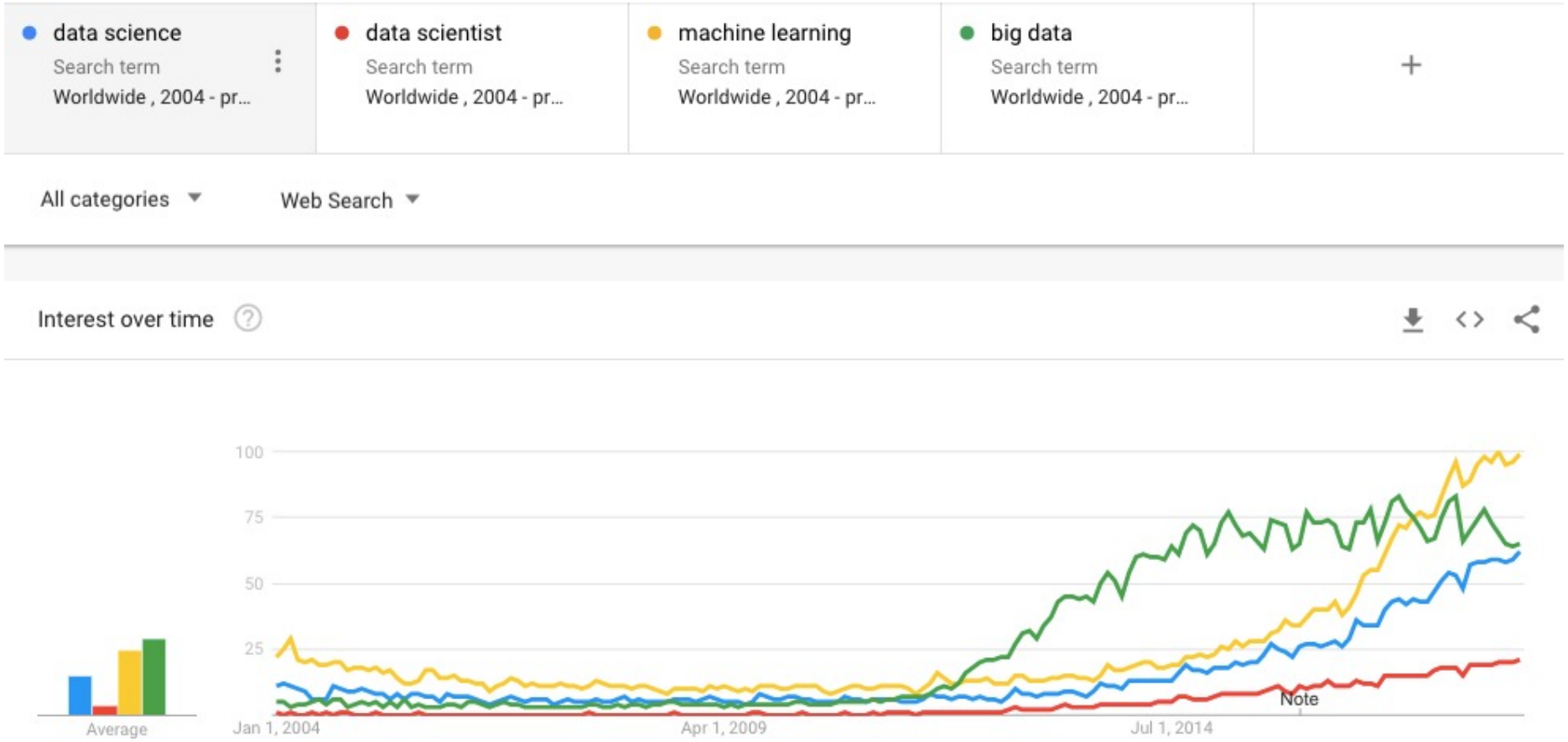
Data 602 @ UMBC

Welcome to Data 602



- Course Logistics
- What is Machine Learning?
- Software tools
- What are we not covering?
- Soft skills
- Homework

Syllabus and Course Logistics

- **Syllabus**: https://github.com/msaricaumbc/DS602_Spring2023
- **Office Hours**: https://calendly.com/msarica1/15min
- **Email:** mehmet.sarica@umbc.edu

Components of a good class

- How do you promote a safe classroom environment?
- How do you address the variety of backgrounds of participants?
- How do you encourage participation? Enable rest?
- What behavior fosters growth?

Activity: Think, then write

Ground rules

- Schedule: 7:10 – 9:40 (we may have breaks)
- I value being punctual (start of class, breaks, end of class)

- Don't apologize for asking a question or for not knowing something
- I find it acceptable for you to occasionally not participate

- Tell me if you cannot hear me or if you cannot understand me
- Slides/notes will be provided after lecture (Github)

- I value your feedback:
  - Direct: verbal
  - Indirect: anonymous question/comment sheets on your desk

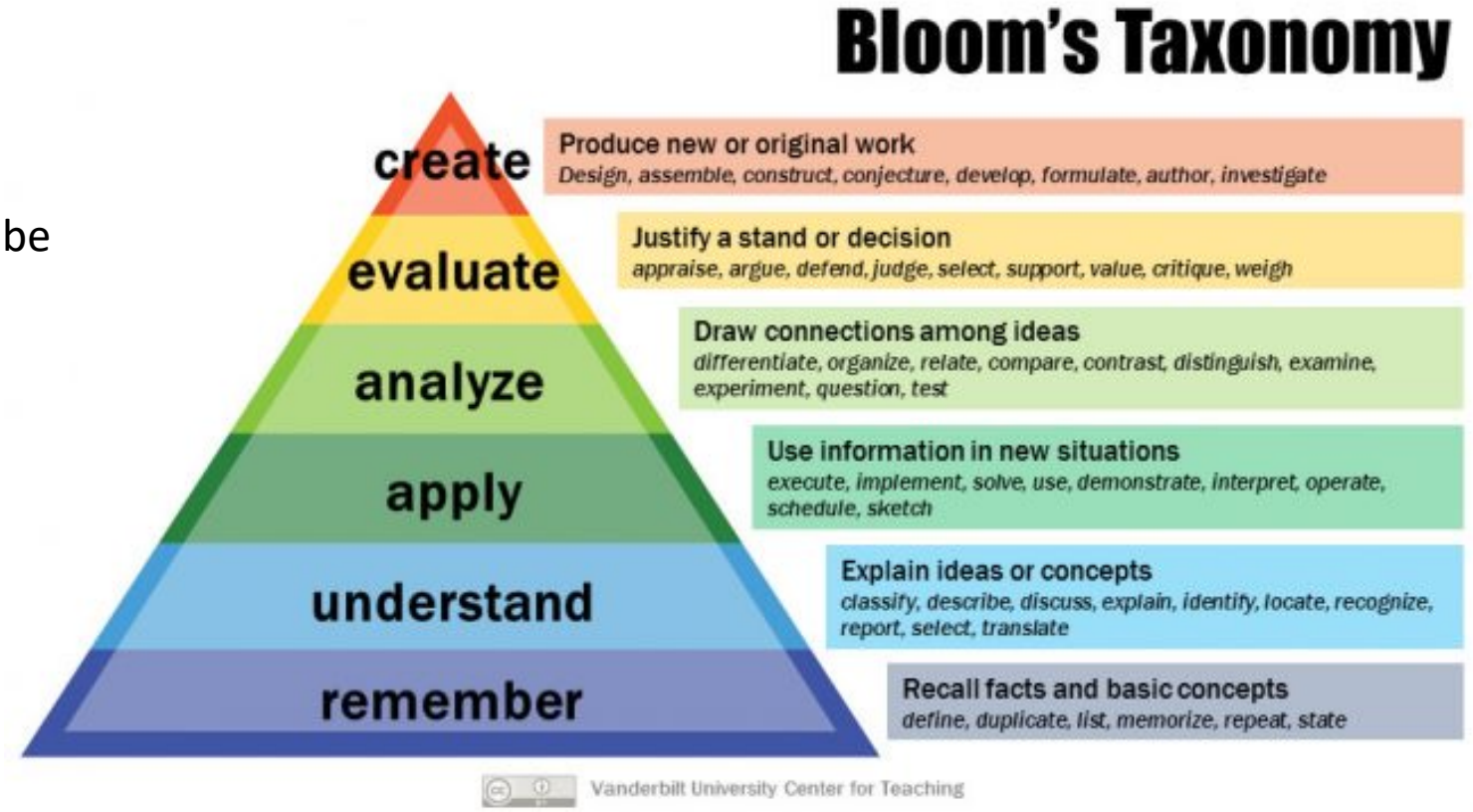
Grading

What you may care about for evaluation

- Attendance: 10%
  - Show up for class (*not always enough)
  - Participate in class exercises and surveys
- Homework: 40%
  - When homework is assigned, the due date will be provided
- Midterm Project: %20
- Final Project: 30%

Learning

What I care about conveying

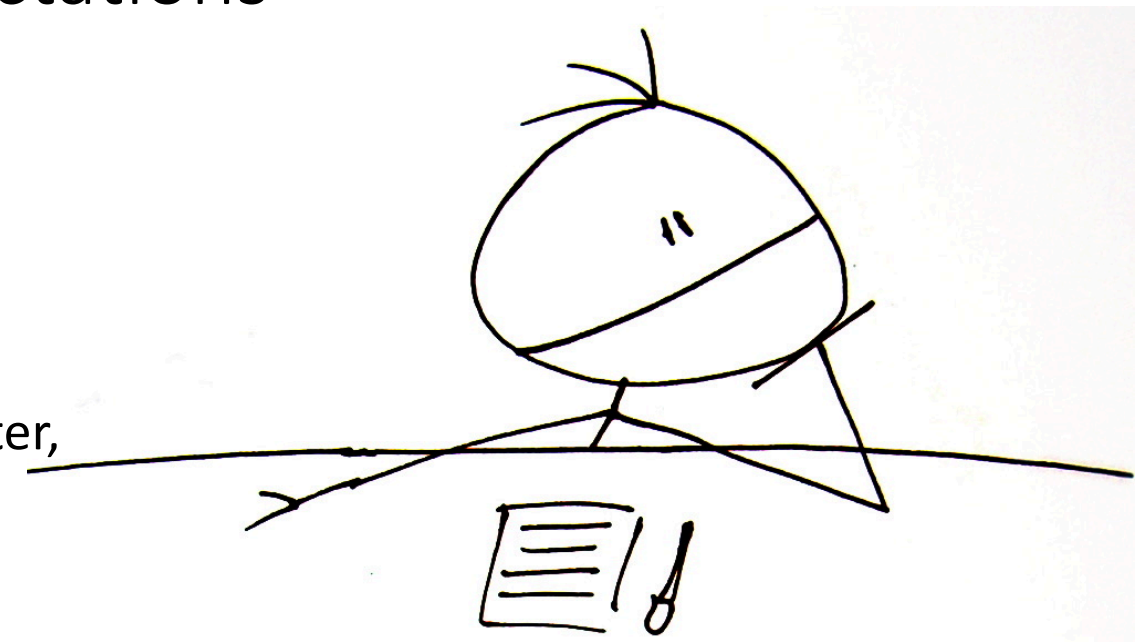


Log your assumptions and expectations

In-class exercise:

- Open a notepad(or a word document) on your computer, record the date.

- Write down your assumptions about this class
- Write down your expectations for this class



Activity: think and write

Store assumptions and expectations

We will revisit these notes later in the semester

Store your note where it can be accessed later in the course

What do you want to learn in this class?

Activity: verbal popcorn; record answers on board

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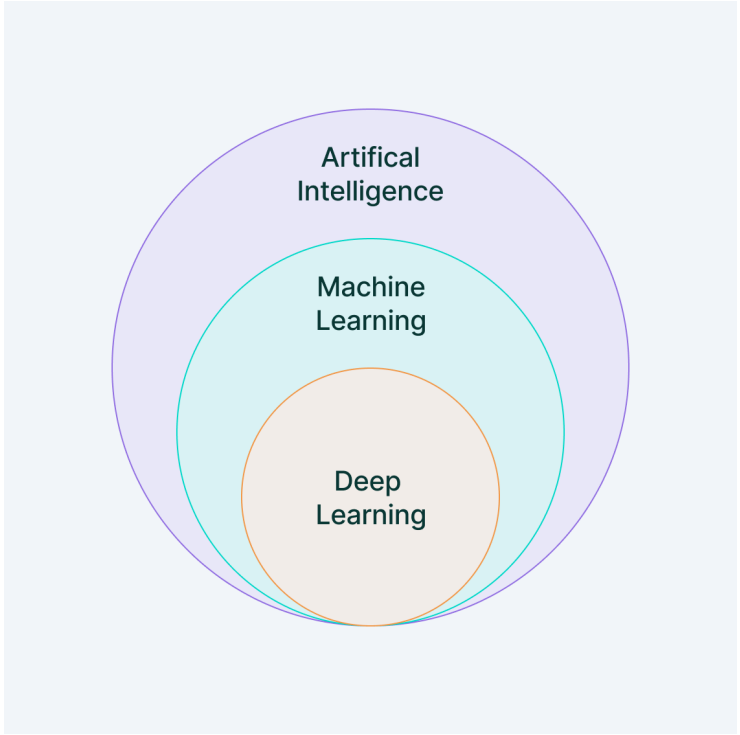
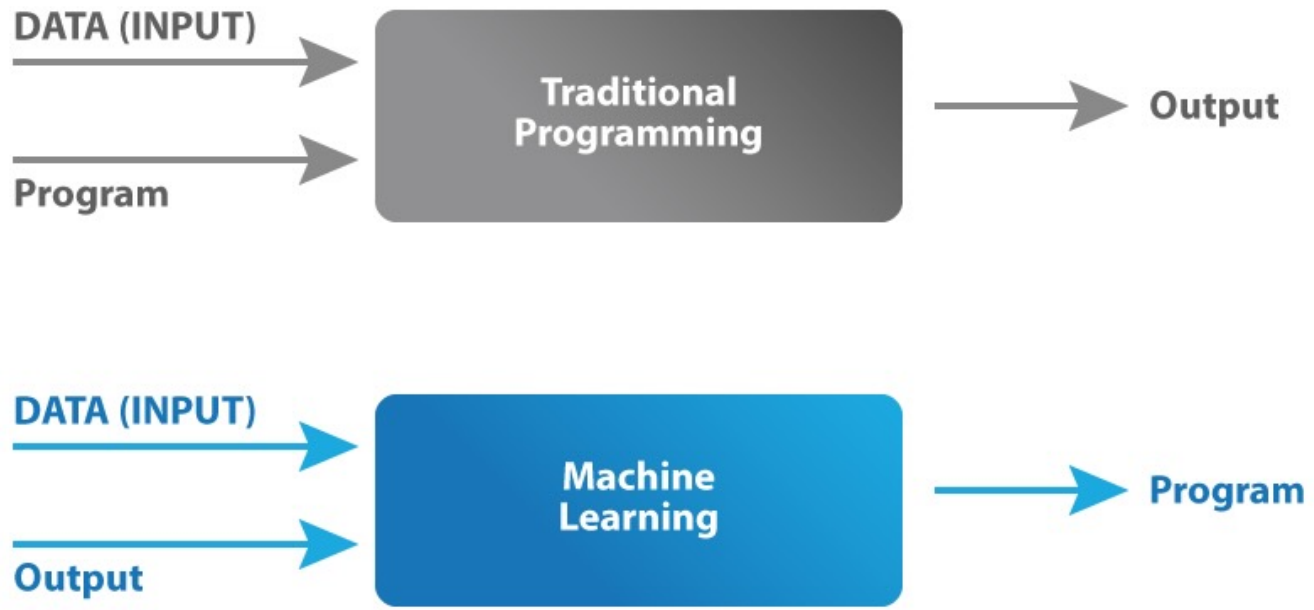
There's a lot to cover





Why learn Machine Learning?

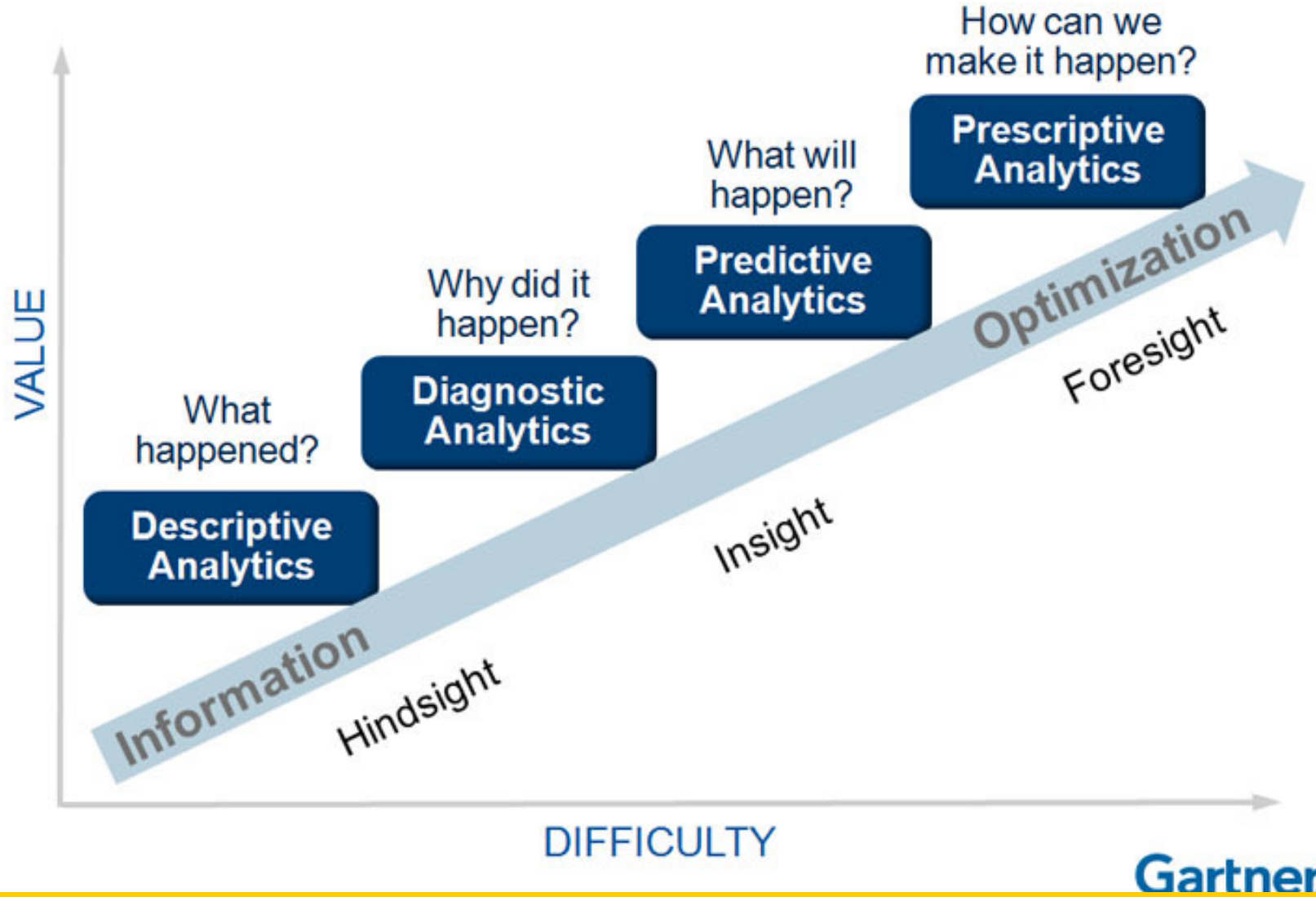
Explore: **identify patterns**

Predict: **make informed guesses**

Infer: **quantify what you know**

Motives:

- Make money
  - Employment
  - Promotion
- Help people
- Gain new knowledge



Large scale use cases with lots of data

- Google's search engine
- Recommendations from Amazon and Netflix
- Bank and Credit Card fraud detection
- Logistics (DHL, UPS) of fleet management
- Healthcare records from patients

Each depends on availability of compute and data

Assumption in this class

- In class we will assume you are a lone data scientist on an island with an internet connection.
- This is not the typical case -- you'll have coworkers, customers, bosses, competitors, collaborators, peers.

Example of how class ≠ real world

- This class will not use competitive grading. (Imagine if it were.)
- As an employee at a company, you may be competing for a bonus or promotion

--> consequence: personal and organizational politics factor into the work environment

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Jupyter Notebook

jupyter spectrogram (autosaved)

File Edit View Insert Cell Kernel Help Python 3

Markdown CellToolbar

Simple spectral analysis

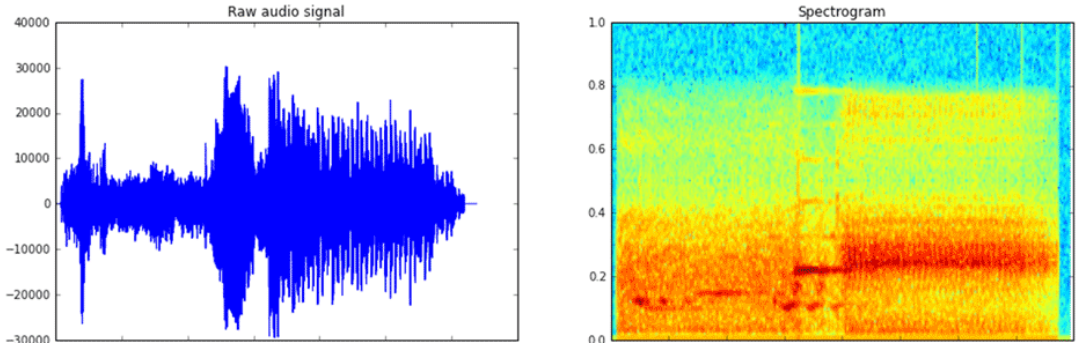
An illustration of the Discrete Fourier Transform

$$X_k = \sum_{n=0}^{N-1} x_n exp^{\frac{-2\pi i}{N} kn} \quad k = 0, \ldots, N-1$$

In [2]:
```
from scipy.io import wavfile
rate, x = wavfile.read('test_mono.wav')
```

And we can easily view it's spectral structure using matplotlib's builtin specgram routine:

In [5]:
```
fig, (ax1, ax2) = plt.subplots(1,2,figsize(16,5))
ax1.plot(x); ax1.set_title('Raw audio signal')
ax2.specgram(x); ax2.set_title('Spectrogram');
```



Why Jupyter + Python?

Jupyter is useful for

- Exploration of data (*jargon*: EDA = exploratory data analysis)
- Documenting your activities (to enable reproducibility)
- Figuring out which software is relevant, which algorithms to use, which software libraries are useful
- Visualizing results

And both Jupyter and Python are free!
And both are widely used!

Python and Jupyter do not cover every use case

- For sufficiently large data sets, Jupyter and Python are not the right tool
- For sufficiently complex analytics, Jupyter and Python are not the right tool

Speed and security are typically not your priority during exploration

Knowing when to invest in switching tools is a skill

Evaluate trade-offs of flexibility and security and speed for a given scale

Best practices: Version control

- Reproducibility applies to your own attempts (not just other people)
- Regardless of how you develop analytics, you'll be creating or editing software and documents.
- [*lesson*] Regardless of how you implement best practices, avoid inventing solutions for which someone else already provided a path.

Suggested resource: https://try.github.io/

Have you used software for version control?

Examples: git, svn, hg

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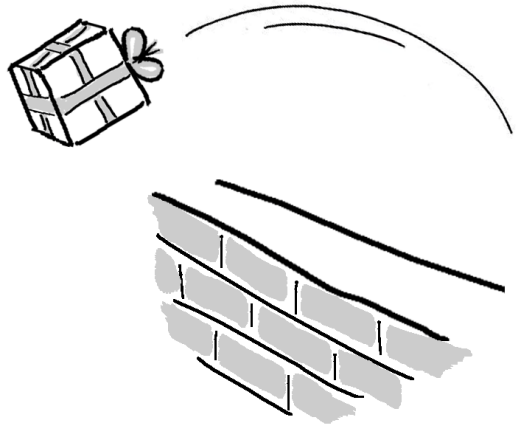
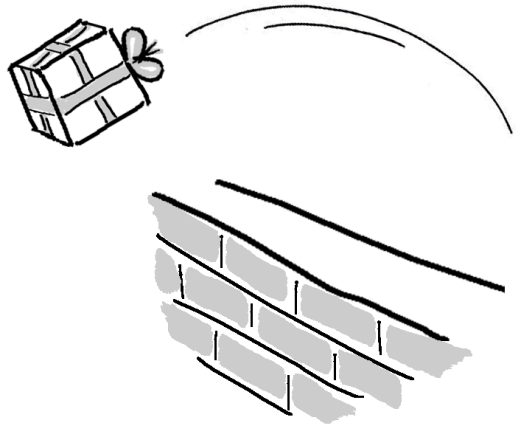
Not covered: Neural Networks/Deep Learning



Not covered: product integration

- There's a complex network of dependencies (i.e. software engineers, managers) of which data science is one component.
- Downstream consumers of your output are likely to be software developers who use containers and support users.
- This class is focused on the data science; not with integration.



See http://dev2ops.org/2010/02/what-is-devops/

Not covered: security

We focus on data science techniques; these do not emphasize secure design of software.

- Let’s Look at some Python code

Figure 1

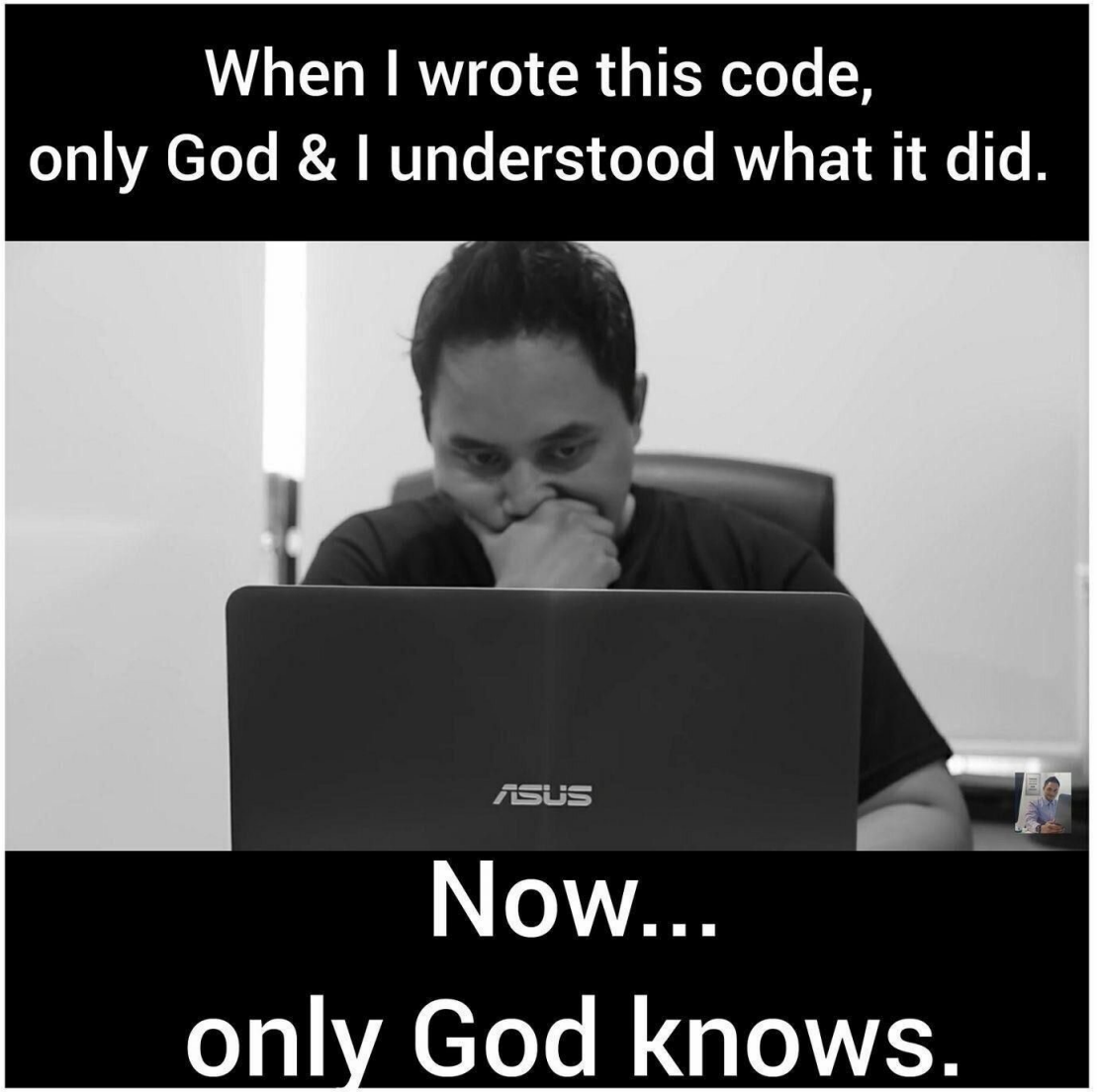
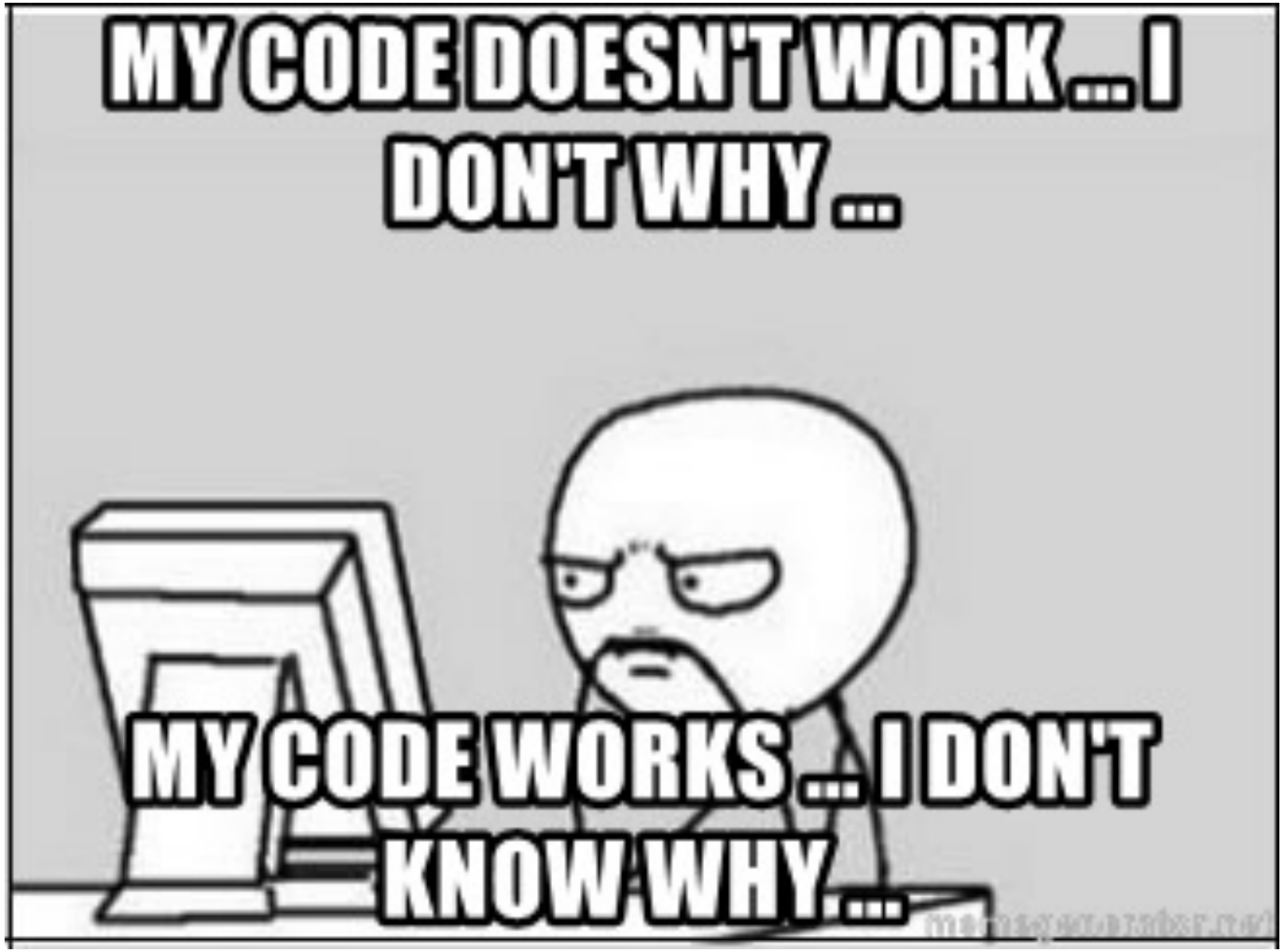
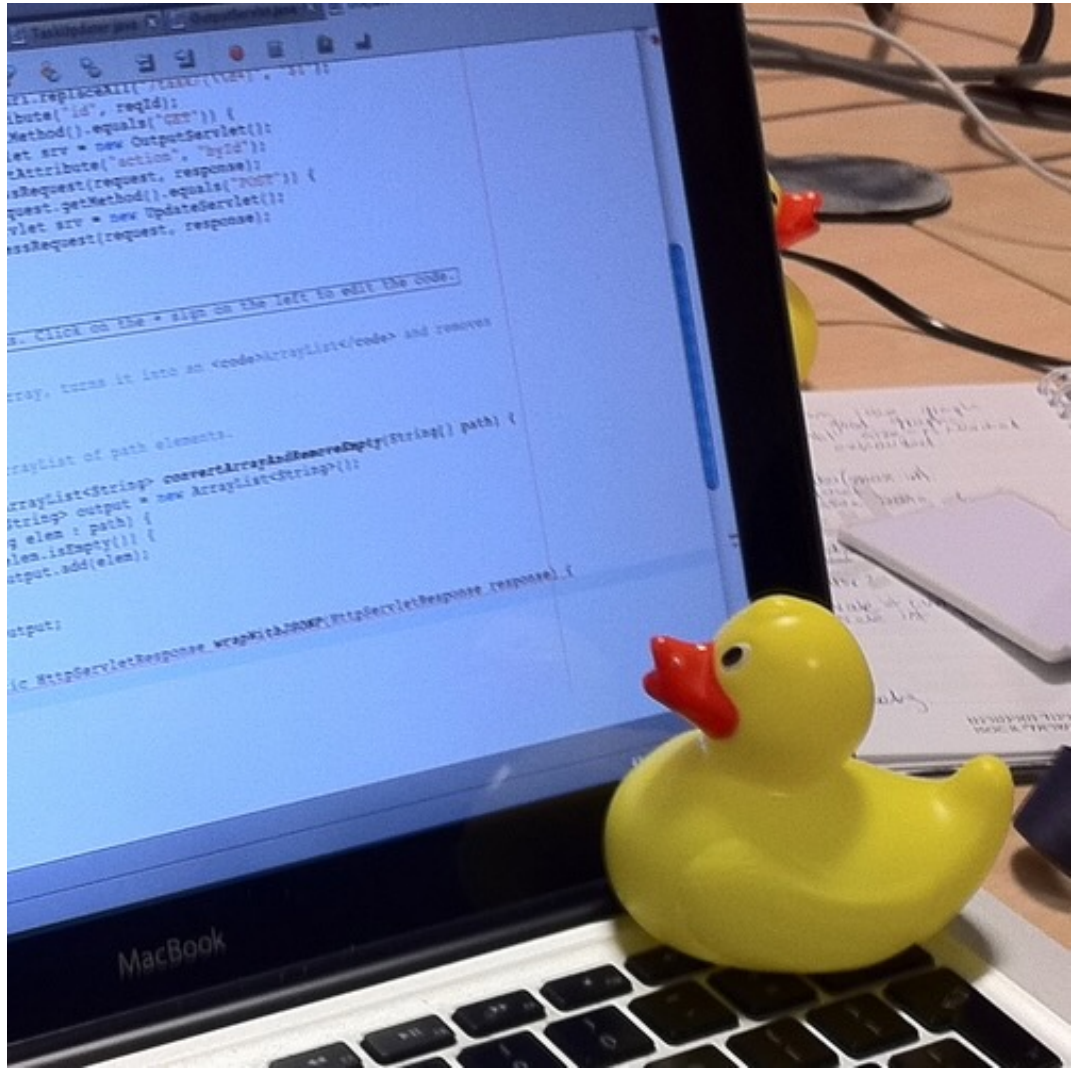

When I wrote this code,
only God & I understood what it did.
ASUS
Now...
only God knows.

Figure 2



Rubber Duck Debugging



https://en.wikipedia.org/wiki/Rubber_duck_debugging

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Data Science is more than Math and Software

Human interaction in data science

- Discovering stakeholders
- Negotiating with data owners
- Customer engagement

https://hbr.org/2017/01/the-best-data-scientists-get-out-and-talk-to-people

Iterating with customers

- As a data scientist, you'll often be working for someone other than yourself.
- Expect under-specified requirements from customers. Iterate.
- Provide incomplete solutions rather than waiting until the product is perfect.

https://en.wikipedia.org/wiki/Minimum_viable_product

When to persist,
When to change course,
When to seek help

Try attacking the challenge for 30 minutes

Then seek help or do something else for a while

https://en.wikipedia.org/wiki/Pomodoro_Technique

Pro-tip when seeking help

How to ask well-formed questions:

https://stackoverflow.com/help/how-to-ask

[Intentional sidetrack to StackOverflow.]

Ask technical questions:

- *Poor*: "I don't understand Python dictionaries" (--> online tutorials)
- *Better*: "When is it appropriate to use a key-value pair?"

- *Poor*: If I submitted this assignment as is, what score would I get?
- *Better*: I am planning to submit the attached assignment, but currently there's an error in the third cell. I've searched online but don't find any references to the error message. Can you provide guidance?

Emotions in Data Science

- As a data scientist, most of your time will be spent in a desert of uncertainty, frustration, and doubt.

- There will be rare short-lived interspersed spikes of excitement and happiness due to events like getting a new dataset, creating a new analytic, getting a new result, or being thanked by a stakeholder.

This experience is normal and does not go away.

See also the psychology of slot machines

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Tasks & Homework

- Install Anaconda
  - Anaconda individual edition - install
  - How to install Anaconda
- Create a github account

Homework

- Blackboard: Introduce yourself in discussion board
- Create a repository & add your instructor and grader as collaborators
- Create a **.gitignore** file in your repository and add following lines in that file: (gitignore)

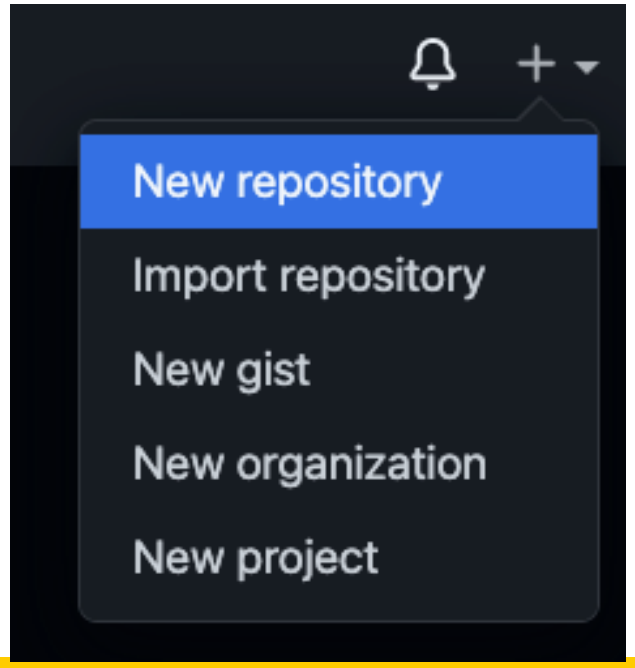
  *.**

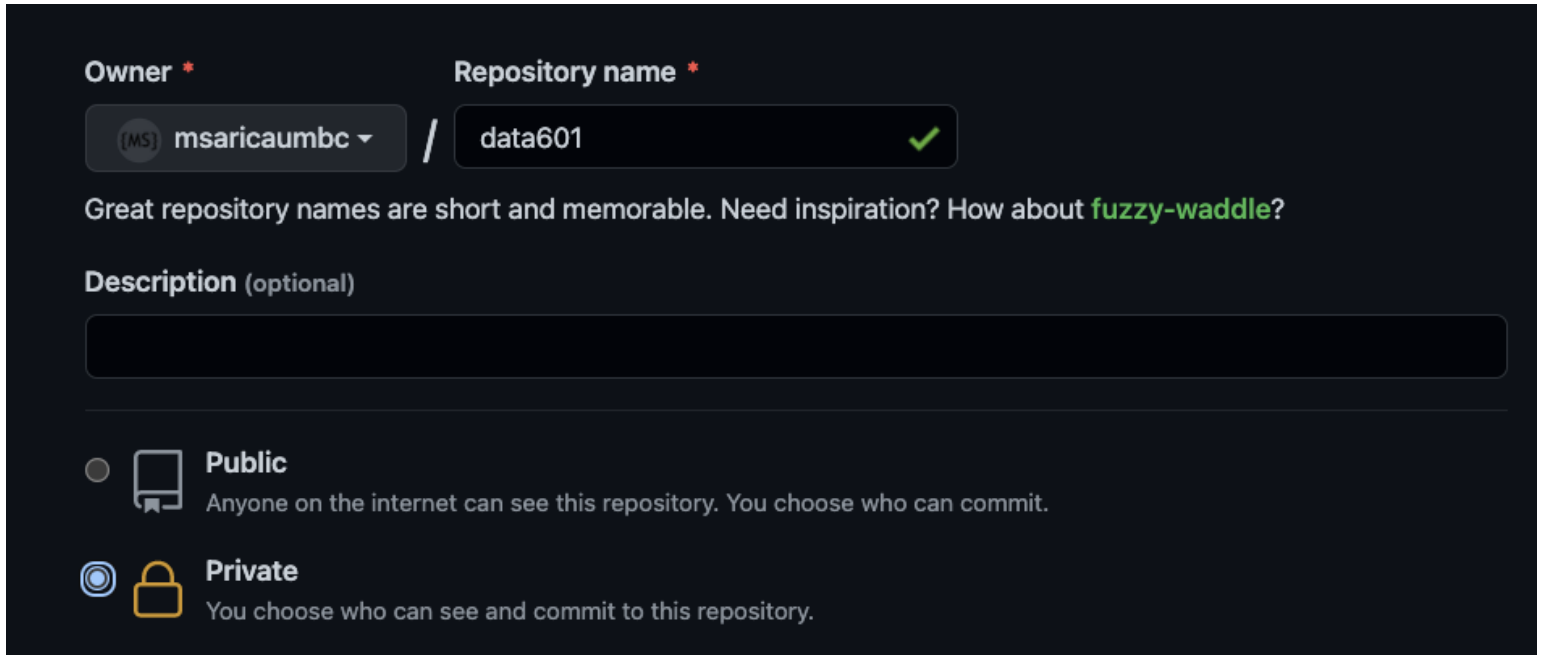
  **.csv*
- Create a folder in your github repository **week01**
- **Complete Homework1**

Create a new repository

- https://github.com/UMBC-Data-Science/Welcome#github

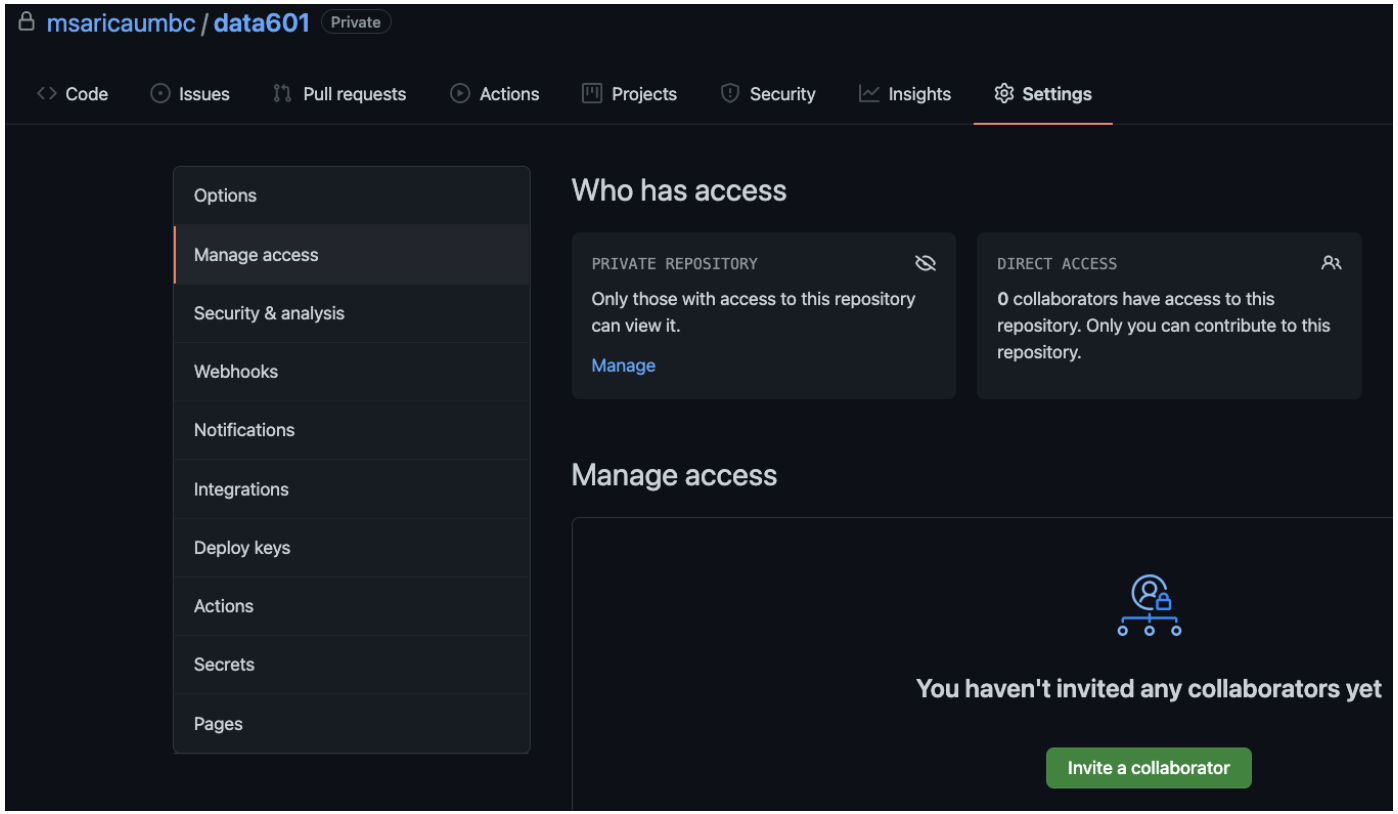
1. Go to github.com and create an account (you may skip this step if you already have an account)
2. Create a new PRIVATE repository & name it Data602.





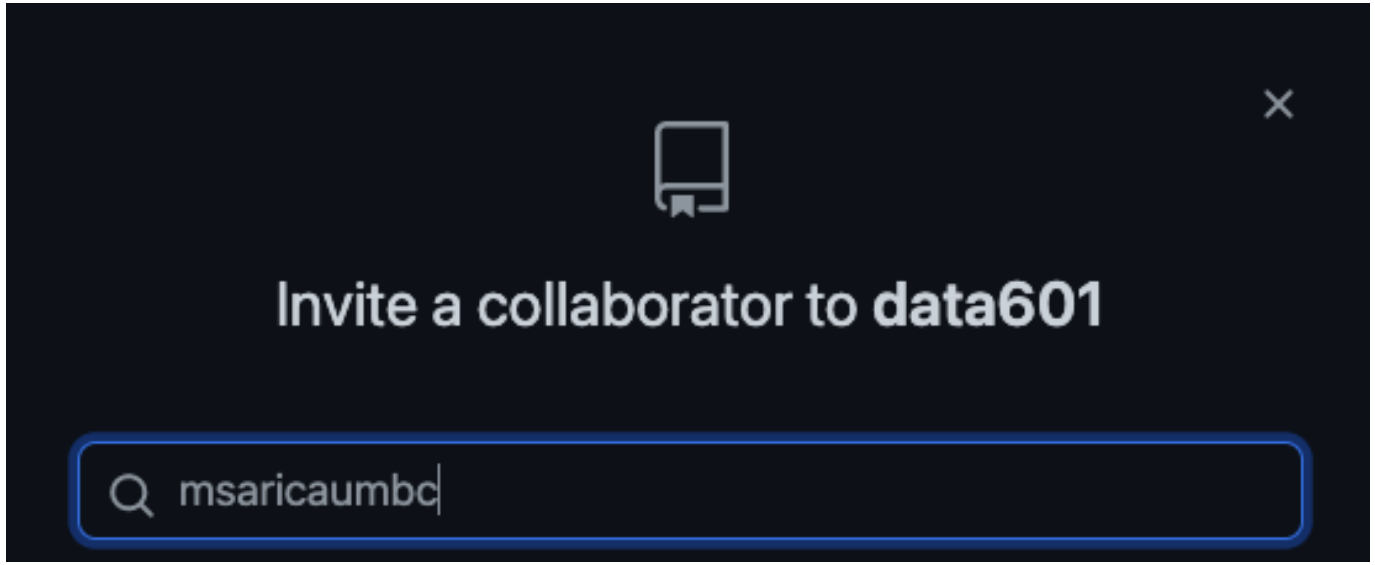
Create a new repository

3. Goto Settings & click Manage access from the left panel. (It may ask you to enter your password).

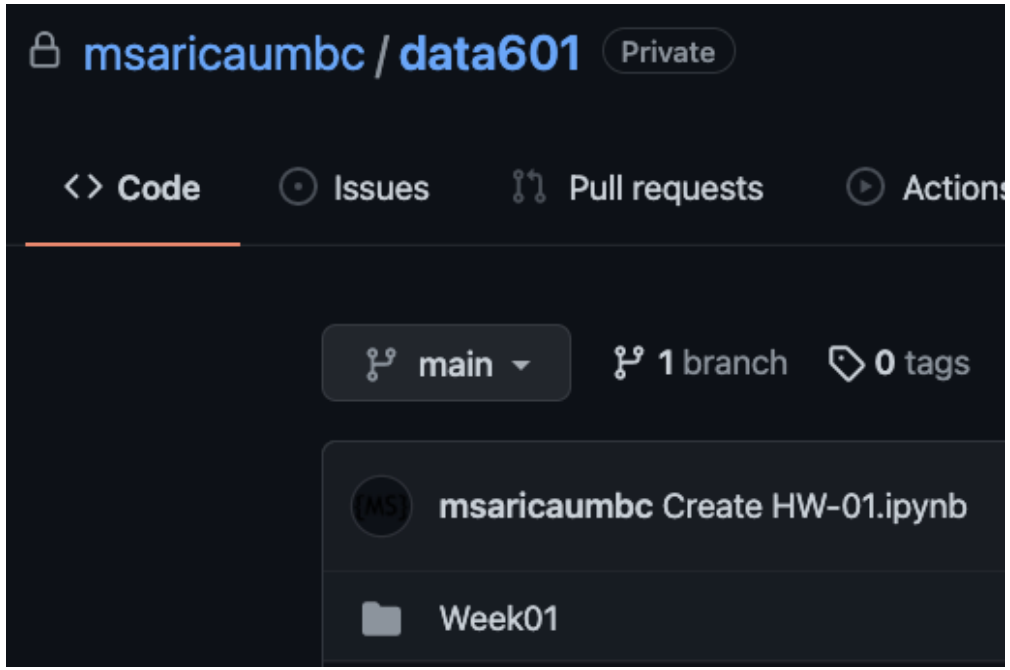


Create a new repository

4. Click Invite collaborator button and enter msaricaumbc
5. Click invite collaborator button and enter xxxxxx. (TA)



Your repo should look like the following!



.gitignore