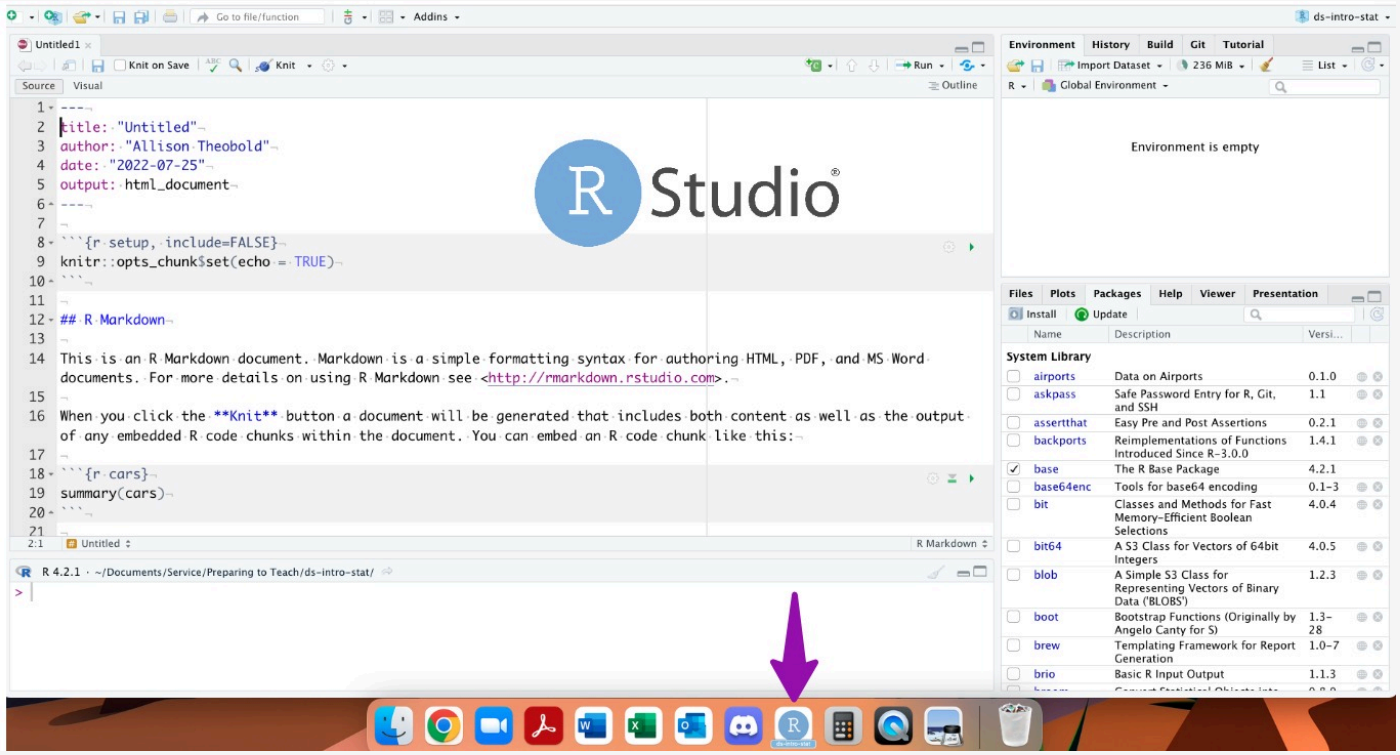
```
> hello R!
```

tl;dr

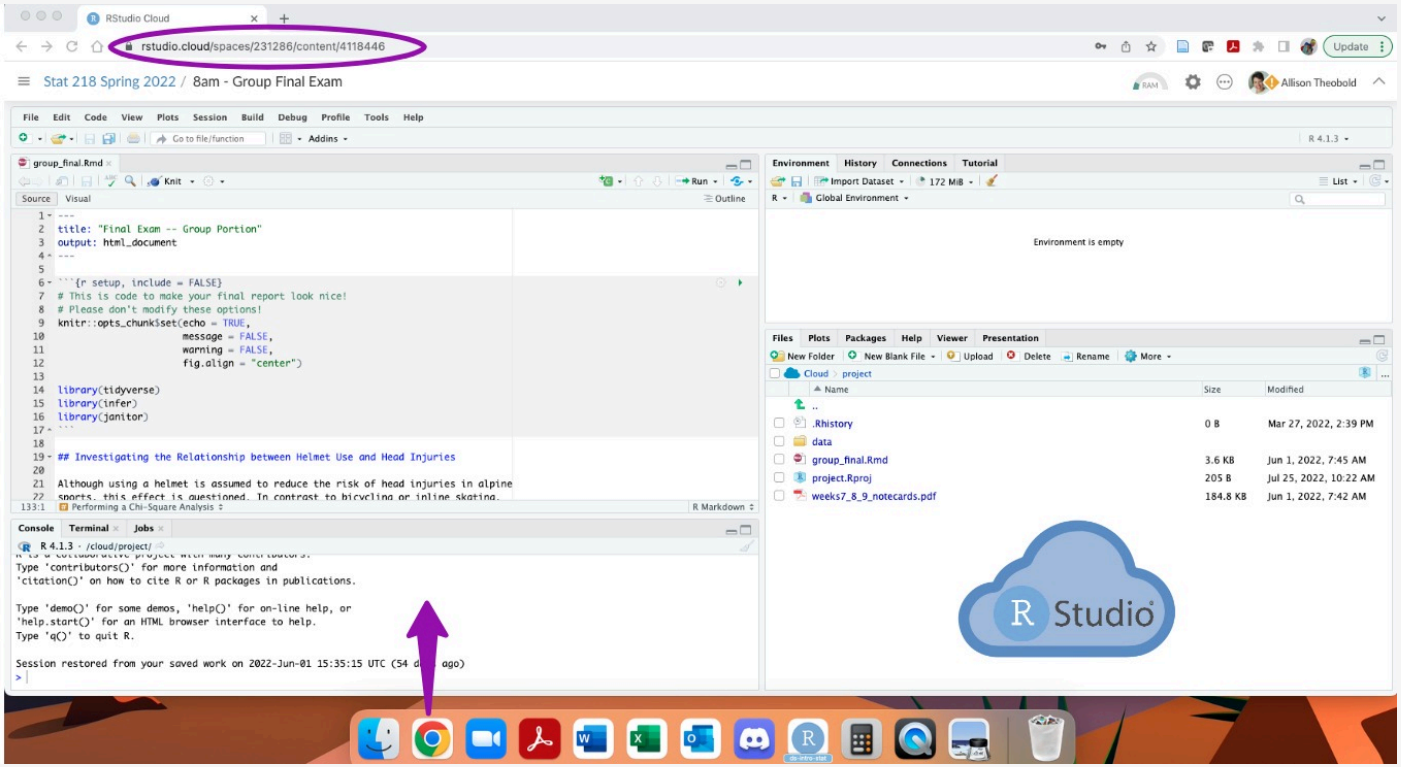
* Çetinkaya-Rundel, Mine. "Teaching R online with RStudio Cloud." RStudio Webinar.

What is RStudio Cloud?

We created **RStudio Cloud** to make it easy for professionals, hobbyists, trainers, teachers, and students to do, share, teach, and learn data science using R.


Untitled1
Knit on Save
Knit
Run
Source
Visual
Outline
---
title: "Untitled"
author: "Allison Theobold"
date: "2022-07-25"
output: html_document

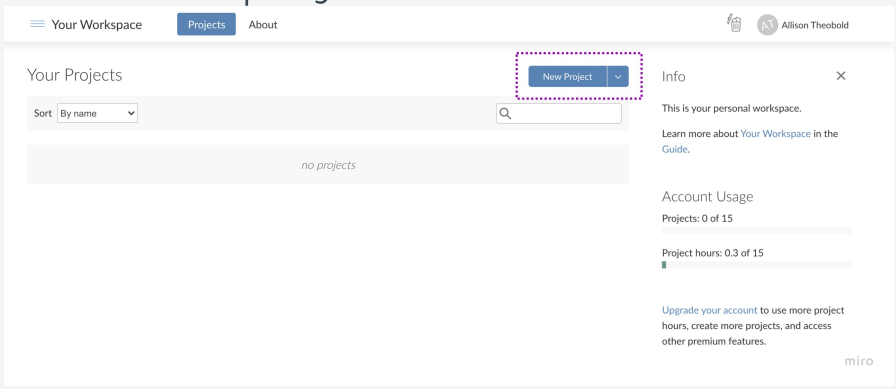
```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)
```
R Markdown
This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.
When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:
```{r cars}
summary(cars)
```
Untitled
R Markdown
R 4.2.1 · ~/Documents/Service/Preparing to Teach/ds-intro-stat/
>
R Studio
Environment
History
Build
Git
Tutorial
Import Dataset
236 MiB
List
R
Global Environment
Environment is empty
Files
Plots
Packages
Help
Viewer
Presentation
Install
Update
Name
Description
Versi...
System Library
airports
Data on Airports
0.1.0
askpass
Safe Password Entry for R, Git, and SSH
1.1
assertthat
Easy Pre and Post Assertions
0.2.1
backports
Reimplementations of Functions Introduced Since R-3.0.0
1.4.1
base
The R Base Package
4.2.1
base64enc
Tools for base64 encoding
0.1-3
bit
Classes and Methods for Fast Memory-Efficient Boolean Selections
4.0.4
bit64
A S3 Class for Vectors of 64bit Integers
4.0.5
blob
A Simple S3 Class for Representing Vectors of Binary Data ('BLOBS')
1.2.3
boot
Bootstrap Functions (Originally by Angelo Canty for S)
1.3-28
brew
Templating Framework for Report Generation
1.0-7
brio
Basic R Input Output
1.1.3



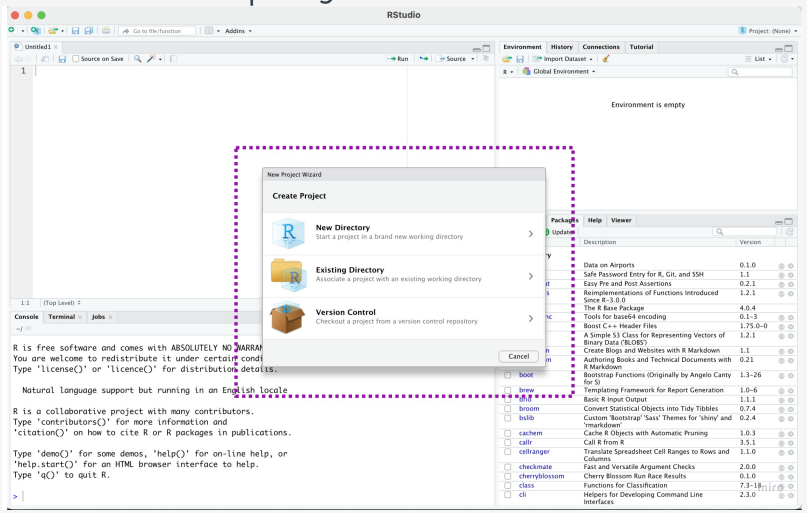
https://bit.ly/ptt2022-tools4ds

Projects

A new project in RStudio Cloud

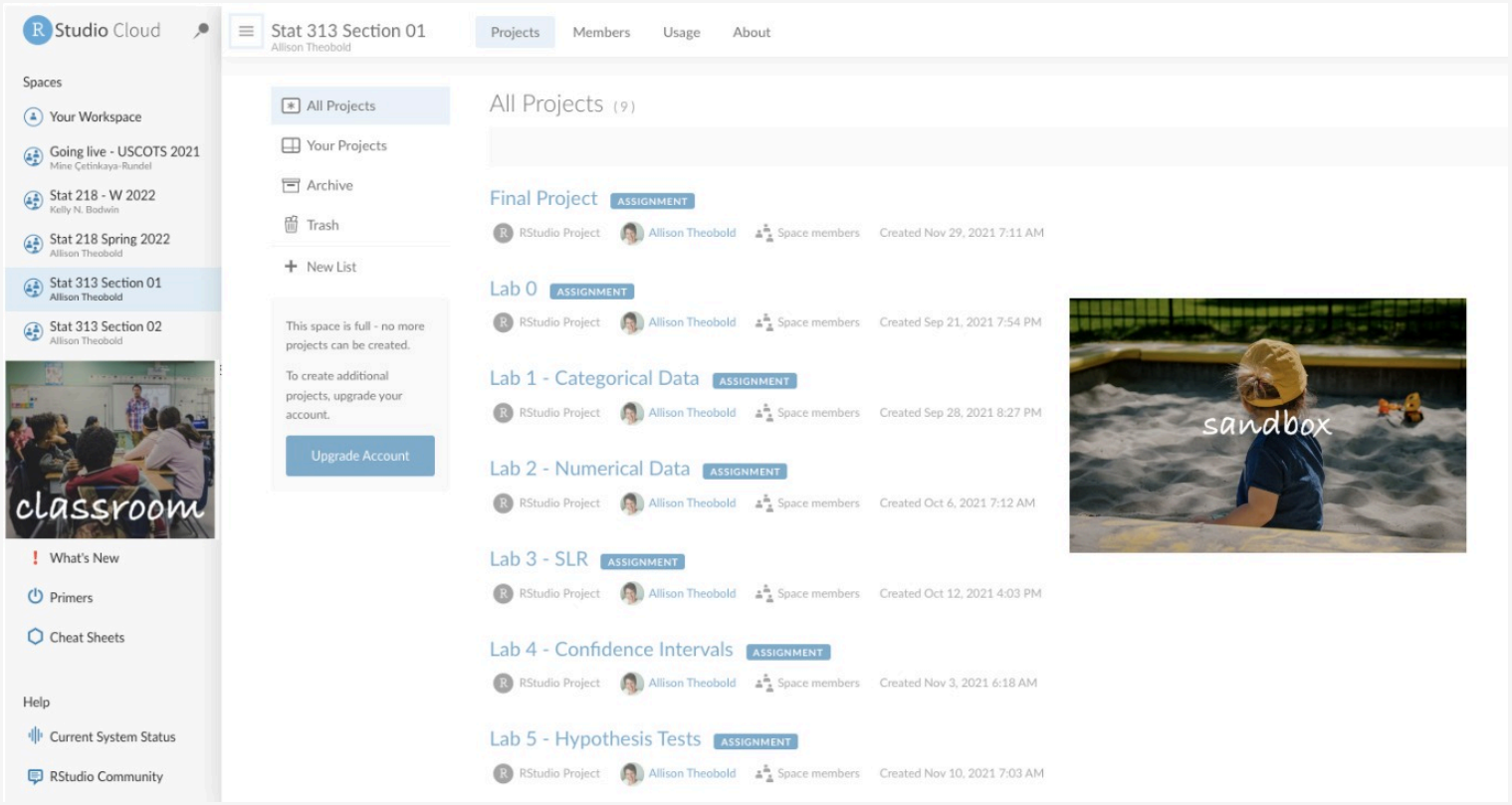


is a new project in RStudio IDE



PSA: If you use RStudio, use projects! Trust me, you won't regret it.

Workspaces


Studio Cloud
Stat 313 Section 01
Allison Theobold
Projects
Members
Usage
About
Spaces
Your Workspace
Going live - USCOTS 2021
Mine Çetinkaya-Rundel
Stat 218 - W 2022
Kelly N. Bodwin
Stat 218 Spring 2022
Allison Theobold
Stat 313 Section 01
Allison Theobold
Stat 313 Section 02
Allison Theobold
classroom
What's New
Primers
Cheat Sheets
Help
Current System Status
RStudio Community
All Projects
Your Projects
Archive
Trash
New List
This space is full - no more projects can be created.
To create additional projects, upgrade your account.
Upgrade Account
All Projects (9)
Final Project ASSIGNMENT
RStudio Project Allison Theobold Space members Created Nov 29, 2021 7:11 AM
Lab 0 ASSIGNMENT
RStudio Project Allison Theobold Space members Created Sep 21, 2021 7:54 PM
Lab 1 - Categorical Data ASSIGNMENT
RStudio Project Allison Theobold Space members Created Sep 28, 2021 8:27 PM
Lab 2 - Numerical Data ASSIGNMENT
RStudio Project Allison Theobold Space members Created Oct 6, 2021 7:12 AM
Lab 3 - SLR ASSIGNMENT
RStudio Project Allison Theobold Space members Created Oct 12, 2021 4:03 PM
Lab 4 - Confidence Intervals ASSIGNMENT
RStudio Project Allison Theobold Space members Created Nov 3, 2021 6:18 AM
Lab 5 - Hypothesis Tests ASSIGNMENT
RStudio Project Allison Theobold Space members Created Nov 10, 2021 7:03 AM
sandbox

Sharing Options

Option 1: Share a single project

Option 2: Share a workspace (presumably with many projects)

Sharing a Single Project

Good!

- Students land directly in a project upon login
- Works well for workshops where all work will be completed in a single project
- Also great for sharing code in general, e.g. collaboration, reprexes, etc.

Not so good...

- Students need to remember to make a copy of the project (which means you need to remember to remind them!)
- You can't keep track which students started their assignment
- You can't easily peek into student projects -- they would need to explicitly share the project with you

Sharing a Workspace

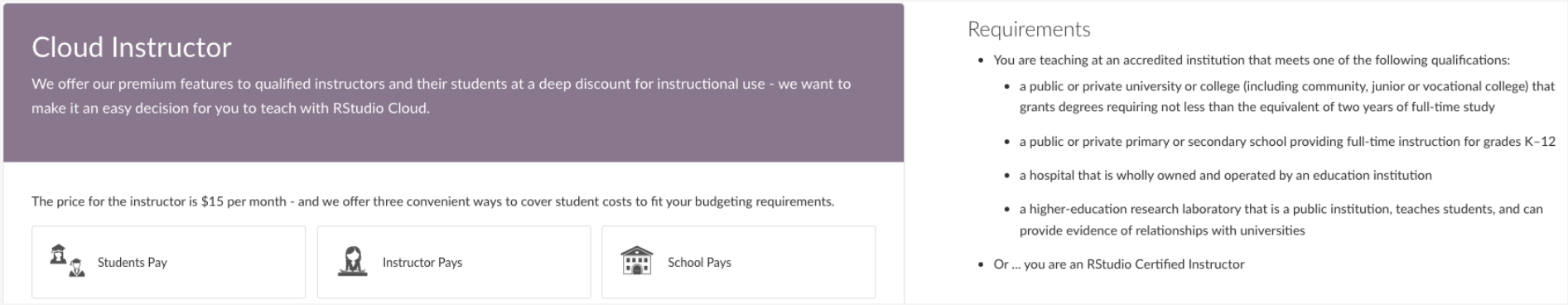
Good!

- Base projects with desired packages installed
- Assignments -- no more "make a copy of the project before starting work"
- Collaborate with students *inside* their projects

Not so good...

- Students land in the workspace, may need to provide instructions for the next steps
- Git config for each project can get tedious and doesn't reflect realistic practice

Q: How do I access RStudio Cloud?



Cloud Instructor

We offer our premium features to qualified instructors and their students at a deep discount for instructional use - we want to make it an easy decision for you to teach with RStudio Cloud.

The price for the instructor is $15 per month - and we offer three convenient ways to cover student costs to fit your budgeting requirements.

Students Pay

Instructor Pays

School Pays

Requirements

- You are teaching at an accredited institution that meets one of the following qualifications:
  - a public or private university or college (including community, junior or vocational college) that grants degrees requiring not less than the equivalent of two years of full-time study
  - a public or private primary or secondary school providing full-time instruction for grades K–12
  - a hospital that is wholly owned and operated by an education institution
  - a higher-education research laboratory that is a public institution, teaches students, and can provide evidence of relationships with universities
- Or ... you are an RStudio Certified Instructor

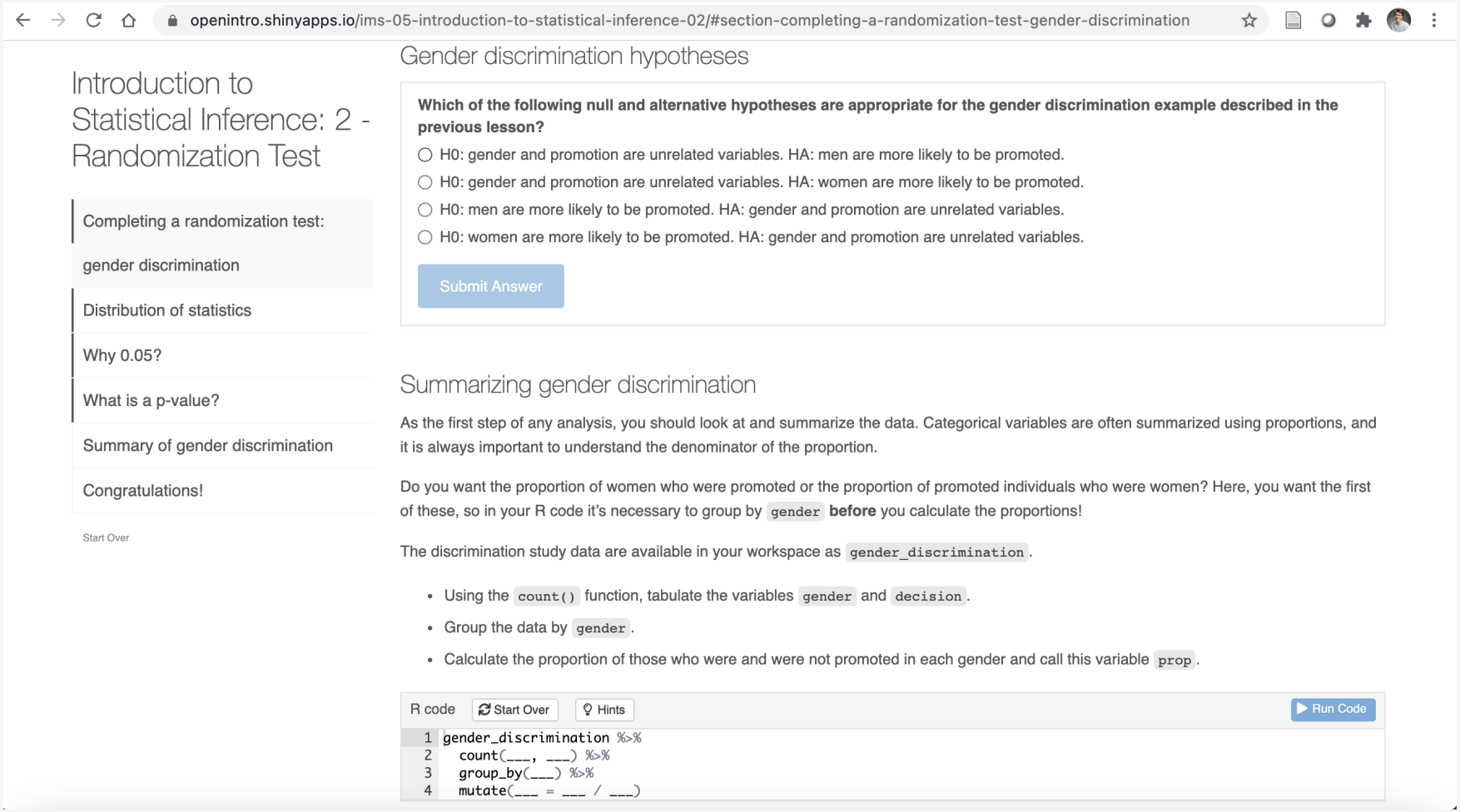
learnr Tutorials

https://bit.ly/ptt2022-tools4ds

📦 learnr

- **learnr** is an R package that makes it easy to create interactive tutorials from R Markdown documents.
- Tutorials can include:
  - Narrative, figures, illustrations, and equations
  - Code exercises (R code chunks that users can edit and execute directly)
  - Multiple choice questions
  - Videos (YouTube, Vimeo)
  - Interactive Shiny components
- learnr is on CRAN

```
install.packages("learnr")
```



https://bit.ly/ptt2022-tools4ds

demo https://rstudio.github.io/learnr/articles/examples.html

[tutorial]

[code]

Components of a `learnr` tutorial

YAML

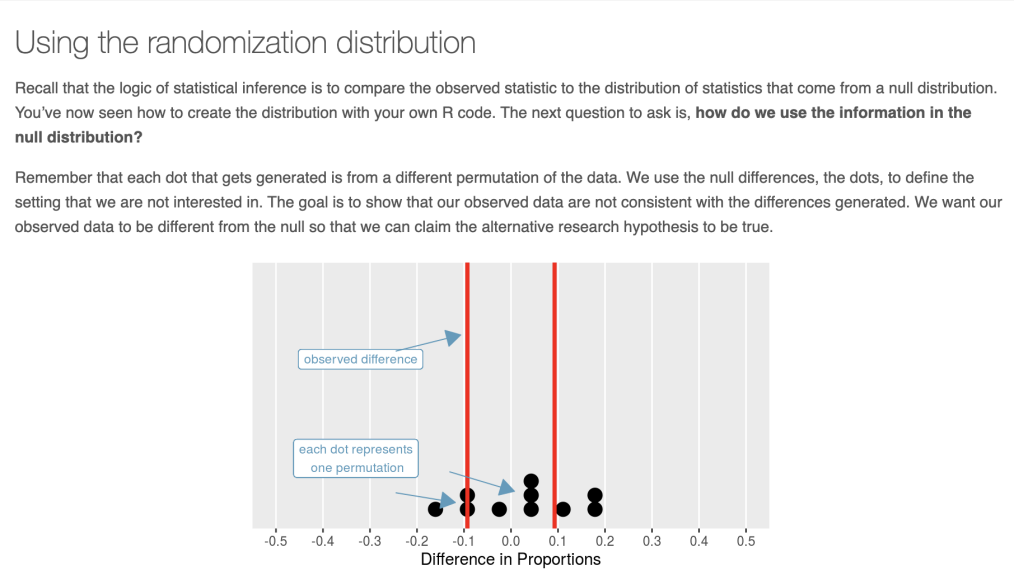
Start with a YAML, just like in R Markdown:

```
---
title: "Starting with Data"
output:
  learnr::tutorial:
    progressive: true
    allow_skip: true
runtime: shiny_prerendered
---
```

1. Create a new RMarkdown file
2. Select from Template
3. Choose the Interactive Tutorial template from `learnr`
4. Start editing!

Narrative

- R Markdown style section and subsection headings with ##, ###, etc.
- Text, figures, illustrations, and equations.
- Videos: supported services include YouTube and Vimeo

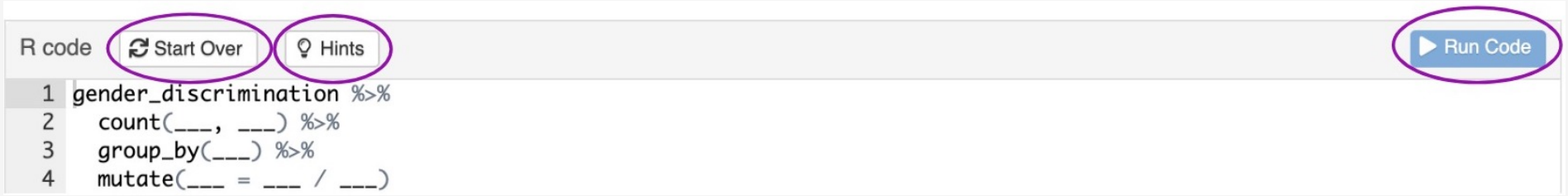


Multiple choice questions

```
quiz(
  question("What position is the letter A in the english alphabet?",
    answer("8"),
    answer("14"),
    answer("1", correct = TRUE),
    answer("23"),
    incorrect = "See [here](https://en.wikipedia.org/wiki/English_alphabet) and try again.",
    allow_retry = TRUE
  ),

  question("Where are you right now? (select ALL that apply)",
    answer("Planet Earth", correct = TRUE),
    answer("Pluto"),
    answer("At a computing device", correct = TRUE),
    answer("In the Milky Way", correct = TRUE),
    incorrect = paste0("Incorrect. You're on Earth, ",
                       "in the Milky Way, at a computer.")
  )
)
```

Code exercises - rendered



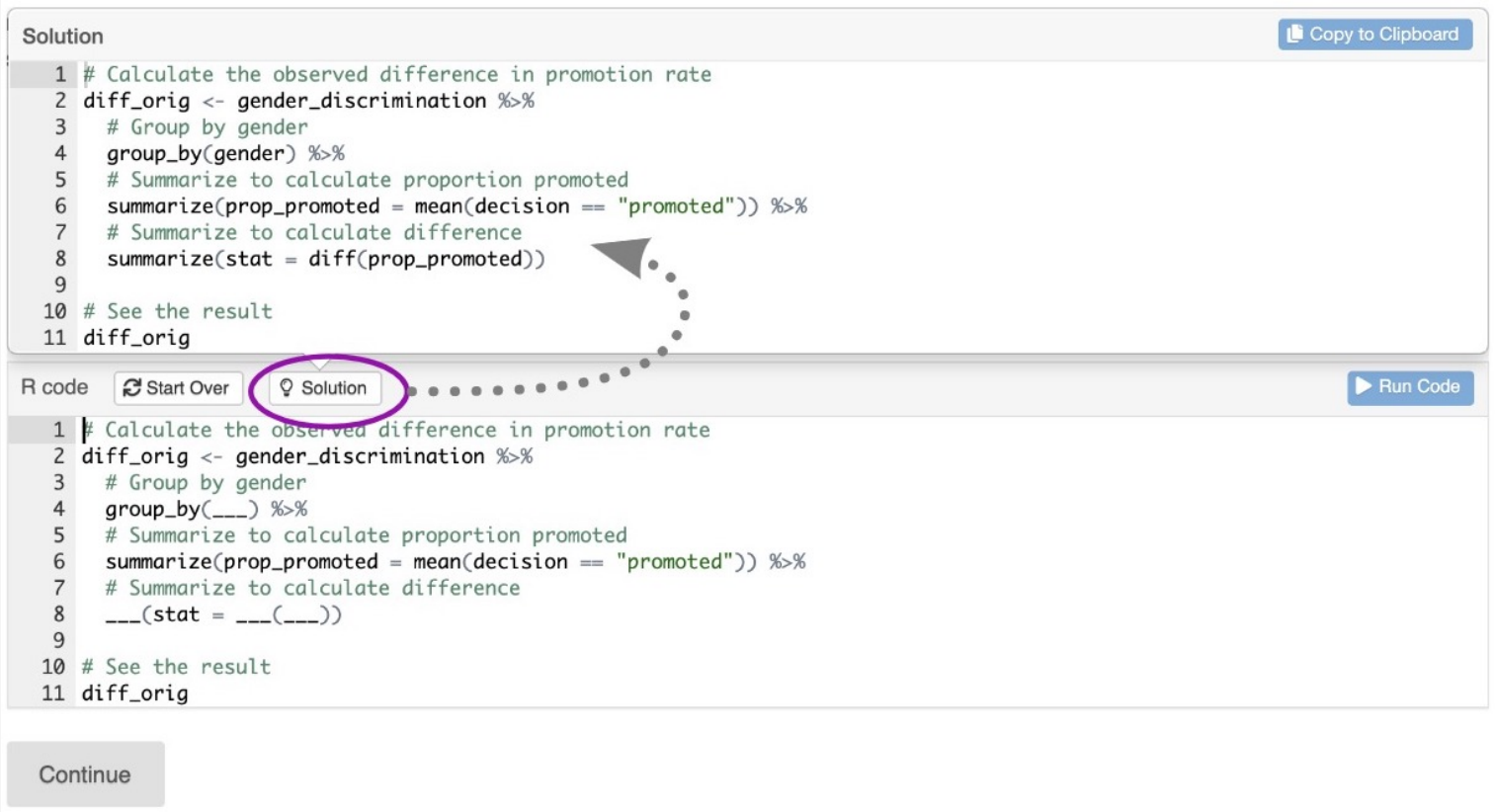
Code exercises - code

```
```{r gender-promoted, exercise=TRUE}
gender_discrimination %>%
  count(___, ___) %>%
  group_by(___) %>%
  mutate(___ = ___ / ___)
```

```{r gender-promoted-hint-1}
gender_discrimination %>%
  count(gender, decision) %>%
  group_by(___) %>%
  mutate(___ = ___ / ___)
```

```{r gender-promoted-hint-2}
gender_discrimination %>%
  count(gender, decision) %>%
  group_by(gender) %>%
  mutate(___ = ___ / ___)
```
```

Code exercises - solution



Q: How do I share with my students?

- Deploy on
  - shinyapps.io (variety of pricing plans available)
  - RStudio Connect (free for academic use, requires setup)
- Essential reading:
  - Publishing learnr Tutorials on shinyapps.io by Angela Li
  - Teach R with learnr: a powerful tool for remote teaching by Allison Horst
  - See the publishing instructions on the learnr website for step-by-step instructions

Questions to Ponder

https://bit.ly/ptt2022-tools4ds

What are my resources?

- Does your university have server time for hosting `learnr` tutorials?
- If not, does your university have funding sources to host these things elsewhere? (e.g. shinyapps.io)
- Can you acquire funding for RStudio Cloud? Can you charge students to use it?
- How much do **you** enjoy creating / teaching with R resources?

What are my learning objectives?

- If **learning R** is one of them...

...students should probably have a native install!

- If **understanding how statisticians use code** is one of them ...

... consider `learnr` tutorials with pre-supplied code or pre-made RS Cloud.

- If **software is not a learning objective**...

... consider using R as a back-end only, to make your own life easier.