Life after 106A

Fare thee well!

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Computer Science

Housekeeping

- Final Exam: Friday at 3:30pm in Skilling (here, sorry)
  - Everything through Friday (except Bit) is fair game
  - Yes this includes classes, tuples and sorting

- Final review tomorrow at 1:30 in Skilling with Clinton!

- Frankie has OH on Thursday 1:30-2:30 in Durand 307, no teatime :(

Today

- **Small code demo**
  - **Talk about the foundations of ChatGPT!**
  - **Plus a little discussion about generative AI**

- 106A: where you can go from here!
  - More Stanford classes
  - Fields + careers in CS
  - Frankie's CS journey

- AMA!

Small code demo- bigrams

- Given a file with text, build a dictionary where:
  1. Each word is a key
  2. Each value is a list of all the words that appeared directly after the key in the text

This and that and the other. ->

```
{
 '': ['This'],
 'This': ['and'],
 'and': ['that', 'the'],
 'that': ['and'],
 'the': ['other.'],
}
```

Bigrams: Gettysburg

Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal.

```
{
  '': ['Four'],
  'Four': ['score'],
  'score': ['and'],
  'and': ['seven', 'dedicated', 'so',
'proper', 'dead,', 'that'],
  'seven': ['years'],
  'dedicated': ['to', 'here', ...],
  ...
}
```

Why bigrams?

- Bigrams give us a “model” of a body of text,
- “Model” = a way to structure “natural language” in a way that a computer can reason about
  - Really, a way to structure natural language in a way we can tell a computer to reason about
- **Key idea: We can make computers generate natural looking text if they have a good enough bigram dictionary**

Code demo - generate natural language

Algorithm - "chase" through the bigrams to create text.

1. Start with a word, e.g. "Four" to start. This is the first word of the output.

2. Look at the list of words that come after it.

3. Choose one of those words at random as the next word. Repeat.

Gettysburg bigram outputs:

1. Four score and dedicated here highly resolve that all men are created equal. Now we can never forget what we can not dedicate a final resting place for us -- that nation so conceived in Liberty, and so nobly advanced. It is rather for the proposition that all men are created equal.

2. Four score and so nobly advanced. It is rather for those who struggled here, have thus far above our fathers brought forth on this continent, a great battle-field of devotion -- that we should do this. But, in Liberty, and dead, who here have consecrated it, far above our fathers brought forth on this continent, a final resting place for which they gave the unfinished work which they gave the people, for which they who fought here highly resolve that these dead we say here, have thus far above our poor power to add or detract.

Key idea: the original text matters!

- Try generating random text using bigrams that were made from different pieces of text

- **Key insight:** You will make more text that “sounds” like the original!

- The more text you give it, the better the output is

- Generative AI: Given a set of “input” text/images/etc, figure out a way to organize it in a pattern, and then generate more of it!

Why does this matter?

- This algorithm is like baby ChatGPT!
  - Really, it's like ChatGPT's great-great-great grandparent

- The way ChatGPT "speaks" matters, it will be a very influential tool for research in many fields

- The "input" we give it and the people who make it matter! A voice left out of ChatGPT's "input" will be felt!

Another important reason this matters

- The bigrams algorithm is not smart!
- The computer did not think about the meaning of the words
- **We** thought about the meaning of the words, and tried to find a pattern
- Then **we** tried to figure out how to instruct a computer to store the pattern
- (We can stop worrying about AI being scary…it's the people making the AI we should watch out for!)

Generative AI + SEO

- Lots of companies (good and bad) and other nefarious actors spend a lot of money and time on SEO - Search Engine Optimization
  - Basically, how can I get my page to the top of the search results for as many queries as possible
- Bajillion: The more frequently terms + combinations of terms appear on a site, the higher they are ranked for a query
- Nefarious idea: Generate a bunch of garbage webpage content that “sounds” like queries we know happen a lot
- This is made easier by tools like ChatGPT :(and it pollutes the internet!

Generative AI + coding help!

- Remember how fast it all went in the first few weeks of the course?
- Remember how slow assignments were?
  - “My idea was right I just forgot colon”
  - “I know what I need to do to this string, I just can’t remember the function name or what parameters it needs!”
- ChatGPT is really good at fixing your code and helping you get started!
- Learning how to make ChatGPT a tool for you is a good thing! As long as you don’t use your powers for nefarious activities!

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  - **Fields + careers in CS**
  - **Frankie's CS journey**

- AMA!

What you know now

- Computers are not magic boxes, in fact they aren't even particularly smart boxes

- They are robots! You give them instructions, they execute the instructions, and they are bad at adjusting for new inputs/mistakes!

- It takes a human being very clever to show a computer how to do a simple task - you are in control, not the computer!

- But once you do, the sky is the limit!

What you know now

- About 80% of all programming techniques
  - loops, lists, strings, functions, tests, files
- A few more to go (take 106B!) but you could hold your own in a conversation about programming!

- Most programmers (including me) don't have all 100% memorized - we look up as we go!

- The most important skill you can practice is looking up your questions early and often

Careers: Programmer Shortage

- Every industry needs programmers!
  - Healthcare - store/send patient info, use AI to identify abnormalities in scans, endless research
  - Transportation - facilitate communication between major systems, use data to coordinate traffic
  - US Government - have you used a .gov website?
  - Agriculture - we need to figure out how to reduce land+water usage! Data science helps with that!

- There are not that many programmers in the world - people think coding is scary

- Now you know its not!

Learn more languages

- Your second language will be SO much easier than your first language

- You will hardly notice learning your third language!

- You will pick many languages on-the-fly

Learn more languages: Why so many?

Python:

- Good for making something fast
- Very programmer friendly, looks close to English
- Lots of libraries/online support!
- Python code is very slow :(

C++:

- Less programmer friendly
- Still lots of libraries/online support
- SUPER fast
- Also kinda broken :(
- What 106B uses!

C++ vs Python

TODO

Learn more languages: Why so many?

Javascript

- The language of the internet!
- Most “frontend” programs are written in Javascript/Typescript
- Not related to Java :)

Java

- What AP CS teaches for some reason

Rust

- Like C++ but not broken!
- Super hard to learn

More Stanford classes: 106B

- The obvious next step in CS - mixture of programming and science
- Coding problems are harder and more “impressive” compared to 106A
- Has section leaders
- Many non-CS-majors take this
- Uses C++ language - don't worry about this
- Recursion (beautiful) .. e.g. solving a maze
  - A sort of jaw-dropping idea when you get it
- Really understand: hash table (dict), sorting algorithms
- More hands-on use of memory

More Stanford Classes

- Scientific Python CME 193
  - Python and scientific computing
  - Applied Python (vs. CS fundamentals)
- Human Computer Interaction (HCI) CS147
  - How to design programs/apps/systems to work well with humans
- Web Applications
  - Building robust web servers+pages
  - Prereq CS107
- CS148: Graphics
  - 3d imagery
  - Prereq: CS107, Math 51
  - How does Mario Cart work?
- Applied Machine Learning CS129
  - Machine Learning is the cutting edge AI technique
  - Prereq 106B

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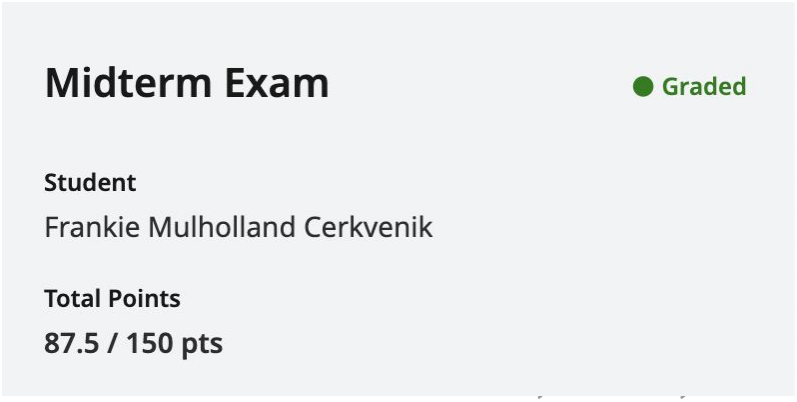
Frankie's CS Journey

- Took one of the first offerings of AP CS at my high school
- Came here, wanted to be a math major, a CS106 course and a math course
  - Dropped math - never thought I would do school without math
  - The CS courses were SO well taught and SO interesting, I couldn't stay away
- Had some low points!

8	CS106XCell	Fri, Dec 7, 2018 5:54 PM (due Fri, Dec 7, 2018 6:00 PM)	Graded	Functionality: - Style: ✓-	0

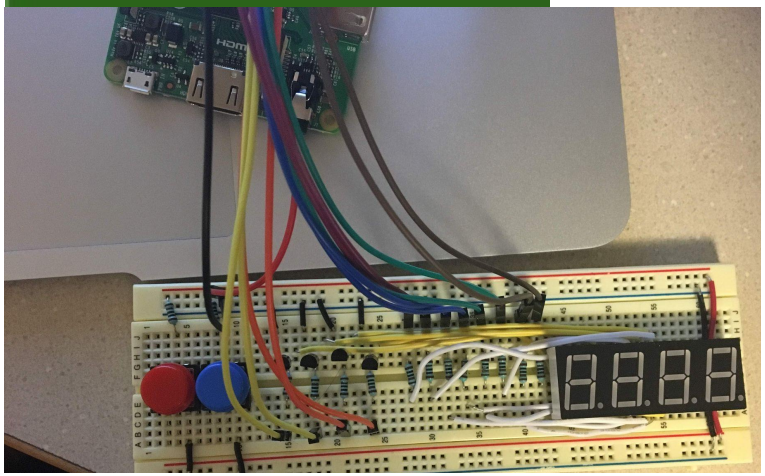


Frankie's CS Journey

- Had a lot of high points!

CS107e

CS107E: Alt version of CS107, made me love systems, I eventually chose systems as my concentration!



- Cool projects, breadboards, coding in C on a Raspberry Pi

Joined the SL community sophomore year - been teaching ever since!

Welcome to CS198! Inbox ×

CS198 Coordinators <cs198@cs.stanford.edu> Fri, Nov 22, 2019, 6:11 PM

to Fmcerk

Hi Frankie,

Congratulations! We were impressed with your application and interviews for the CS198 program and are excited to offer you a section leading position starting in Winter 2020.

It should be an amazing quarter and we are looking forward to working with you! The times to add to your calendar are:

Frankie's CS Journey

- Always loved teaching - originally wanted to teach HS math (it shouldn't be so miserable! It can be fun!)
- SLed for 2 years, mostly CS106B!
  - Covid pandemic: We were sent home, classes all remote
  - Junior year: Moved into my Toyota Sienna + drove around the country, taught remote section
  - SLed for Code in Place - you can too!
- Senior year: lectured CS106L
- As a grad student: lectured CS107A
- I've learned more teaching these intro level classes than in all my other courses combined!

Frankie's CS Journey: Now

- My undergrad focused on systems: the low level of how computers and their architecture work, how we can make "systems" for specific tasks
- My masters focused on networks - these are large systems! - and their security
- Special interest in the internet, security + safety on the internet
- After 106A (and currently): Software engineering at Block Party (AKA Privacy Party) - I want to keep people safe online!
- Eventually: continue teaching

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Before we move on… Thanks are in order!

- Our fearless head TA Ecy is a superstar - 106A simply would not run without her

- The SLs are an incredible group! They all work so hard to keep this class afloat and to keep **you** afloat - they genuinely care if you succeed!

THANK YOU!

AMA time!

- Ask about anything!
  - CS
  - Internet stuff
  - Software engineering stuff
  - Stanford
  - College in general
  - Masters programs
  - Living in a van!
  - Minnesota
  - My hobbies
  - ???

AMA time!