THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

STOR 320 Introduction to Data Science

Lecture 1

Yao Li
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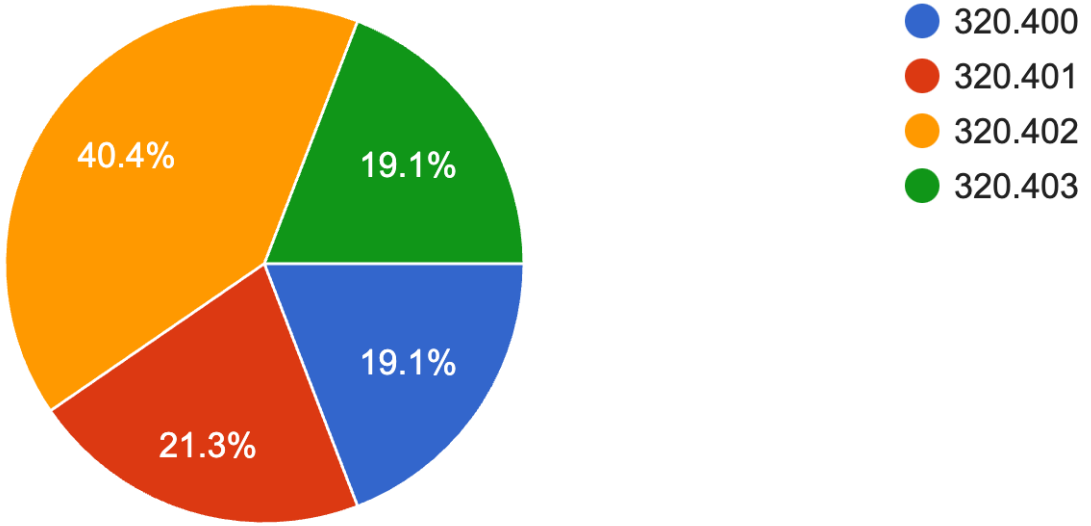
Instructor

- Name: Yao Li
- Email: yaoli@email.unc.edu
- Office: Hanes 334
- Office hours: Wednesday 2:00PM to 4:00PM
- Personal website: https://liyao880.github.io/yaoli/
- Course website: https://liyao880.github.io/stor320/
- Research interest: adversarial deep learning, backdoor learning, large language models, computational pathology

Survey Results

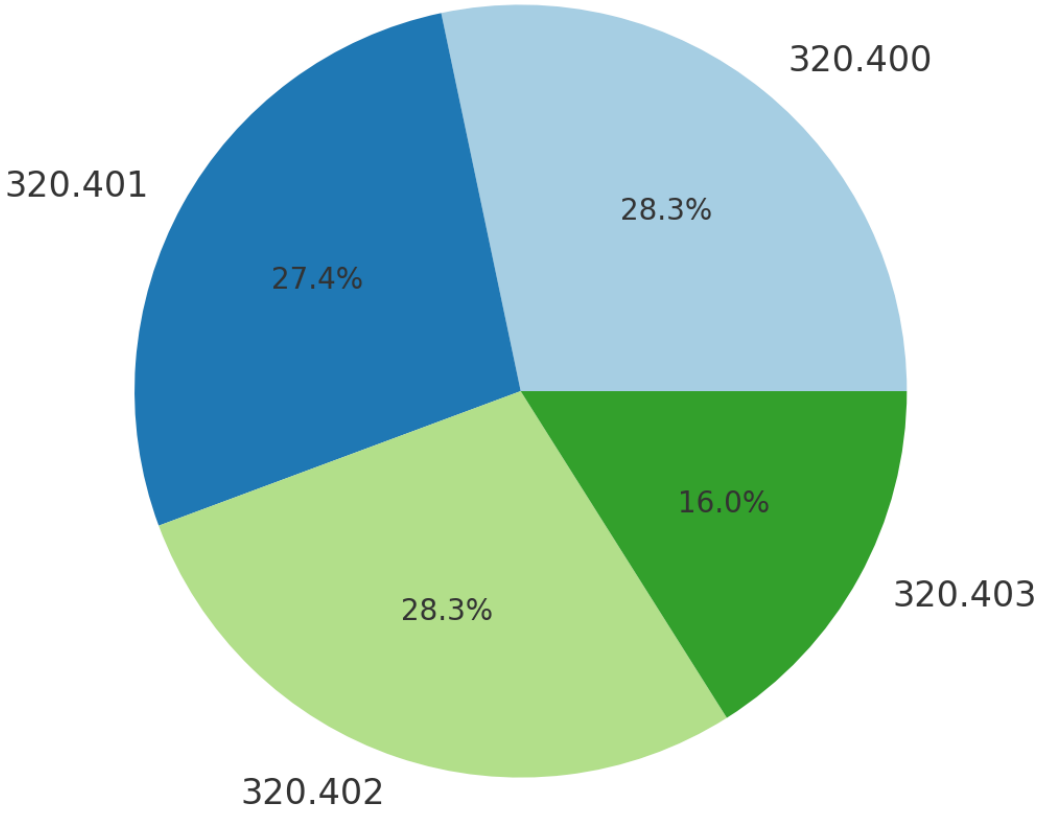
In what lab section are you registered?

47 responses

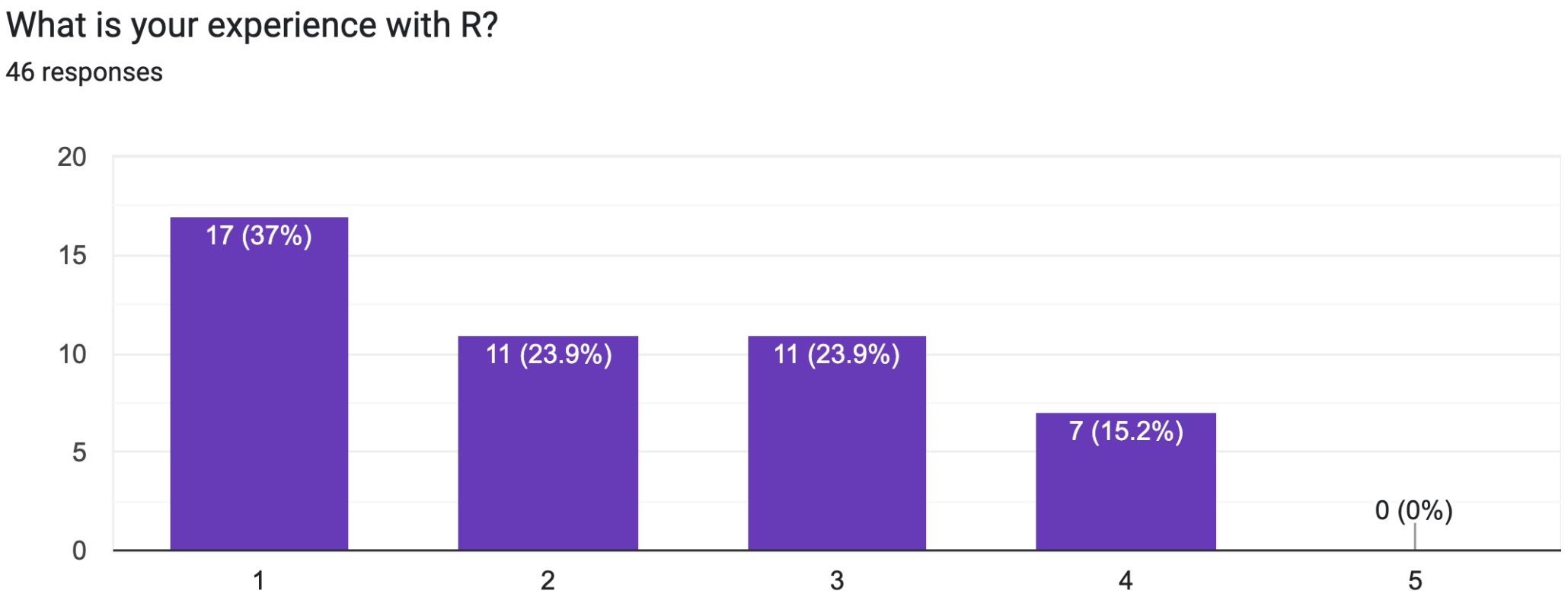


Actual Distribution

Lab session	Number of Students
320.400	30
320.401	29
320.402	30
320.403	17



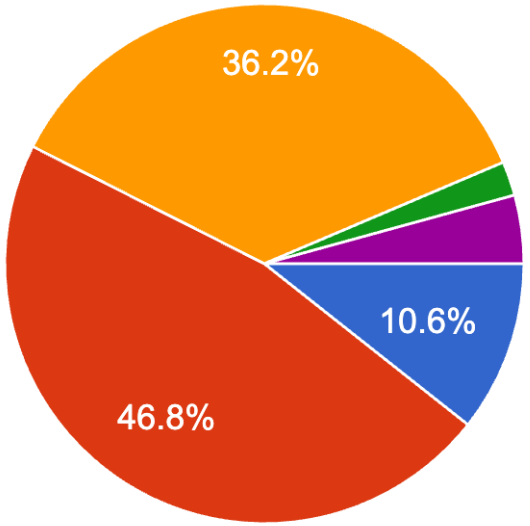
Survey Results



Survey Results

What do you plan to pursue after graduation?

47 responses



- Job Not in Field Related to Data Science
- Job in Field Related to Data Science
- Master's Degree
- Doctoral Degree
- Medical, Pharmaceutical, Dental, Nursing, or Veterinary Degree

Instructional Assistant

- Morgan Smith (400, 401)
  - Email: smithmor@email.unc.edu
  - Office Hours: T 10:00 – 11:00 AM, Th 3:00PM – 4:00PM

- Yuhao Zhou (402, 403)
  - Email: yuhaoza@live.unc.edu
  - Office Hours: TTH 2:00PM – 3:00PM

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Lectures and Labs

- Lectures TTH 8:00 AM – 9:15 AM

- Labs
  - 400: W 3:30PM – 4:20PM HN107
  - 401: W 5:00PM – 5:50PM CH104
  - 402: F 10:10AM – 11:00AM HN107
  - 403: F 3:30PM – 4:20PM DE203

- Email Christine (crikeat@email.unc.edu)

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Outline

- Administrative details
- What's the course about?
- Introduction to R

Instruction

- This will be an in-person course:
  a) No chat in class;

  b) lectures and labs will be held on campus;

  a) Morgan's office hours will be held online;

  b) laptop is required.

Questions and Class Participation

- Three ways to ask questions:
  - ask questions in class;
  - come to the virtual office hours on Zoom;
  - send an email to the instructor or the IAs.
- Class participation:
  - answer questions to get class participation grades;
  - 2.5 points each time.

Grading

Class Participation	5%
Lab Attendance	5%
Labs	15%
Homework	45%
Final Project	30%

A	94 to 100	B	83 to 86.99	C	73 to 76.99	D	60 to 66.99
A-	90 to 93.99	B-	80 to 82.99	C-	70 to 72.99	F	0 to 59.99
B+	87 to 89.99	C+	77 to 79.99	D+	67 to 69.99		

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Homework and Labs

- Around 7 homework assignments and 4 data analysis assignments. They will be posted on Canvas and there will be about one week to complete the homework and about two weeks to complete data analysis assignments.

- Lab assignment:
  - Due 30 minutes after the lab ends.
  - No late submission will be accepted.
  - will be based on the topics discussed in lecture or related to your final project.

Project

- For the final project, each section of STOR 320 will be divided into research groups of size 4 or 5. To ensure fairness, students will be assigned randomly based on lab session.

- The groups will be assigned by August 31, 2021 (Tuesday) and you can find your group on the course website.

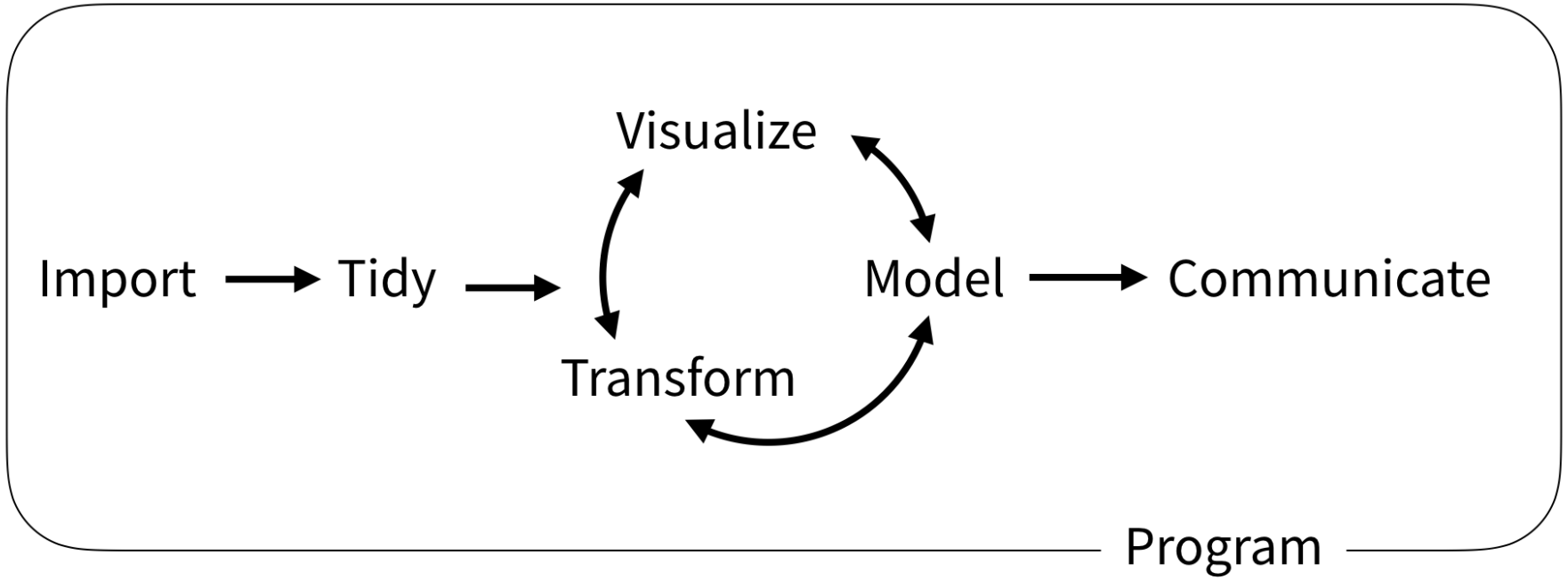
Project

Project proposal	10%
Exploratory data analysis	20%
Final report	40%
Final presentation	30%

Important dates

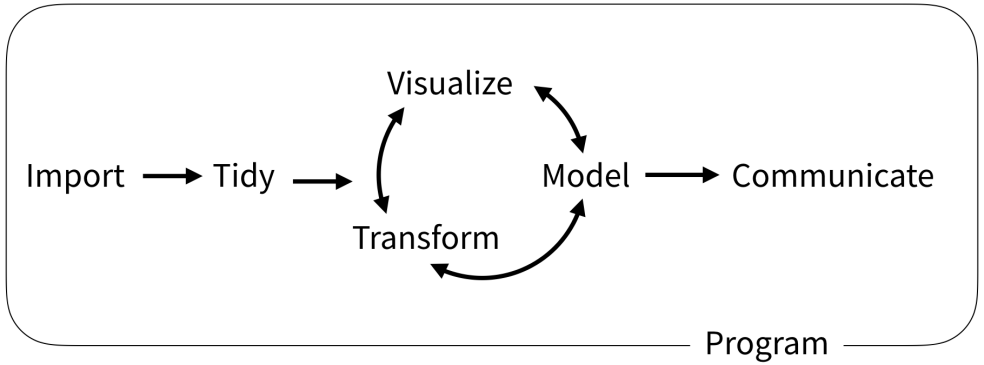
Project proposal	September 16
Exploratory data analysis	Oct 27
Final report	Dec 6
Final Presentation	Nov 21, Nov 26, Dec 3

What is data science?



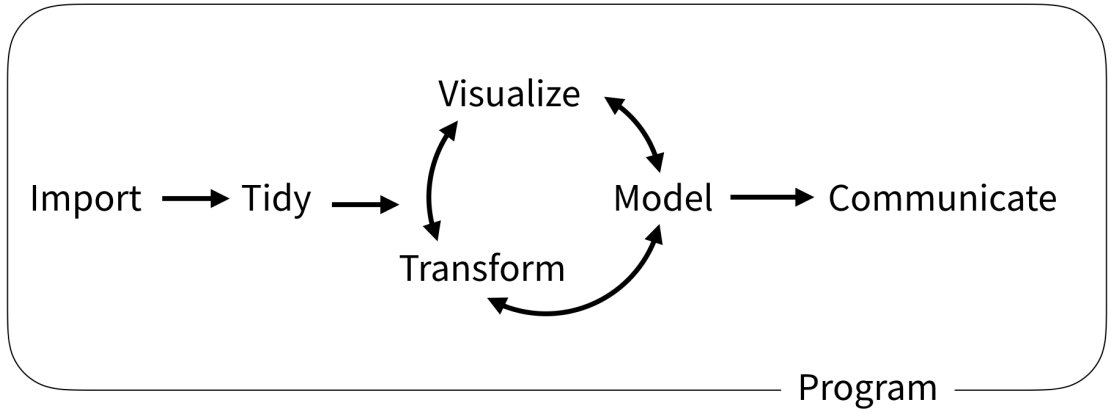
Wickham and Grolemund (2017)

The model of data science



- First we must *import* our data.
- *Tidy* data → consistent structure
- Transformation:
  - narrowing in on observations of interest
  - creating new variables
  - calculating a set of summary statistics

The model of data science



- *Visualization:* show you things that you did not expect or raise new questions about the data.
- Use a *model* to answer your questions
- *Communication:* an absolutely critical part of any data analysis project.
- Surrounding all these tools is programming.

R and RStudio

~/Documents/rmarkdown - gh-pages - RStudio

5-parameters.Rmd

```
1  ---
2  title: "Visualizing the ocean floor"
3  output: html_document
4  params:
5    data: "hawaii"
6  ---
7
8  ```{r include = FALSE}
9  library(marmap)
10 library(ggplot2)
11 ```
12
13
14 The [marmap](https://cran.r-project.org/web/packages/marmap/index.html) package provides tools and data for visualizing the ocean floor. Here is an example contour plot of marmap's ``r params$data`` dataset.
15
16 ```{r echo = FALSE}
17 data(list = params$data)
18 autoplot(get(params$data))
19 ```
20
```

21:1 (Top Level) R Markdown

Console R Markdown

~/Documents/rmarkdown/demos/

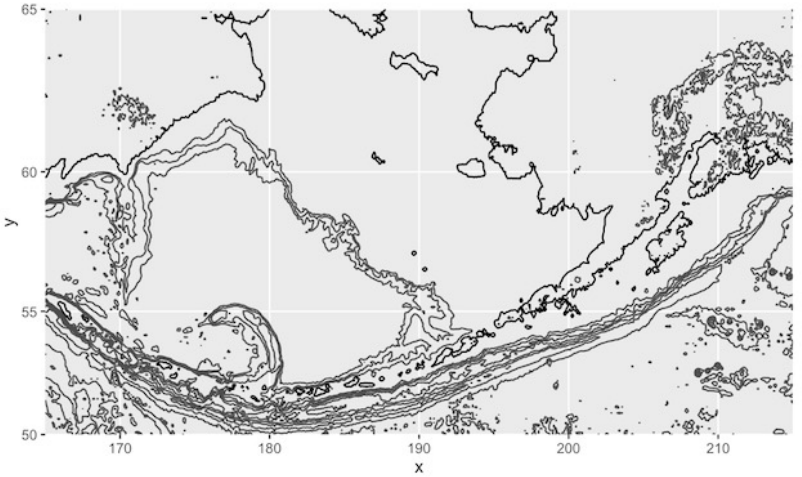
```
> render("5-parameters.Rmd", params = list(data = "aleutians"))
```

Environment History Build Git

Files Plots Packages Help Viewer

Visualizing the ocean floor

The marmap package provides tools and data for visualizing the ocean floor. Here is an example contour plot of marmap's `aleutians` dataset.



Why R?

- Easy to learn and easy to use.
- Very popular and one of the standard languages for statistics, data science, computational biology, finance, industry, etc.
- Free and open-source.
- A lot of high-quality packages.
- New technology and ideas often appear first in R.
- Supported by a vast community that maintains and updates R.
- Runs on basically any platform.

Learning Programming

- Transfer the concepts to other languages
- How you approach a computational task and reason about the computations is similar
- Learning another programming language will be much easier in the future

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Statistical Learning

- Linear regression.
- Classification (logistic regression, LDA, K-nearest neighbors).
- Cross-validation and bootstrap.
- Principal component analysis.
- Clustering methods (K-means clustering and hierarchical clustering).
- Recommender systems.
- Neural networks.

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Textbooks

- *R for Data Science.* Hadley Wickham. Legally free online, but can be purchased for less than $40 on Amazon. Additional suggested texts are provided on the website. All texts used in this course are free and downloadable from course website.

- *The elements of statistical learning: data mining, inference, and prediction*. Hastie, Trevor, Robert Tibshirani, and Jerome Friedman.