

Introduction to Data Analysis

Campus Labs

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Overview

This is an introductory data analysis course. The primary goal of the course is to be able to answer elementary product data questions. We will be using [R](#) and [SQL](#) to accomplish this goal.

The three primary foci of the course are:

- Data Visualization
- Data Structuring
- Data Collection

Approach

I learned to play guitar in my late teens. I remember buying a book that had me start with scales and progressing through some kiddie folk songs like *Twinkle, Twinkle Little Star*, and finally ending with playing *Tom Dooley*. This was absolute torture. I never made it past page 3. Thankfully, the Internet was in it's infancy at this time but I was able to find music for Tom Petty's *Free Falling*. I started with a song I wanted to play and learned the chords to play it. It was a manageable song, not some Jimmy Page solo, but something meaningful & achievable. I had success quickly which in turn motivated me to learn more. Eventually, I learned the Page solos too. I remember this experience when I am teaching others.

I take the educational stance that true learning happens around problems we're motivated to solve. We figure out what we want to do and then get the language, knowledge, and skills necessary to accomplish this goal. This is a top down approach. Often data analysis courses have the participants pass through a progressive series of steps, starting with a "Hello World" exercise and building up with a grand finale capstone project. The progression is boring and the final project is often unrelated to the problems the student actually wants to solve. Sounds like a "scales and *Tom Dooley*" approach to me. I take the opposite approach. The course

assumes that the participants have questions about product data that they would like to answer quickly. This is where the course will begin. Theory and skills will be woven into the process in a “just in time” fashion.

Secondly, I take the stance that struggle is a requisite for learning. Please don’t confuse frustration and struggle. The former is not productive but the latter is essential. If you haven’t struggled, I’d venture to say you haven’t really learned anything of value. Learning something new is a series of inner dialogue feedback loops. We ask a question, learn about that for a bit. We are usually just learning what are the right words to Google. This first pass snowballs new questions, things we didn’t know we needed to ask before. And this recursive process ends when we’re satisfied that we’ve learned what we set out to learn originally (or we’ve determined it wasn’t really worth the investment). This course will not give you all the language, knowledge, and skills you need to analyze your problems. Instead, it will give you the most important language, the most relevant knowledge, and the most generalizable skills. This will help to avoid frustration but not the struggle.

Required Texts

We will be using the following texts for the course.

1. Grolemund, G. & Wickham, H. (2016). *R for Data Science*. Retrieved from <http://r4ds.had.co.nz>
2. Wickham, H. (2016). *ggplot2: Elegant Graphics for Data Analysis*. New York: Springer. Retrieved from <https://github.com/hadley/ggplot2-book>

Additionally, we will read from articles, blogs, & cheatsheets. All of the reading materials are provided.

Course Schedule

This course is based around 7 modules.

1. Intro to R
2. Data Transforming
3. Data Visualization
4. Exploratory Data Analysis (EDA)
5. Data Tidying
6. Data Import/Export (R & SQL)

Modules vary in size and scope and have a series of interactive lectures attached to them. This is the schedule for lectures.

Module 1: Intro to R			
Day	Topic	Reading	Assignment
0	Install Course Tools	<ul style="list-style-type: none"> Syllabus Grolemund & Wickham Ch. 1 	<ul style="list-style-type: none"> Install R, Rstudio, & SQL Ops
1	R, RStudio, & Visualization	<ul style="list-style-type: none"> Grolemund & Wickham Ch. 3 & 5 	<ul style="list-style-type: none"> Assignment 1
Module 2: Data Transforming			
Day	Topic	Reading	Assignment
2	Filter, Select, Arrange, & Mutate	<ul style="list-style-type: none"> Grolemund & Wickham Ch. 5 R: Transformations Cheatsheet 	<ul style="list-style-type: none"> Assignment 2
3	Mutate, Summarize, & Group By	<ul style="list-style-type: none"> Grolemund & Wickham Ch. 3 	<ul style="list-style-type: none"> Assignment 3
Module 3: Data Visualization			
Day	Topic	Reading	Assignment
4	Applying Grammar & Theory	<ul style="list-style-type: none"> Grolemund & Wickham Ch. 7 R: Transformations Cheatsheet 	<ul style="list-style-type: none"> Assignment 4
5	Mutate, Summarize, & Group By	<ul style="list-style-type: none"> Grolemund & Wickham Ch. 3 & 7 	<ul style="list-style-type: none"> Assignment 5
Module 4: Exploratory Data Analysis (EDA)			
Day	Topic	Reading	Assignment
6	Applying Grammar & Theory	<ul style="list-style-type: none"> Grolemund & Wickham Ch. 7 R: Transformations Cheatsheet 	<ul style="list-style-type: none"> Assignment 6
7	Finding Patterns	<ul style="list-style-type: none"> Grolemund & Wickham Ch. 12 	<ul style="list-style-type: none"> Assignment 7
Module 5: Data Tidying			
Day	Topic	Reading	Assignment
8	Reshaping	<ul style="list-style-type: none"> Grolemund & Wickham Ch. 13 R: Transformations Cheatsheet 	<ul style="list-style-type: none"> Assignment 8
9	Combining: Joins & Binds	<ul style="list-style-type: none"> Grolemund & Wickham Ch. 11 R: Wrangling Cheatsheet 	<ul style="list-style-type: none"> Assignment 9
Module 6: Data Importing & Exporting			
Day	Topic	Reading	Assignment
10	Import/Export in R	<ul style="list-style-type: none"> YouTube: Learn Basic SQL in 10 Minutes R: Transformations Cheatsheet 	<ul style="list-style-type: none"> Assignment 10
11	SQL Querying: Select, From, & Where	<ul style="list-style-type: none"> R: Querying Cheatsheet 	<ul style="list-style-type: none"> Assignment 11
12	SQL Querying: Count, Group By, & Join		

Assignments

Assignment	Description
1	*
2	*
3	*
4	*
5	*
6	*
7	*
8	*
9	*
10	*
11	*

Learning Outcomes

1. Query SQL databases.
2. Import common data file formats into R.
3. Combine data from multiple sources.
4. Manipulate data into a tidy format.
5. Transform data with mutations and summarizations.
6. Select appropriate graph forms and aesthetics to represent data.
7. Produce tabular and graphical summaries of data.
8. Export tabular and graphical summaries of data from R.

What You Won't Learn

This course will not teach advanced data science techniques. It will not cover statistical modeling, machine learning, computer programming, big data, text analysis, reporting, or dashboarding. Additionally, R and SQL are capable of much more than this course uses them for. They are full featured and capable of integrating with a host of other technologies and products. We will utilize ~10% these tools' features to accomplish the primary goal and learning outcomes of this course.

Required Technologies

We will use [R](#), [RStudio](#), and [Install SQL Operations Studio](#). Sometimes people confuse R & RStudio. R is the backend while RStudio is an IDE for working with R.

1. [Install R](#) (Do this before installing RStudio)
 - Click on the download link corresponding to your computer's operating system
 - Download the installer and follow the directions.
2. [Install RStudio](#)
 - Scroll down to "Installers for Supported Platforms"
 - Click on the download link corresponding to your computer's operating system
3. [Install SQL Operations Studio](#)
 - Click on the download link corresponding to your computer's operating system
 - Download the installer (Windows) or .zip (Mac) and follow the directions

Note: If you need more detailed instructions on how to install R and RStudio, watch this [DataCamp video \(1m22s\)](#).

Cheat Sheets

Cheat sheets provide nice references for utilizing the R & SQL tooling.

Link	Description
R: Base R	Covers many basic R functions
R: Data Transformations	Create new columns & summarize data (tidyverse)
R: Data Visualization	Visualization in ggplot2
R: Data Import	Importing, cleaning, & restructuring (tidyverse)
R: Data Import	Wrangling (tidyverse)
SQL: Basic Querying	Basic SQL queries