CS106A: Programming Methodology
• Childhood: Iran
• High School: San Diego
• Stanford Ph.D. in Machine Learning
  (Before Machine Learning was cool)
• Spent a decade in tech industry before coming back as professor
  • Love of teaching is why I came back
Mehran Sahami

• Took CS106A my freshman year at Stanford
  • It changed my life

• But it did not make me cut my mullet
  • It should have...
Section Leaders

* Actually some past section leaders

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Course mechanics
(This is a brief version. Please read the handout for full details).
Course Website

http://cs106a.stanford.edu
Prerequisite Test
“It is a really difficult time for my family right now, but I will still be trying my best in this class.”

• Please be safe, compassionate, and kind. So will we.
Lectures and Sections

• Lectures MWF 12:15-1:15pm
  – Will be recorded (available on Canvas)
• Weekly 50-min section led by awesome section leaders (the backbone of the class!)
  – Section signups will be on class webpage (not Axess)
  – Signups begin on Thursday at 5pm and close Sunday at 5pm.
Office Hours in Durand Building

LaIR: evenings Sunday through Thursday (starting Sunday)

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Grading Scale

**Functionality** and **style** grades for the assignments use the following scale:

- **+++** A submission so good it “makes you weep”
- **++** Exceeds requirements (and has great style)
- **++** Satisfies all requirements, with good functionality and style
- **+** Meets the requirements, but perhaps with a small problem
- **+** Has some somewhat more serious problems
- **-** Is worse than that, but shows real effort and understanding
- **--** Better than nothing

You are only competing against yourself.
Interactive Grading

One on one feedback from your section leader

- Chance for you to get more feedback than just a grade
- Opportunity to really develop “style” as a programmer
  - We’ll talk more about that soon
- We can put focus on learning rather than grading
What we will ask you to do

• 7 programming assignment 50%
  • Get more complicated as quarter progresses
• Midterm exam 15%
• Final exam 30%
• Section participation 5%

• Get 4 free “late days” (on assignments)
  • Each “late day” is a 24-hour period
  • Allows for turning in assignment late without penalty
  • After free late days are used, assignments penalized one grade bucket per day late
  • For extensions beyond free late days, contact Juliette (head TA)
Optional Contest
Online Text Books

Karel the Robot

Learns Python

Chris Piech and Eric Roberts
Department of Computer Science
Stanford University
January 2019

Get Started
Chapter 2: Programming Karel

The simplest style of Karel program uses text to specify a sequence of built-in commands that should be executed when the program is run. Consider the simple Karel program below. The text on the left is the program. The state of Karel's world is shown on the right:

```
# File: FirstKarel.py
# This program defines a "main" function with three commands.
# These commands cause Karel to move forward one block, pick up a beeper
# and then move ahead to the next corner.
from karel.stanfordkarel import *

def main():
    move()
    pick_beeper()
    move()
```

Press the "Run" button to execute the program. Programs are typically written in a special application called an Integrated Development Environment (IDE) and most Karel programs are written in an IDE called PyCharm. Like an IDE, this reader has the ability to execute programs in order to help you see how things work as you learn.

The program is composed of several parts. The first part consists of the following lines:

```
# File: FirstKarel.py
# This program defines a "main" function with three commands.
```
CS106A Units

Hours per week = Units \times 3

Average about 10 hours / week for assignments

Start Here

Are you an undergrad?

Yes

No

Do you want to take CS106A for fewer units?

Yes

3 Units -or- 4 Units

No

5 Units
Are you in the right place?
### Where Should You Start?

- **No/light previous programming (many students start here)** → **CS106A**
- **Limited previous programming (e.g., written “short” programs)** → **CS106A**
- **AP exam: CS Principles, score 4 or 5** → **CS106A**
- **AP exam: CS A, score 4 or 5** → **CS106B**
- **No AP, significant previous programming experience** → **CS106B**
- **Extensive prior experience and/or multiple prior CS classes** → **CS106B or 107**
- **Just want to satisfy “Ways” and know that will be all you’ll take** → **CS105 or 106A**
What is CS106A?
“Computer science is no more about computers than astronomy is about telescopes, biology is about microscopes or chemistry is about beakers and test tubes. Science is not about tools, it is about how we use them and what we find out when we do.”

— Michael Fellows and Ian Parberry

“You must unlearn what you have learned”

— Yoda
Learning Goals

- Learn how to harness computing power to solve problems.

To that end:
- Explore fundamental techniques in computer programming.
- Develop good software engineering style.
- Gain familiarity with the Python programming language.
There are a lot of cool programs you may one day write
Pat Hanrahan, one of the founders of Pixar is a professor here. He recently won the Turing Award – the Nobel Prize of Computer Science.
Consumer Applications
Self-Driving Car

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If only we could program self-driving cars...
Image Transformation

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Data Science

The image shows a timeline graph for baby names, with the names Kylie, Nicholas, and Sonja highlighted. The graph tracks the popularity of these names from 1900 to 2010. The names Kylie and Nicholas show a decrease in popularity, while Sonja shows a significant increase in popularity over the years. The graph also includes search functionality for baby names.
Internet Applications

Can Yahoo dominate next decade?
...But for others there is another, newer net icon threatening to overshadow Yahoo in the post dot-com world - Google. The veteran and the upstart have plenty in common - Yahoo was the first internet fi...

Yahoo celebrates a decade online
...f people and the two saw business potential in their idea. Originally dubbed "Jerry's Guide to the World Wide Web" the firm adopted the moniker Yahoo because the founders liked the dictionary definit...

Musical future for phones
...re's never anything worth watching on TV, is hardly going to embrace these phones. But just as the World Wide Web was the "killer application" that drove internet adoption, music videos are going to ...

Rolling out next generation's net
...e web. At Cern, Dr Carpenter helped pioneer advanced net applications during the development of the world wide web, so he is well-placed to take on such a task. The net's growth and evolution depend o...
Strive for Everyone to Succeed
Lets Get Started
Meet Karel the Robot

Good morning
Karel Speaks Python
Why Python?

https://stackoverflow.blog/2017/09/06/incredible-growth-python/
Guido van Rossum
Karel’s World

“Streets” run East/West

“Avenues” run North/South
Walls
Beepers

1
2
3

1 2 3 4 5

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Knows Four Commands

move()
turn_left()
put_beeper()
pick_beeper()
move()
move()
move()
turn_left()
`turn_left()`
**turn_left()**
pick_beeper()
turn_left()
turn_left()
Make Sense?
Bird’s Eye View
Bird’s Eye View

Karel is facing East
Turn Left

Karel is facing North
Turn Left

Karel is facing West
Turn Left

Karel is facing South
Learn By Doing
First Challenge
First Challenge

![Diagram of a grid with a robot and obstacles]

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def name():
    function statements

This adds a new command to Karel’s vocabulary
Anatomy of a Program

Import Packages

Program
Anatomy of a Program

Import Packages
def main():
    move()
    pick_beeper()
    move()
    turn_left()
    move()
    turn_right()
    move()
    put_beeper()
    move()

def turn_right():
    turn_left()
    turn_left()
    turn_left()

if __name__ == '__main__':
    run_karel_program()
def main():
    move()
    pick_beeper()
    move()
    turn_left()
    move()
    turn_right()
    move()
    put_beeper()
    move()
def main():
    move()
    pick_beeper()
    move()
    turn_left()
    move()
    move()
    turn_right()
    move()
    move()
    put_beeper()
    move()

def turn_right():
    turn_left()
    turn_left()
    turn_left()
def main():
    move()
    pick_beeper()
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    turn_left()
    move()
    move()
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def turn_right():
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    turn_left()
    turn_left()

if __name__ == "__main__":
    run_karel_program()

This piece of the program's source code is called a function.
from karel.stanfordkarel import *

def main():
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    move()
    turn_left()
    move()
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def turn_right():
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if __name__ == "__main__":
    run_karel_program()
Anatomy of a Program

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    move()
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    move()
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if __name__ == "__main__":
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from karel.stanfordkarel import *

def main():
moves
pick_beeper()
moves
turn_left()
moves
turn_right()
moves
put_beeper()
moves

def turn_right():
turn_left()
turn_left()
turn_left()

if __name__ == '__main__':
    run_karel_program()
Why Study CS?
Interdisciplinary
Closest Thing To Magic
Everyone is Welcome
The End
The End?