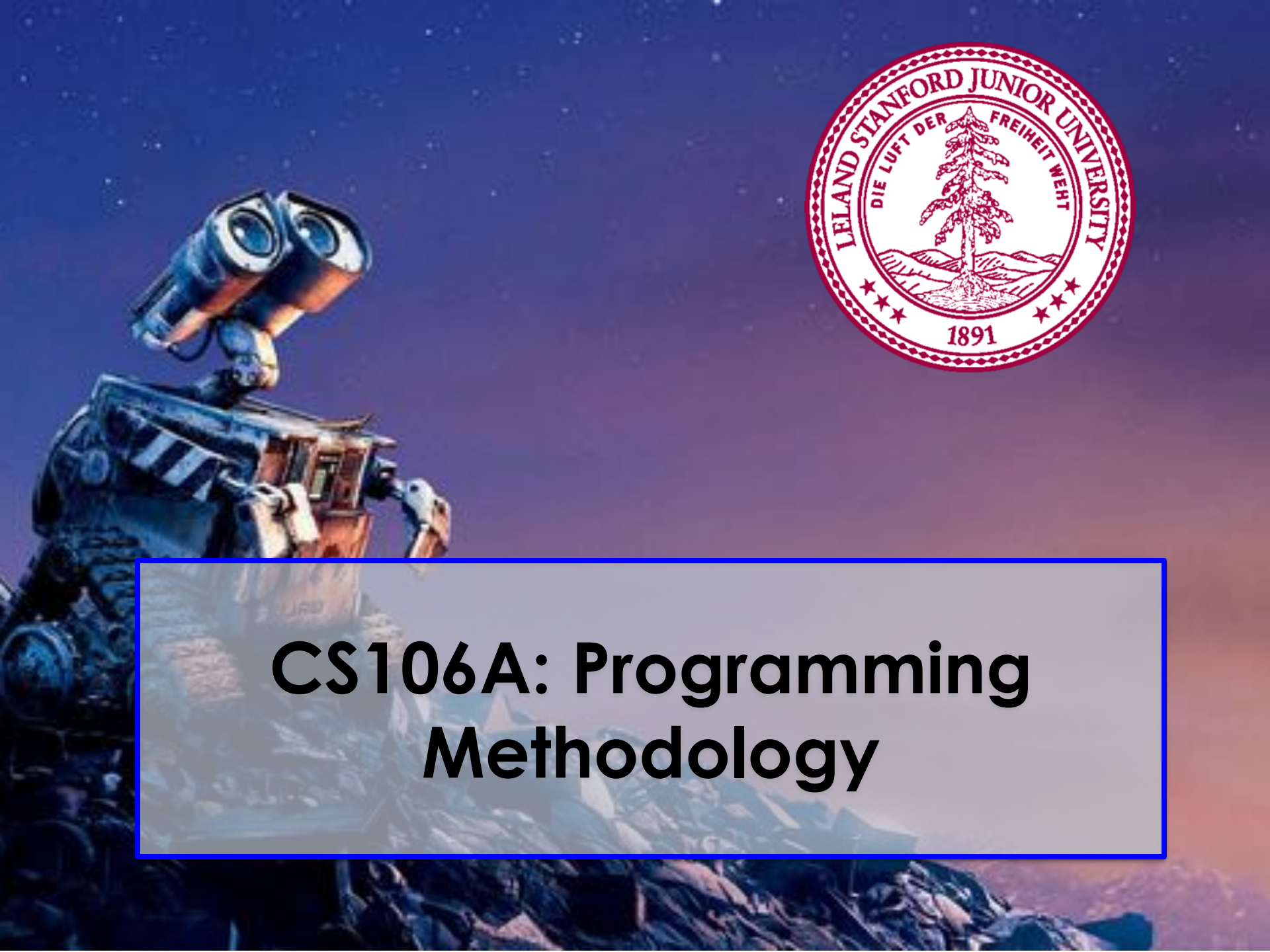


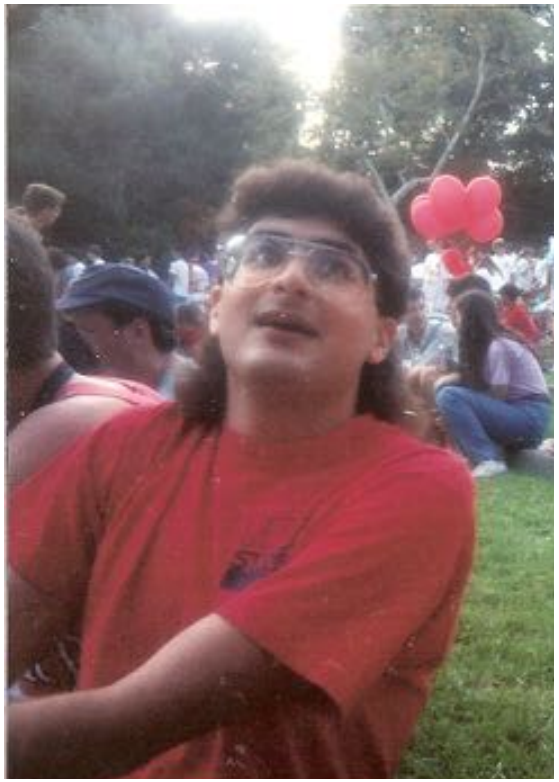
CS106A: Programming Methodology

Mehran Sahami

- Childhood: Iran
- High School: San Diego
- Stanford University 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…



Chris Piech

My parents are interesting folks

I originally concentrated in graphics and worked at Pixar

- Childhood: Nairobi, Kenya
- High School: Kuala Lumpur, Malaysia
- Stanford University Ph.D. in Neural Networks
- Research lab on AI for Social Good

The problem I really want to solve is to make high quality education more accessible

Chris Piech

12 years ago to this day, I was sitting in your seats

Head TA: Brahm Capoor

Section Leaders


Luciano Gonzalez


Maggie Davis


Marilyn Zhang


Meng Zhang


Nidhi Manoj


Niki Agrawal


Peter Maldonado


Rachel Gardner


Rhea Karuturi


Robbie Jones


Ruiqi Chen


Semir Shafi


Shanon Reckinger


Tessera Chin


Thariq Ridha

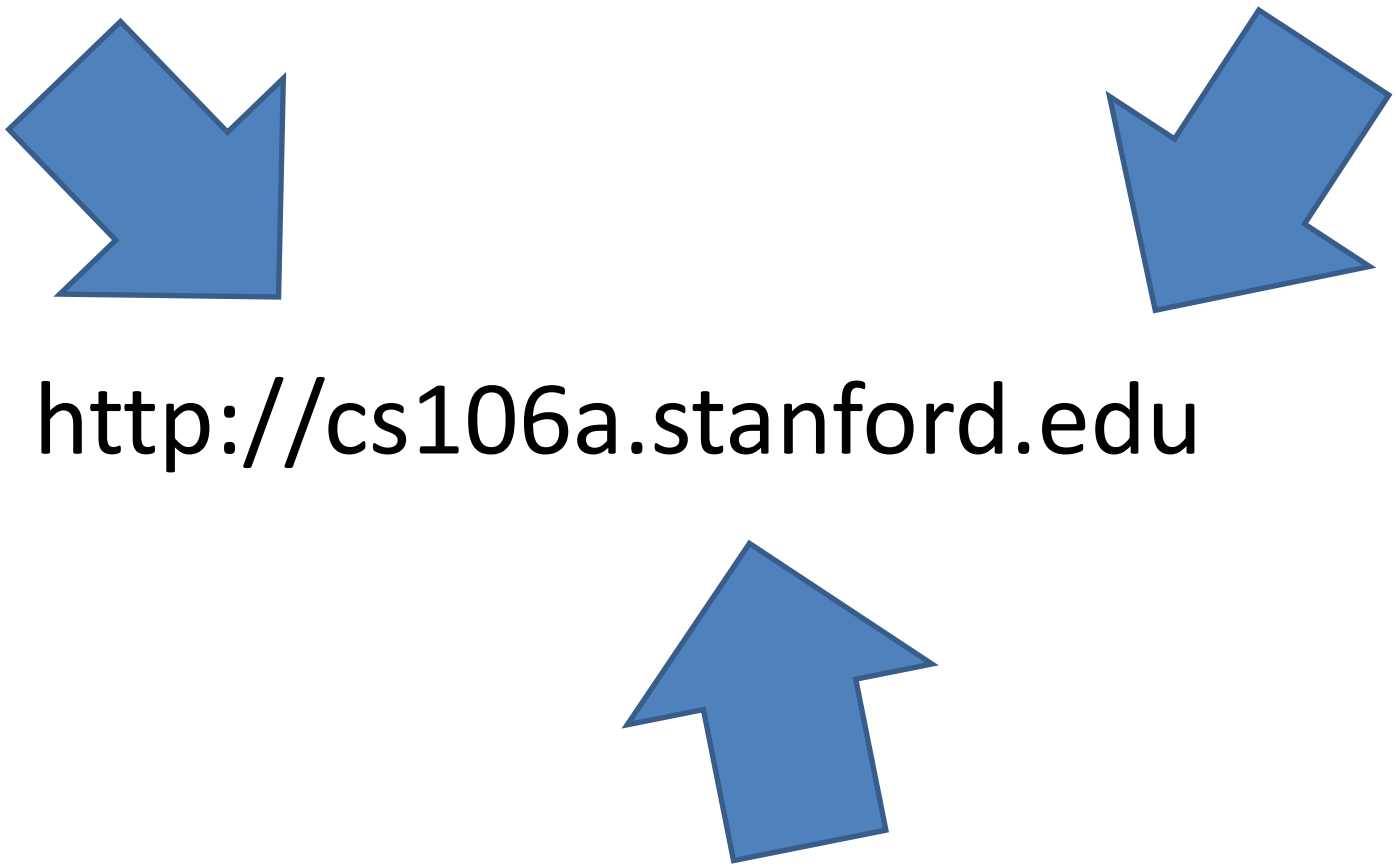

Vineet Kosaraju

* Actually some of last year's section leaders

Course mechanics

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

Course Website

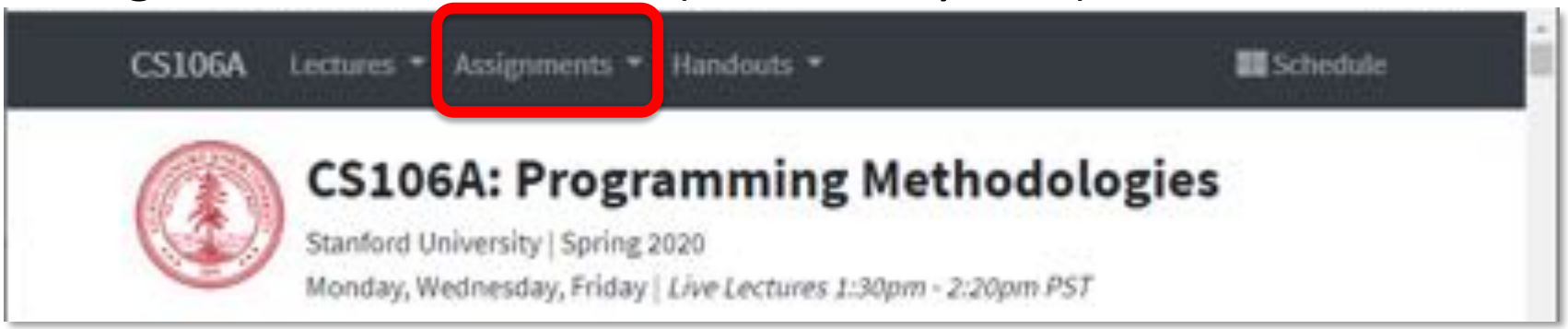


http://cs106a.stanford.edu

Prerequisite Test

Getting To Know You

- Assignment #0 on website ("Who are you?")



- Some initial responses (~125 responses so far)
  - Class is 60% women, 39% men, 1% prefer not to say
  - 4 students are former/current members of the armed forces
  - 15 students have founded socially-focused ventures
  - 1 student attacked by kangaroo when they were younger
  - "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 1:30-2:20pm
  - 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

LaIR: evenings Sunday through Thursday (starting Sunday)

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 small problems
✓−	Has some somewhat 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

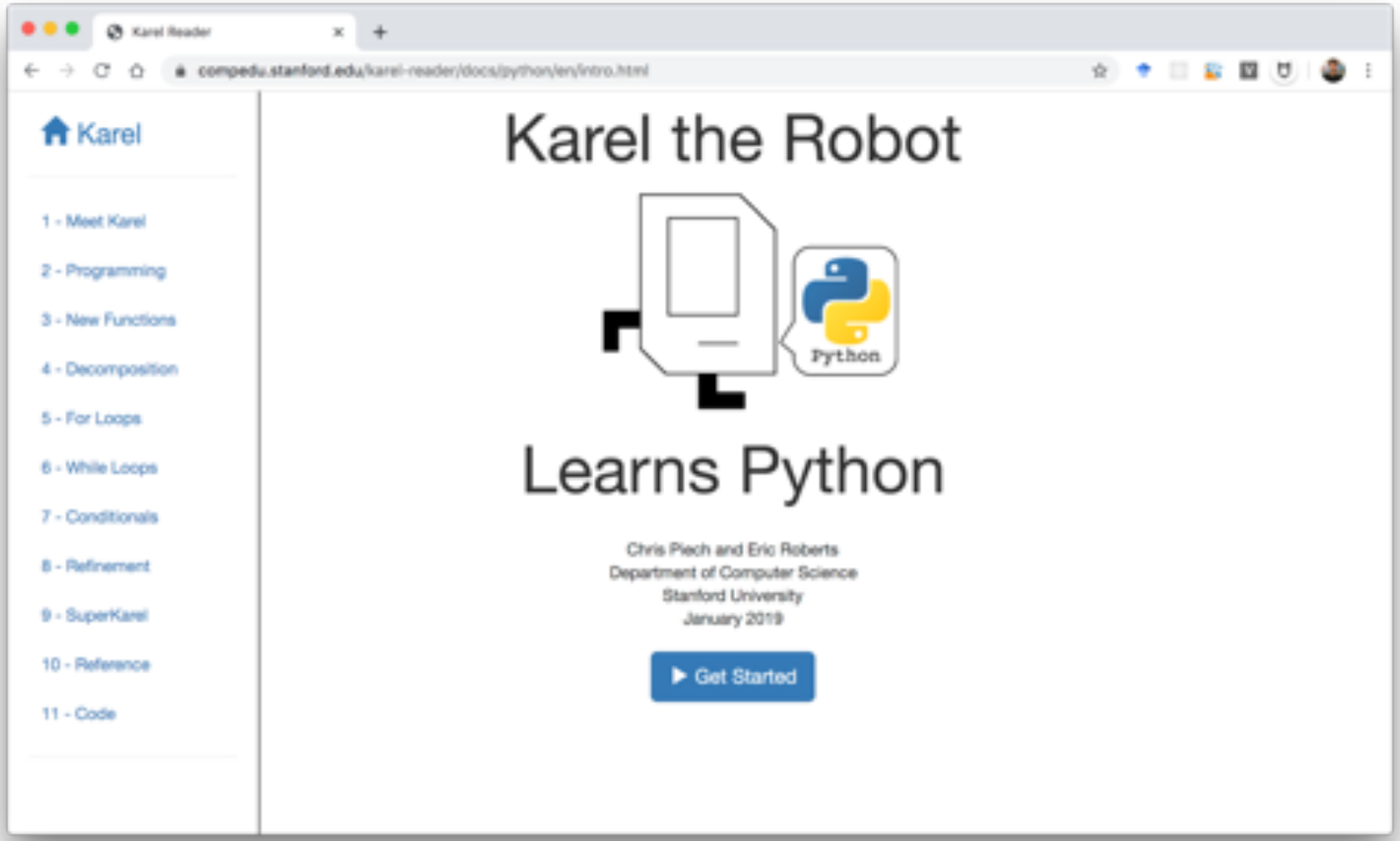
- Chance for you to get more feedback than just a grade
- Opportunity to really develop “style” as a programmer
  - We’ll talk more about that soon
- This quarter, especially, we can put much more focus on *learning* rather than grading

What we will ask you to do

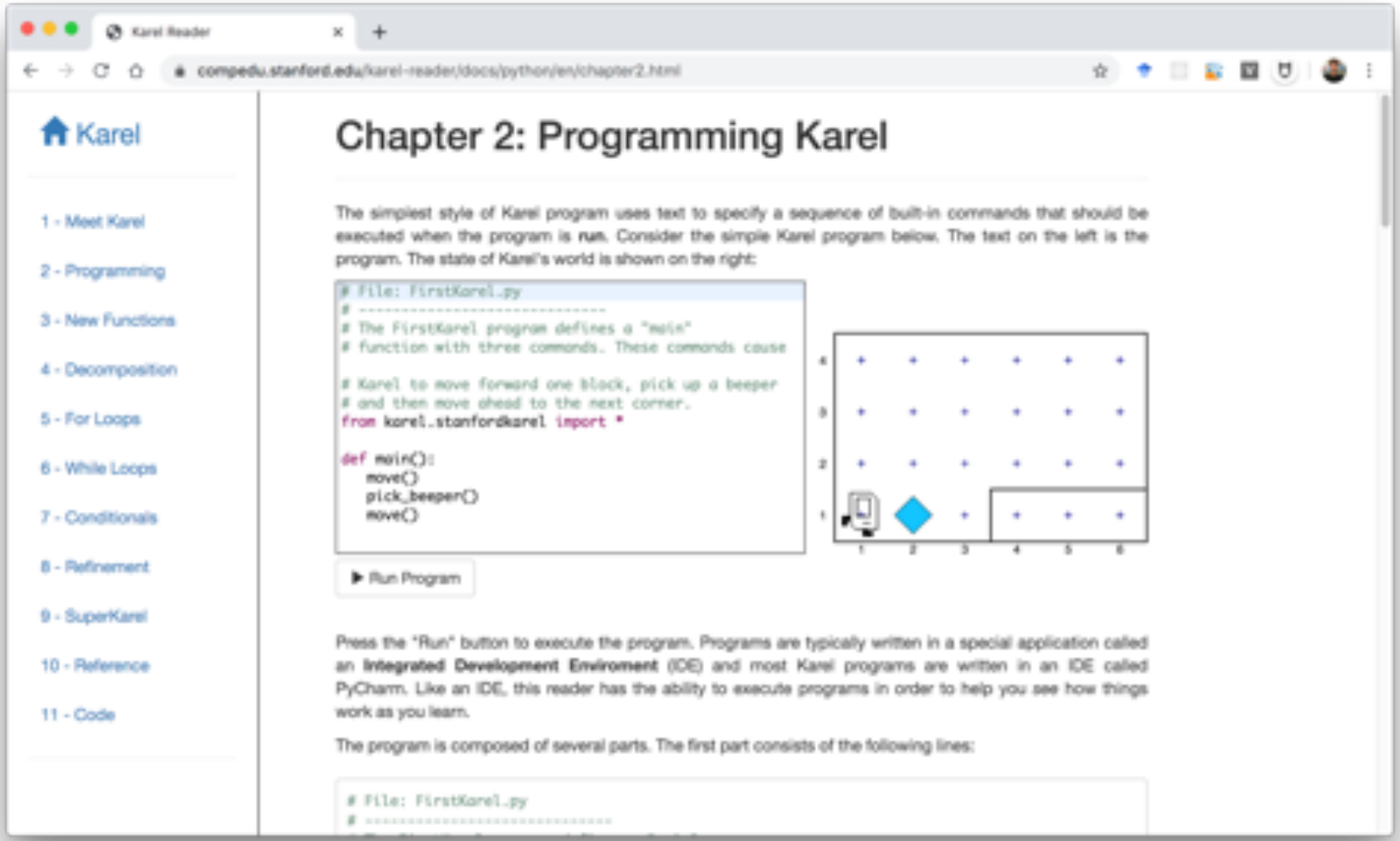
- 7 programming assignment 75%
  - Get more complicated as quarter progresses
- In-class diagnostic assessment (exam) 15%
- Section participation 10%
- Get 4 free "late days" (on assignments)
  - Each "late day" is a 24-hour period
  - Allows for turning in assignment late without penalty
  - After free late days are used, assignments penalized one grade bucket per day late
  - For extensions beyond free late days, contact Brahm (head TA)

Optional Contest

Online Text Books



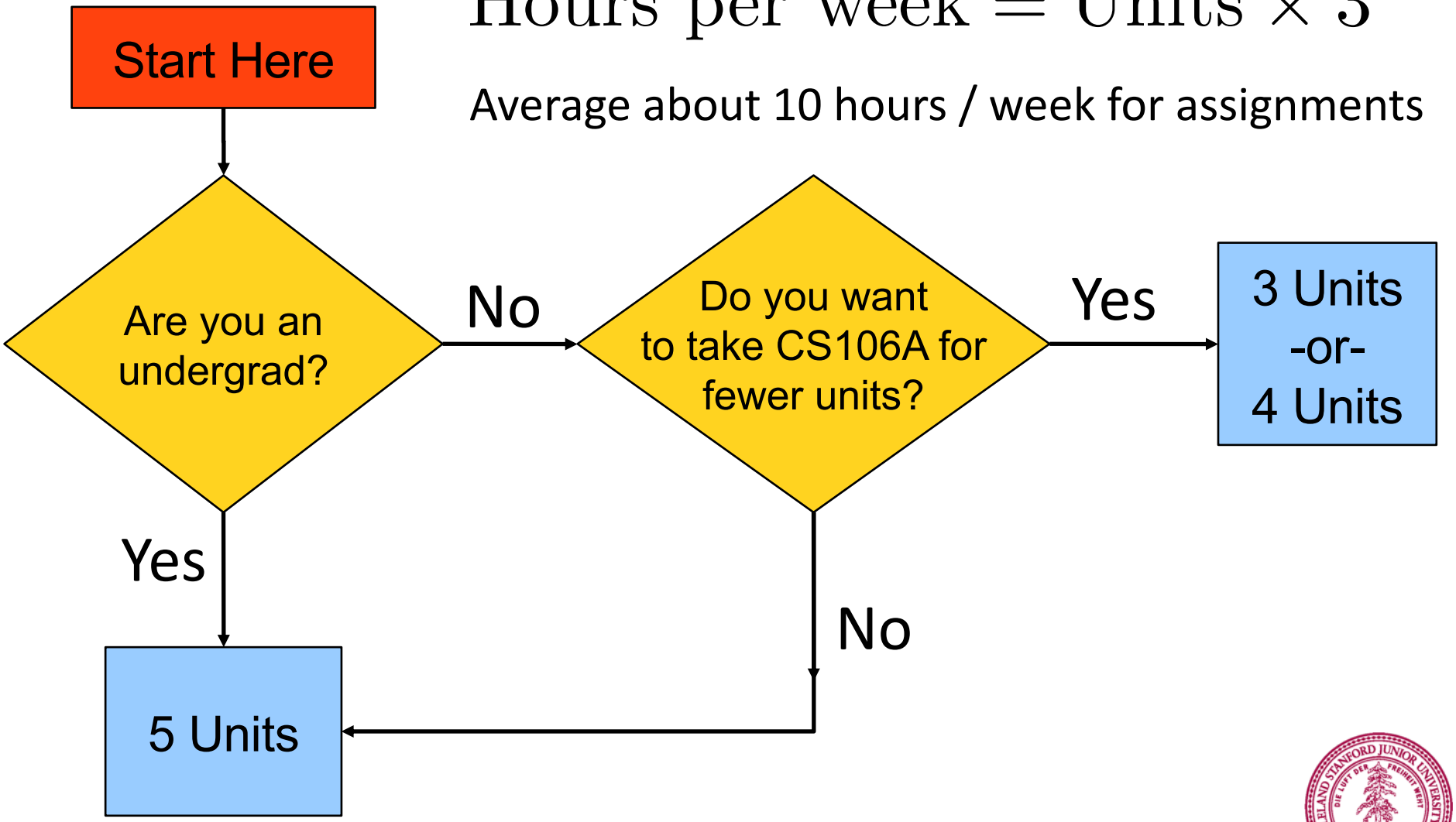
Online Karel Reader



CS106A Units

$$\text{Hours per week} = \text{Units} \times 3$$

Average about 10 hours / week for assignments



Are you in the right place?

What is CS106A?

Computer Science

"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

Computer Graphics

Pat Hanrahan, one of the founders of Pixar is a professor here.
He just won the Turing Award – the Nobel Prize of Computer Science

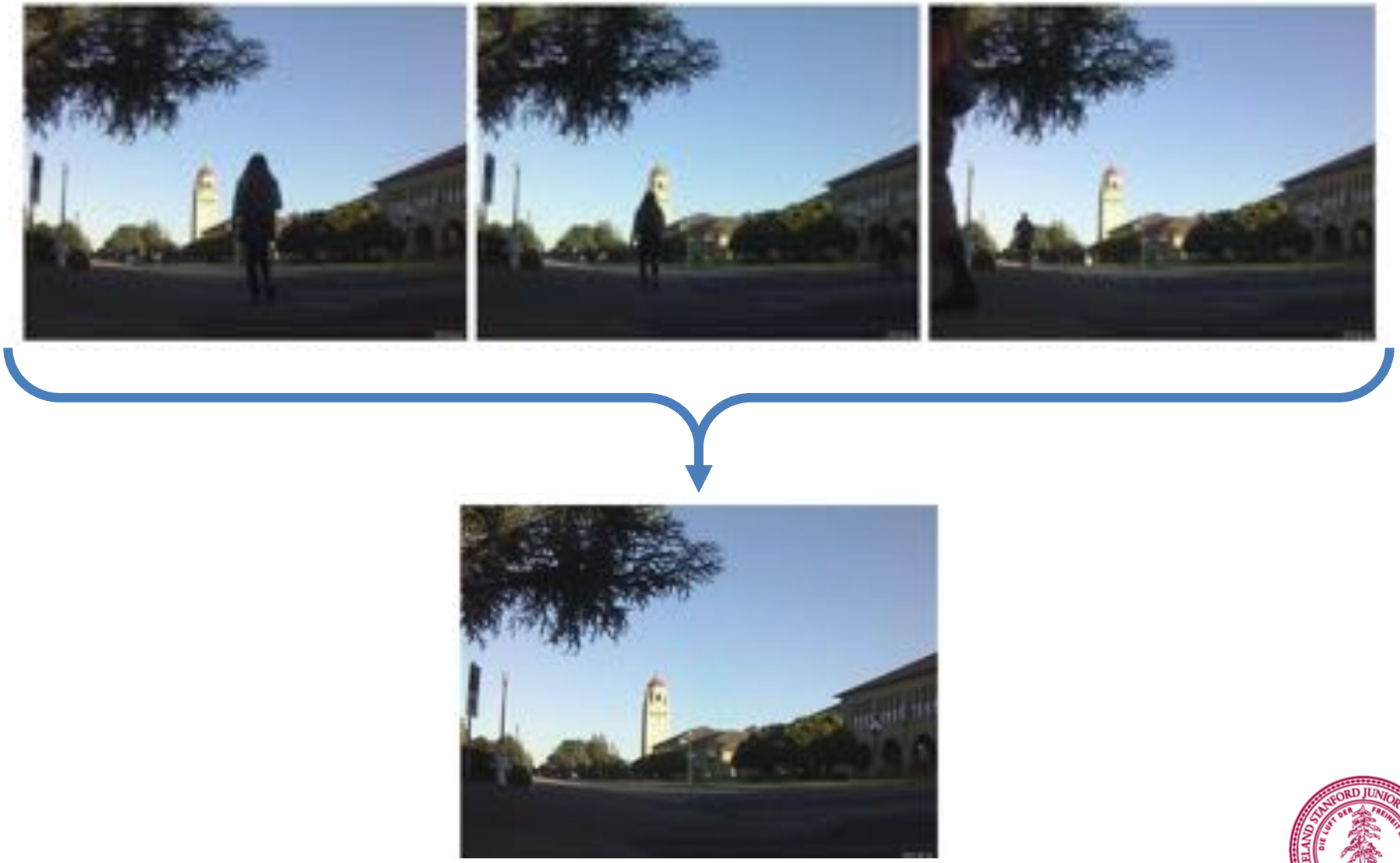
Consumer Applications

Autonomous Surgery

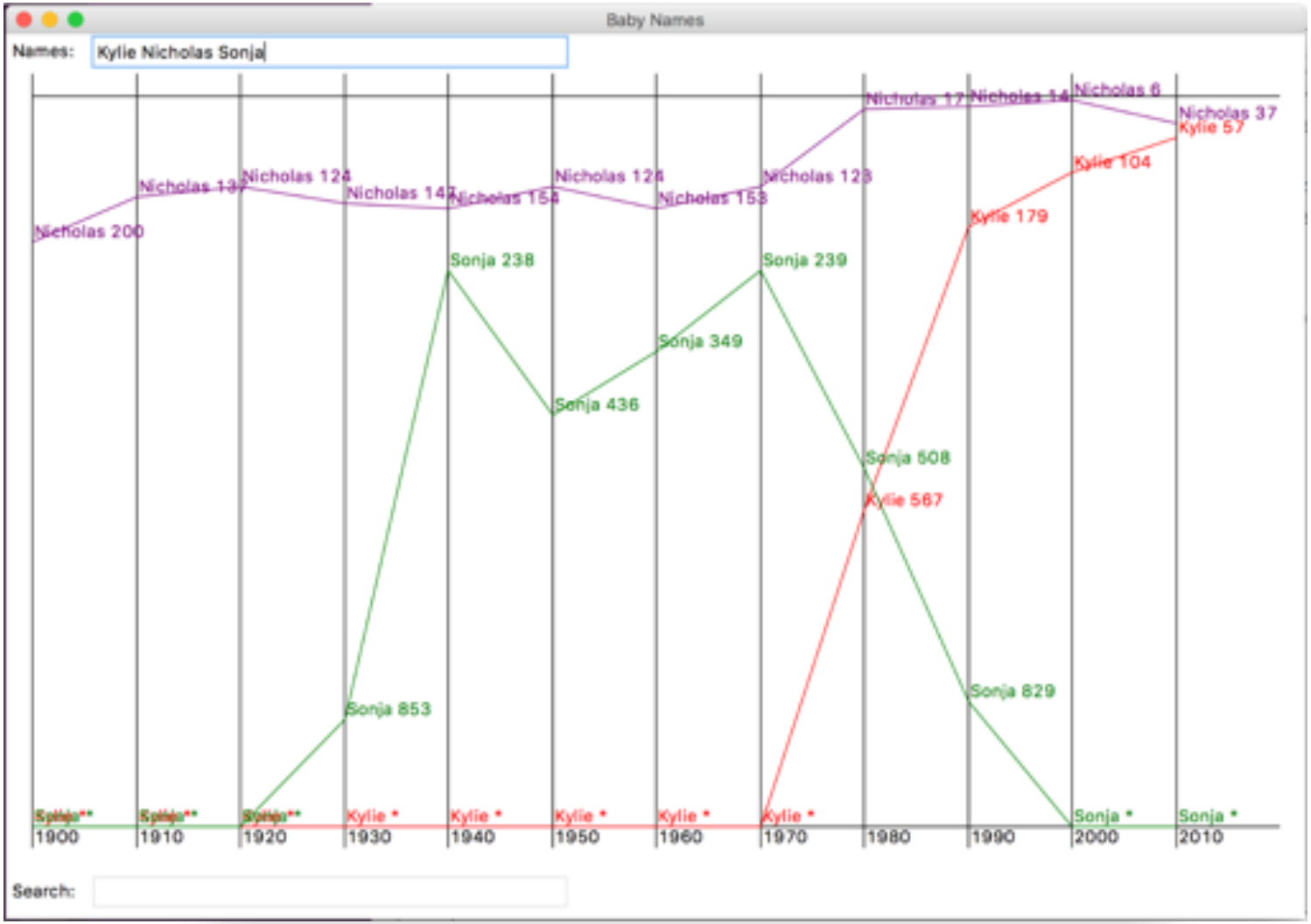
Self-Driving Car

If only we could program self-driving cars…

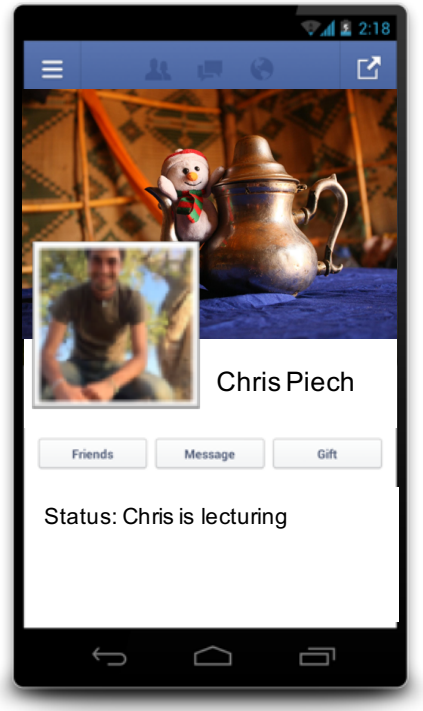
Image Transformation

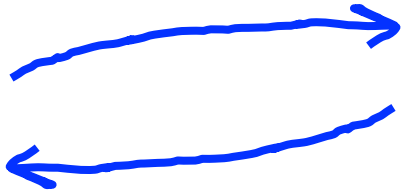


Data Visualization



Internet Applications





FacePamphletServer

```
Starting server on port 8000...
addProfile (name=Mehran)
  => success
addProfile (name=Chris)
  => success
addProfile (name=Chris)
  => Error: Database already contains Chris.
getStatus (name=Chris)
  => none
setStatus (name=Chris, status=teaching)
  => success
getStatus (name=Chris)
  => teaching
addFriend (name2=Mehran, name1=Chris)
  => success
getFriends (name=Chris)
  => [Mehran]
addProfile (name=Julie)
  => success
getImg (name=Julie)
  => none
getStatus (name=Julie)
  => none
getFriends (name=Julie)
  => []
setImg (img=JulieZ.jpg, name=Julie)
  => success
getImg (name=Julie)
  => JulieZ.jpg
getStatus (name=Julie)
  => none
getFriends (name=Julie)
  => []
addFriend (name2=Chris, name1=Julie)
  => success
getImg (name=Julie)
  => JulieZ.jpg
getStatus (name=Julie)
  => none
```

Art of Computer *Science*

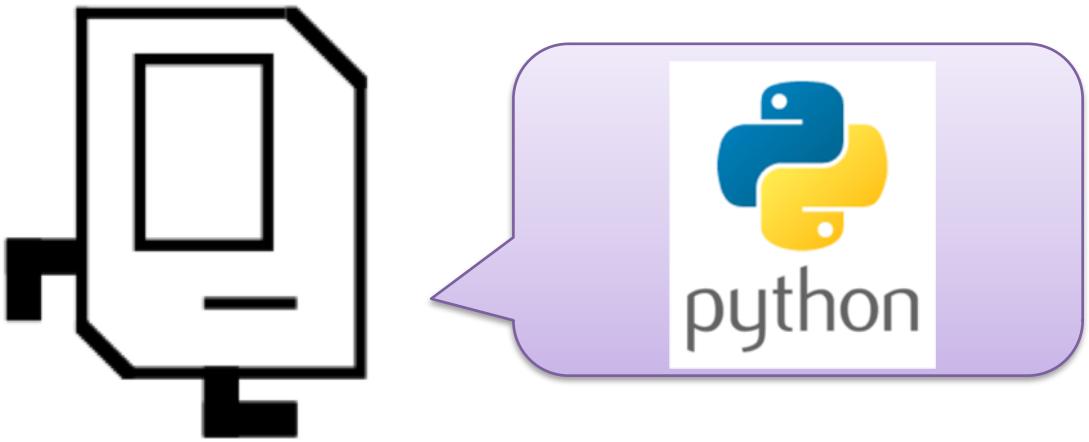
Strive for Everyone to Succeed

Lets Get Started

Meet Karel the Robot

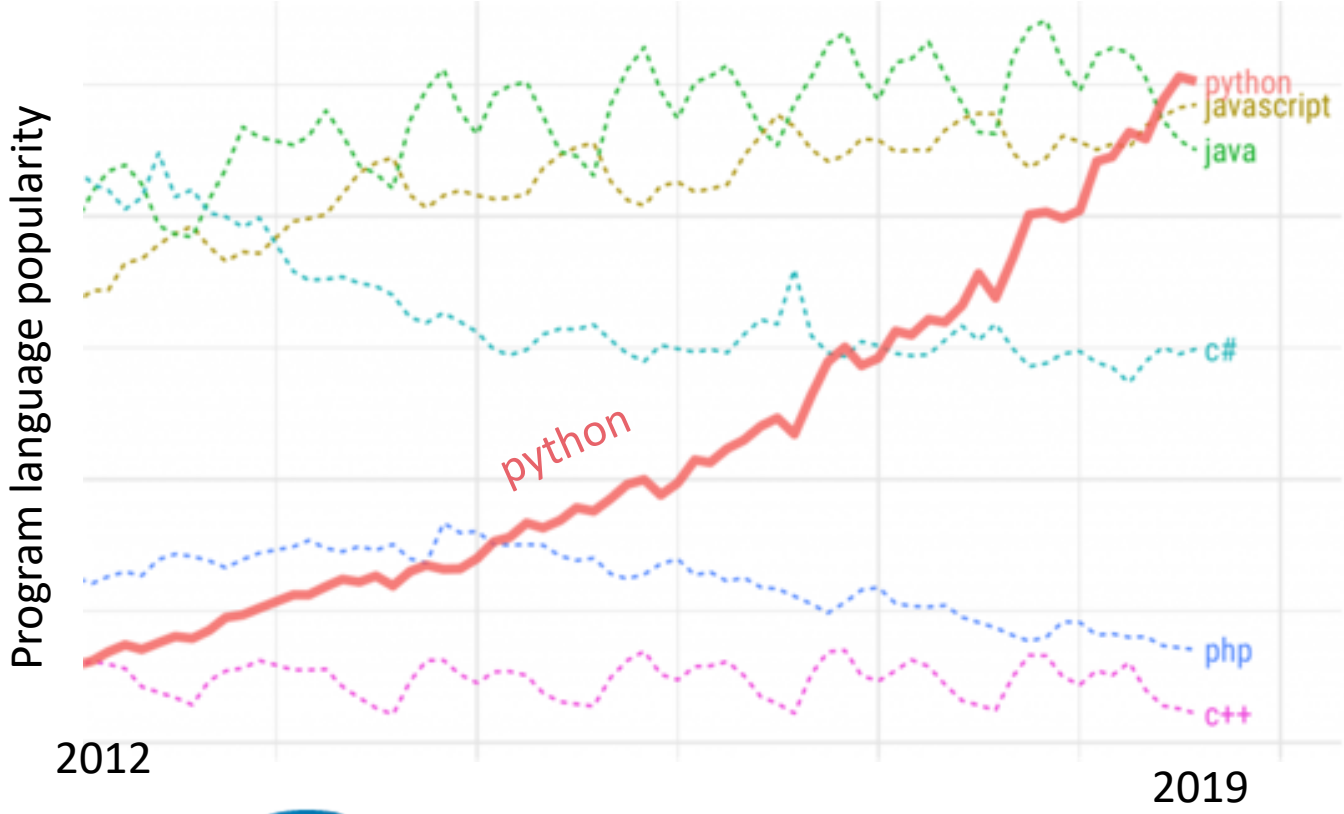
Good morning

Karel Speaks Python



Why Python?

1



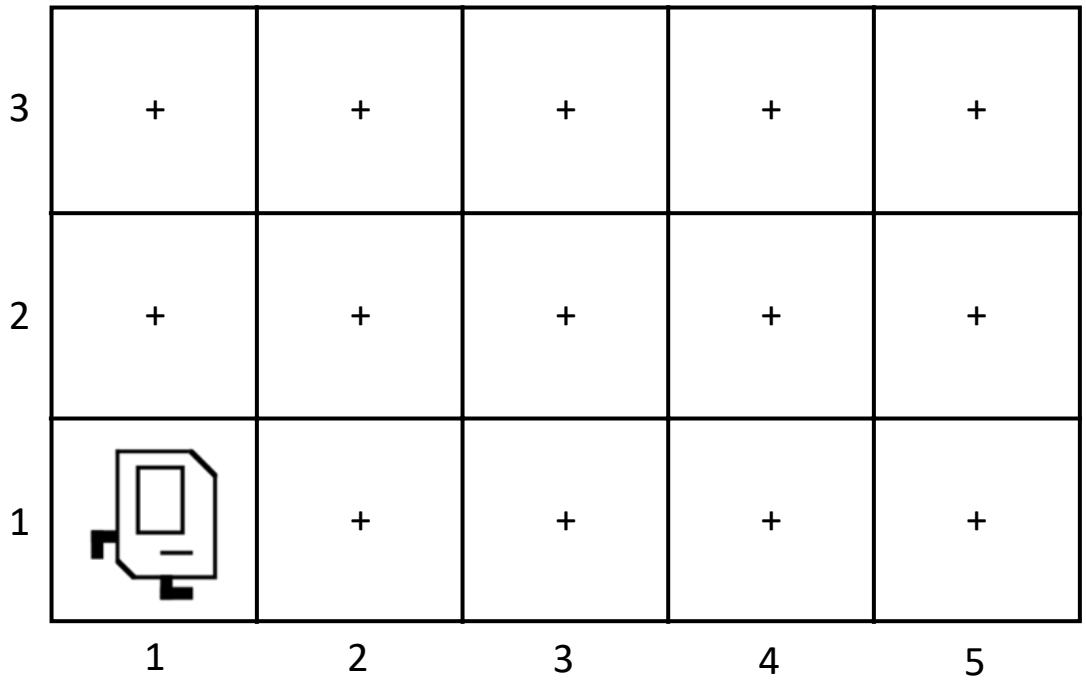
2

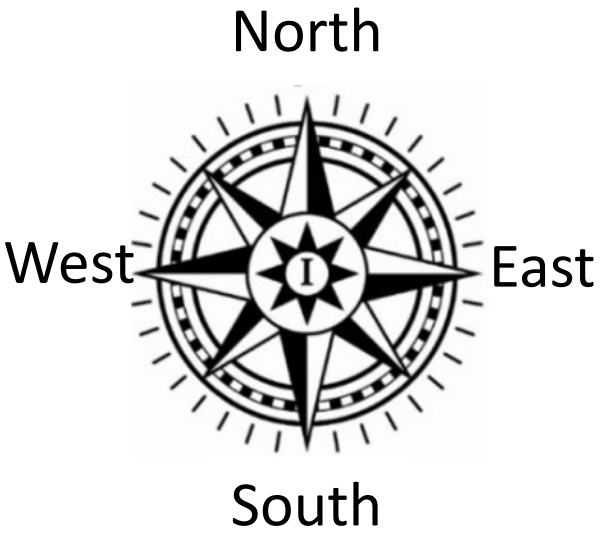
python

https://stackoverflow.blog/2017/09/06/incredible-growth-python/

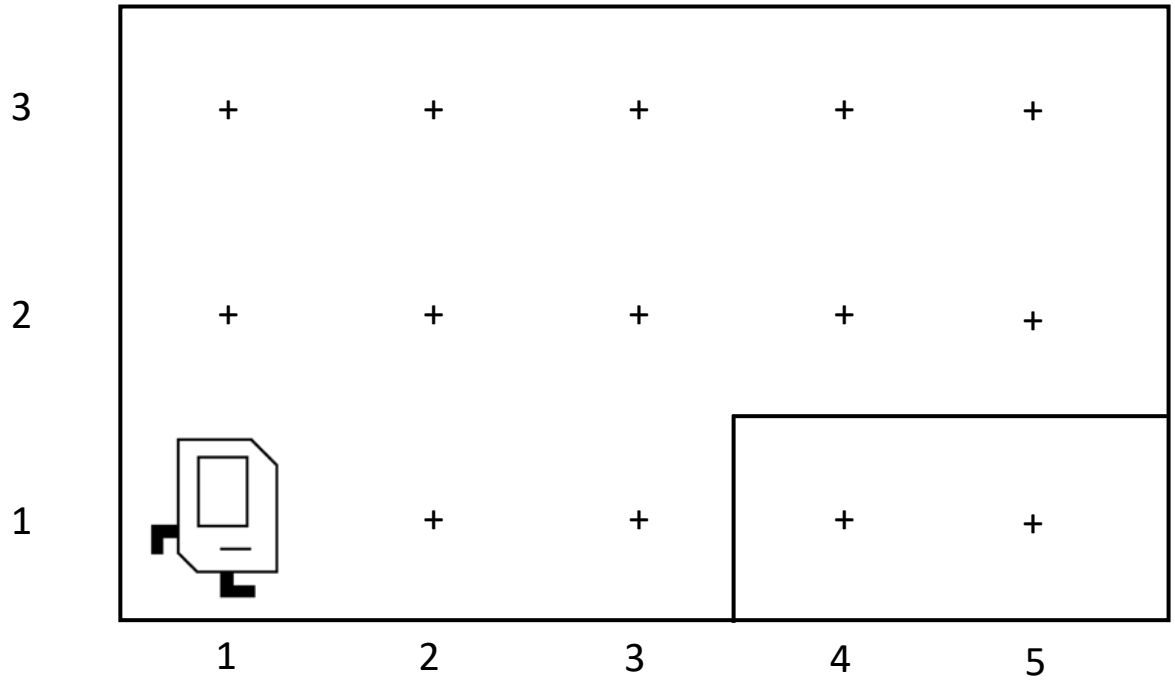
Guido van Rossum

Karel's World

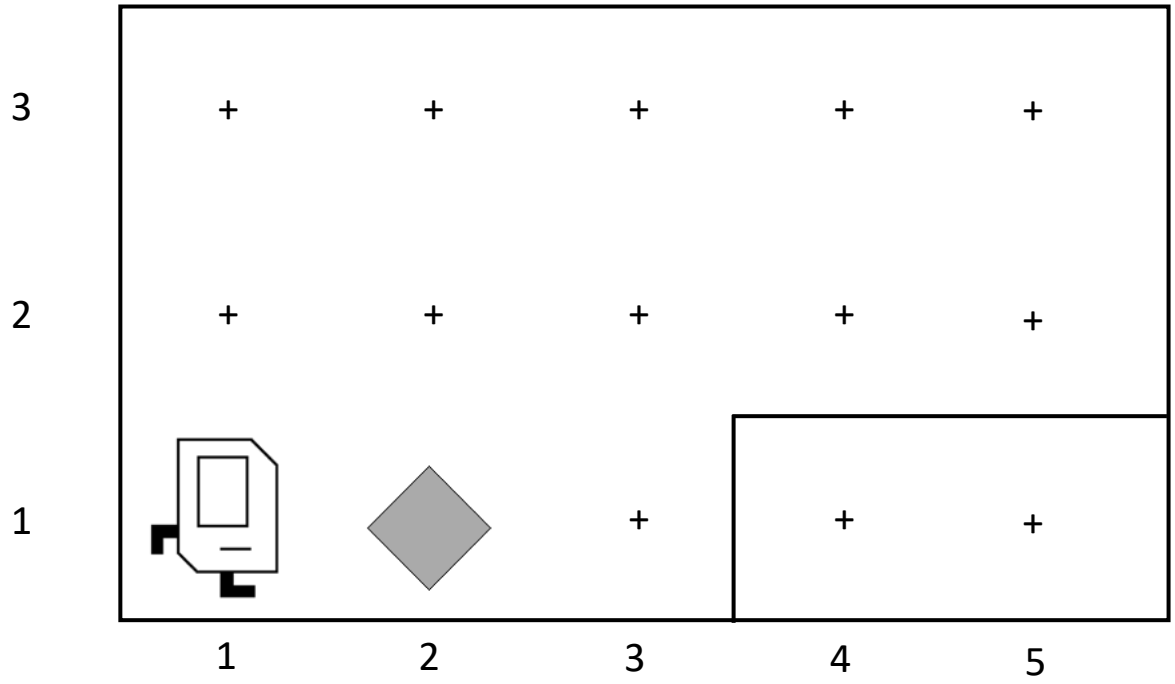




Walls



Beepers

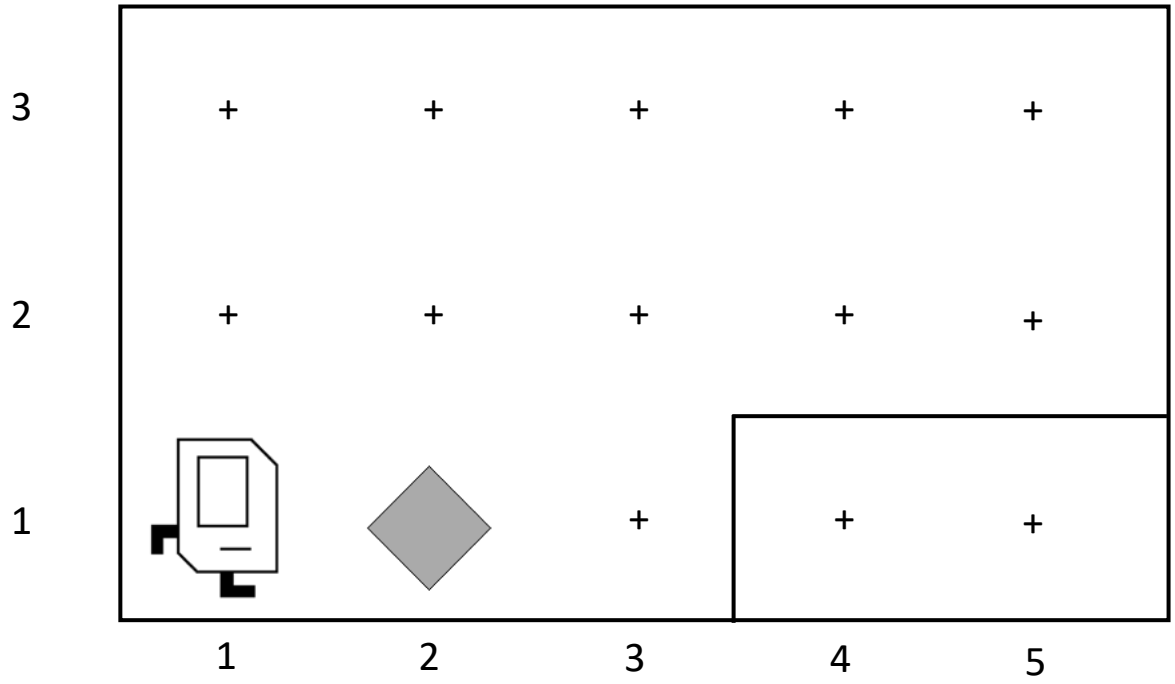


Knows Four Commands

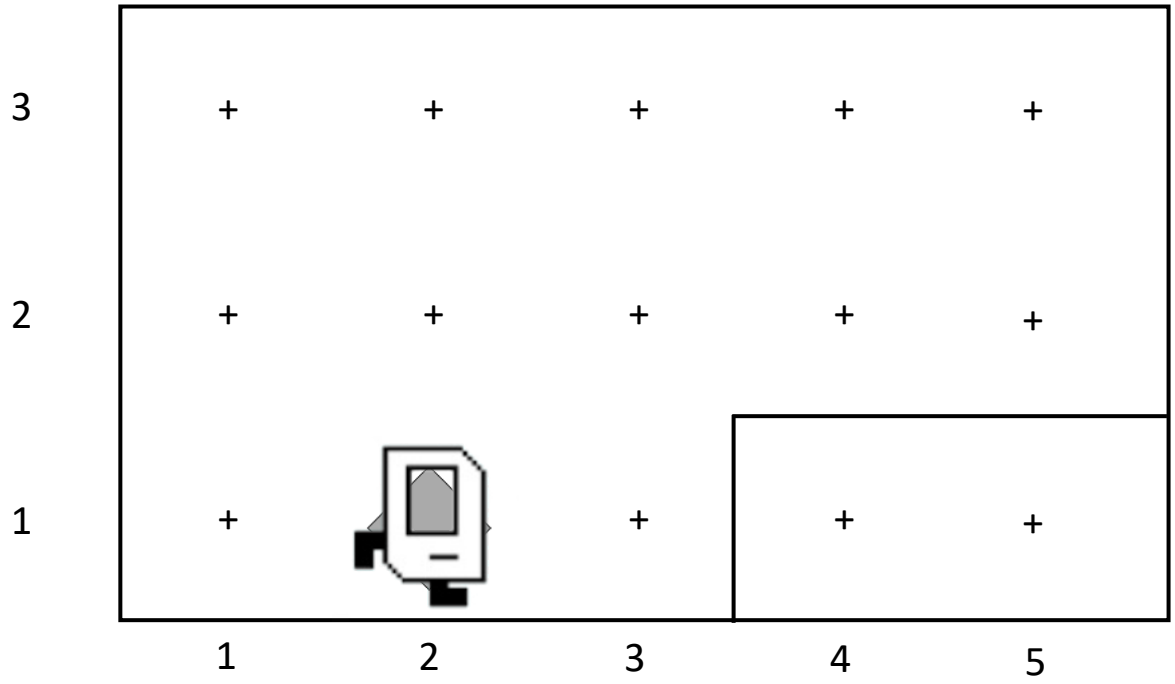
```
move()

turn_left()

put_beeper()

pick_beeper()
```

move()

move()

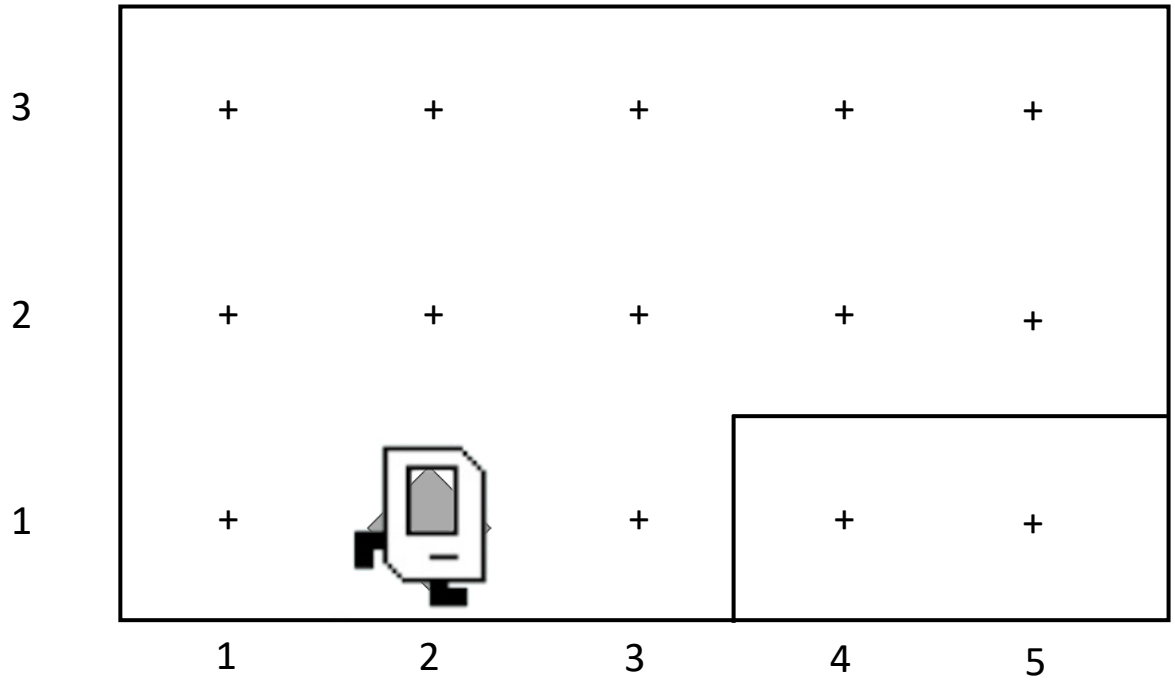


move()

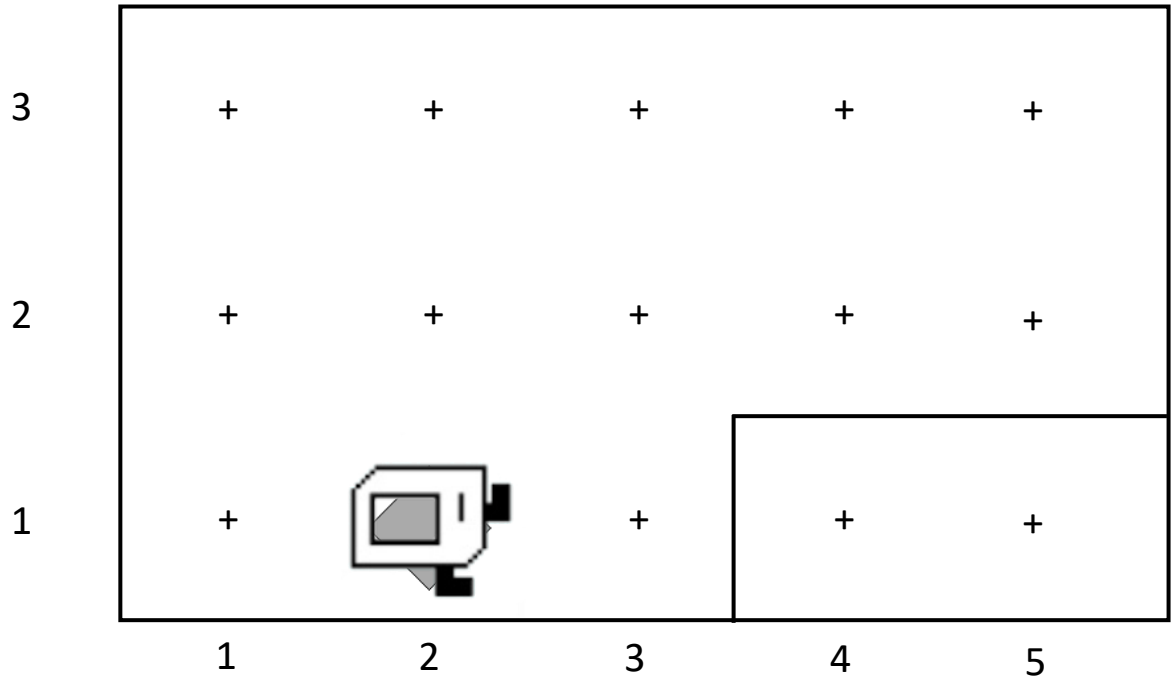


```
turn_left()
```

turn_left()

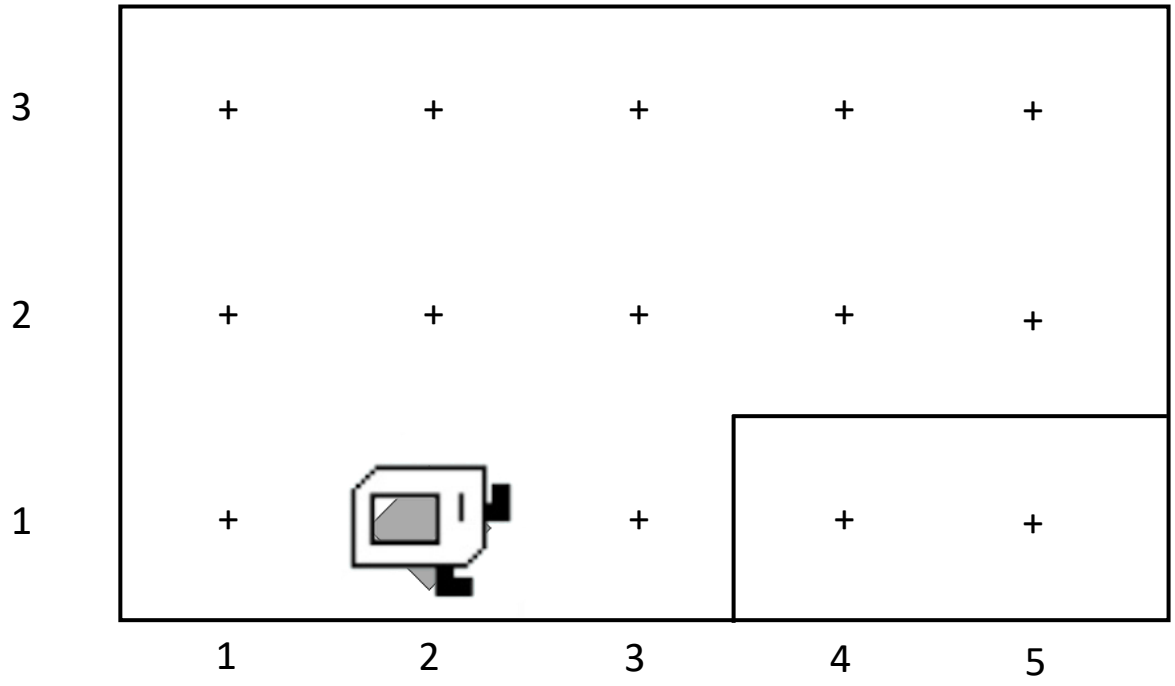


turn_left()

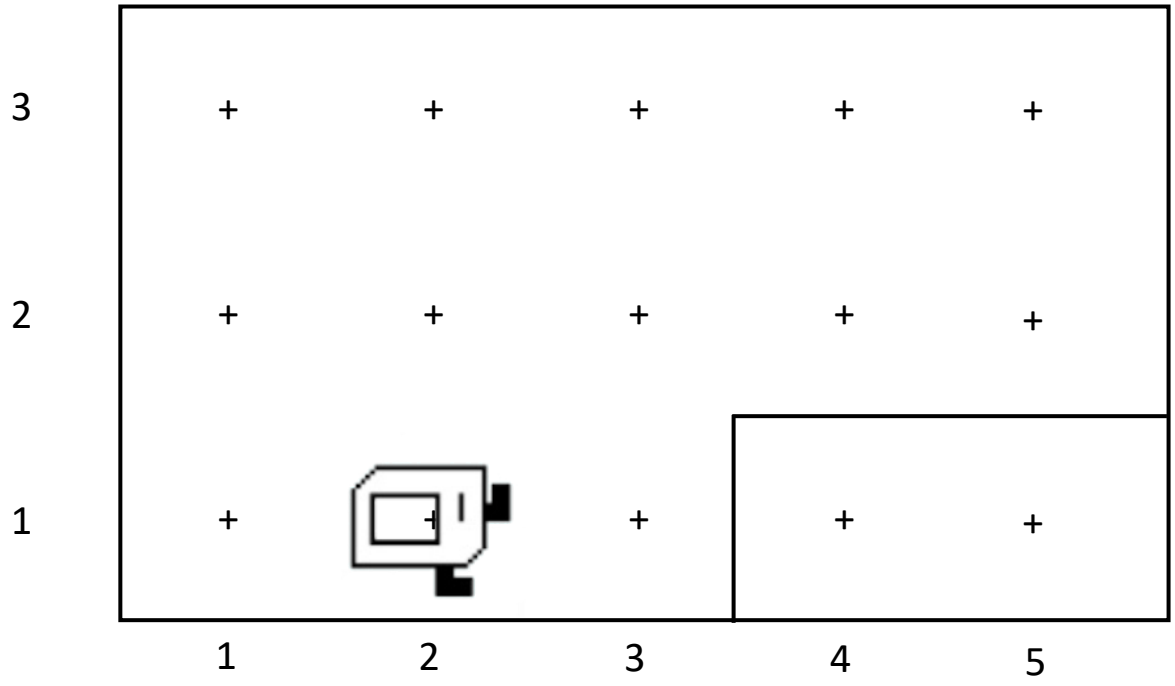


```
pick_beeper()
```

turn_left()

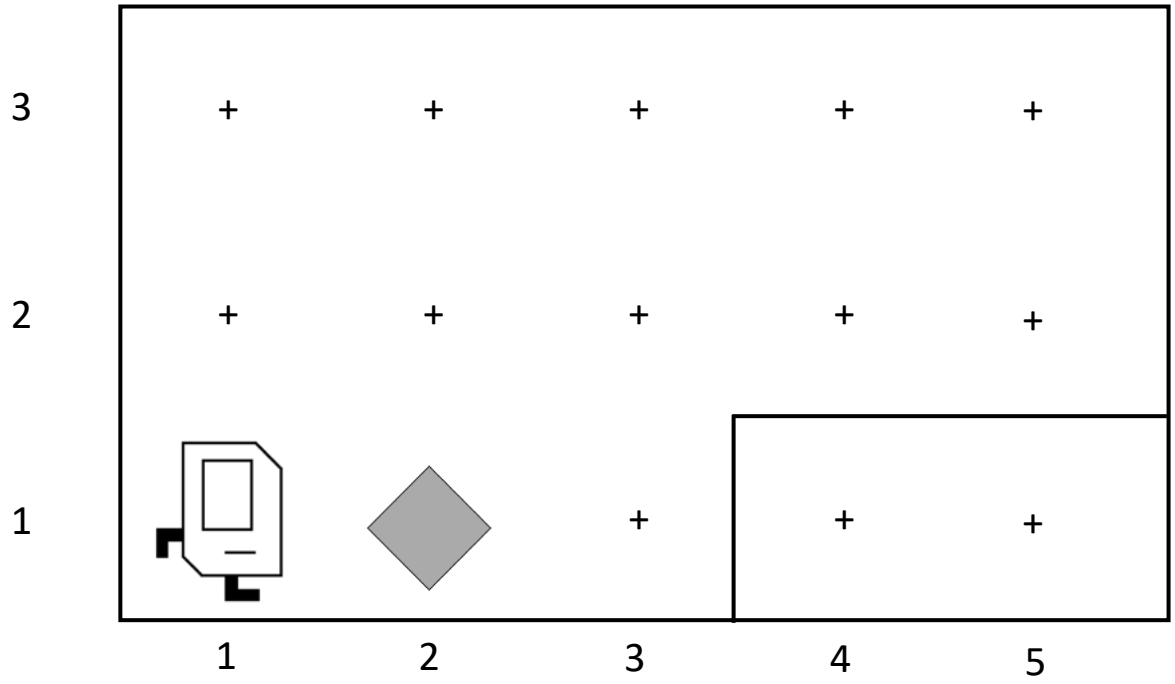


turn_left()

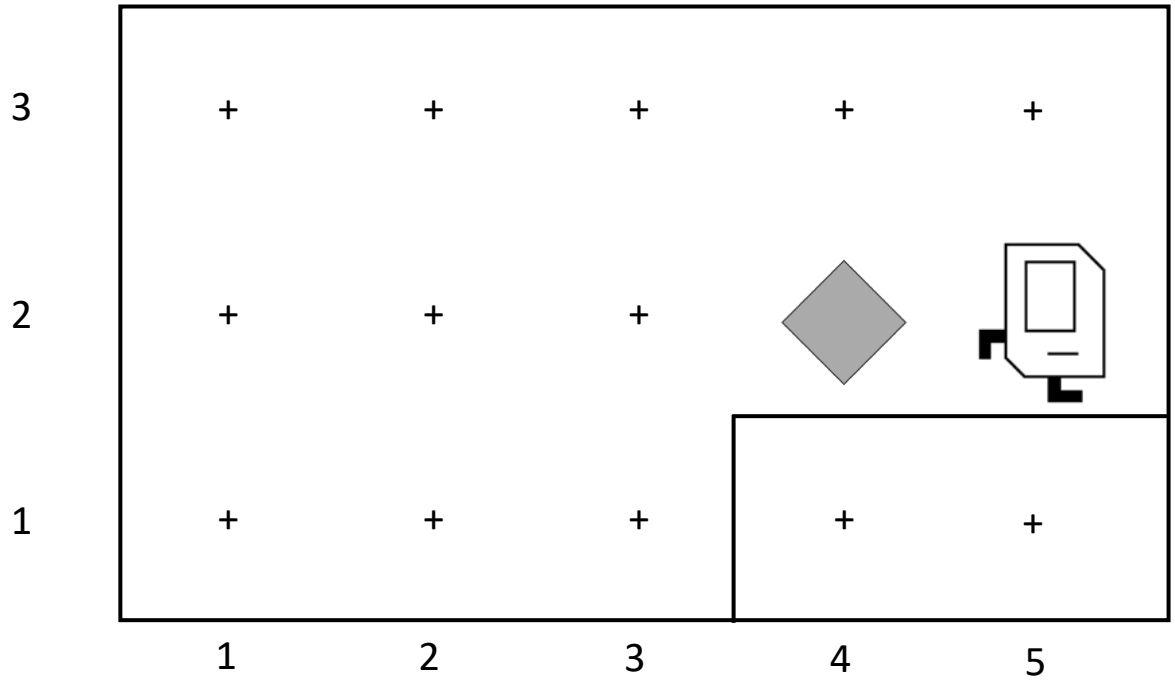


Make Sense?

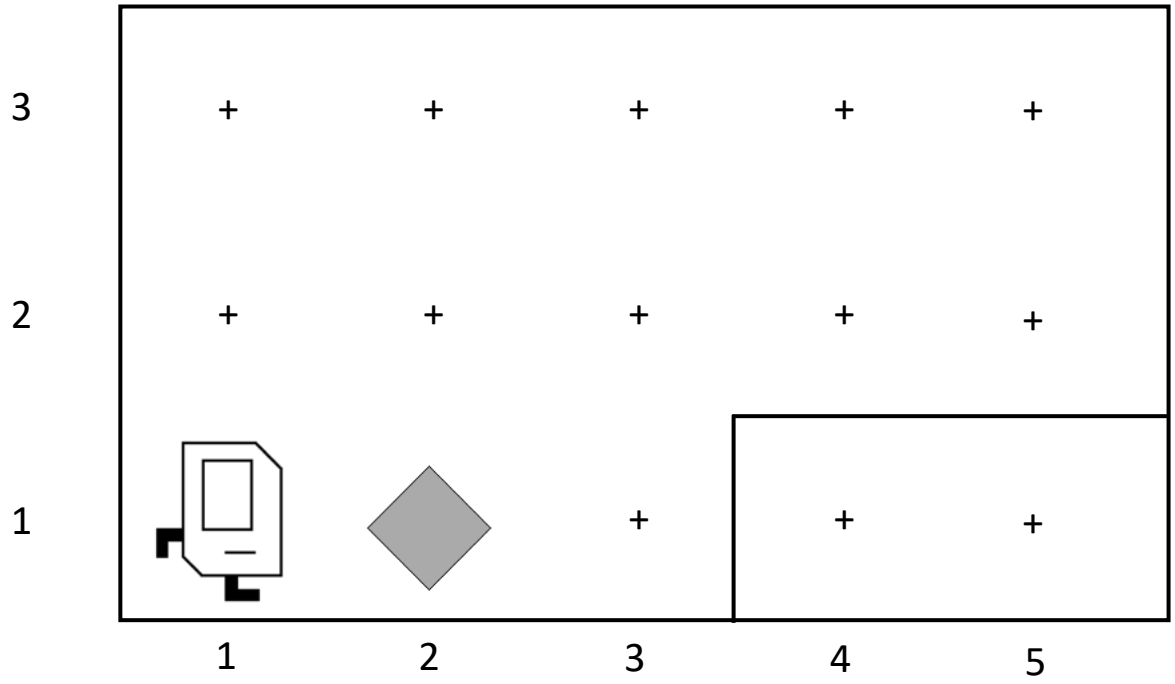
First Challenge



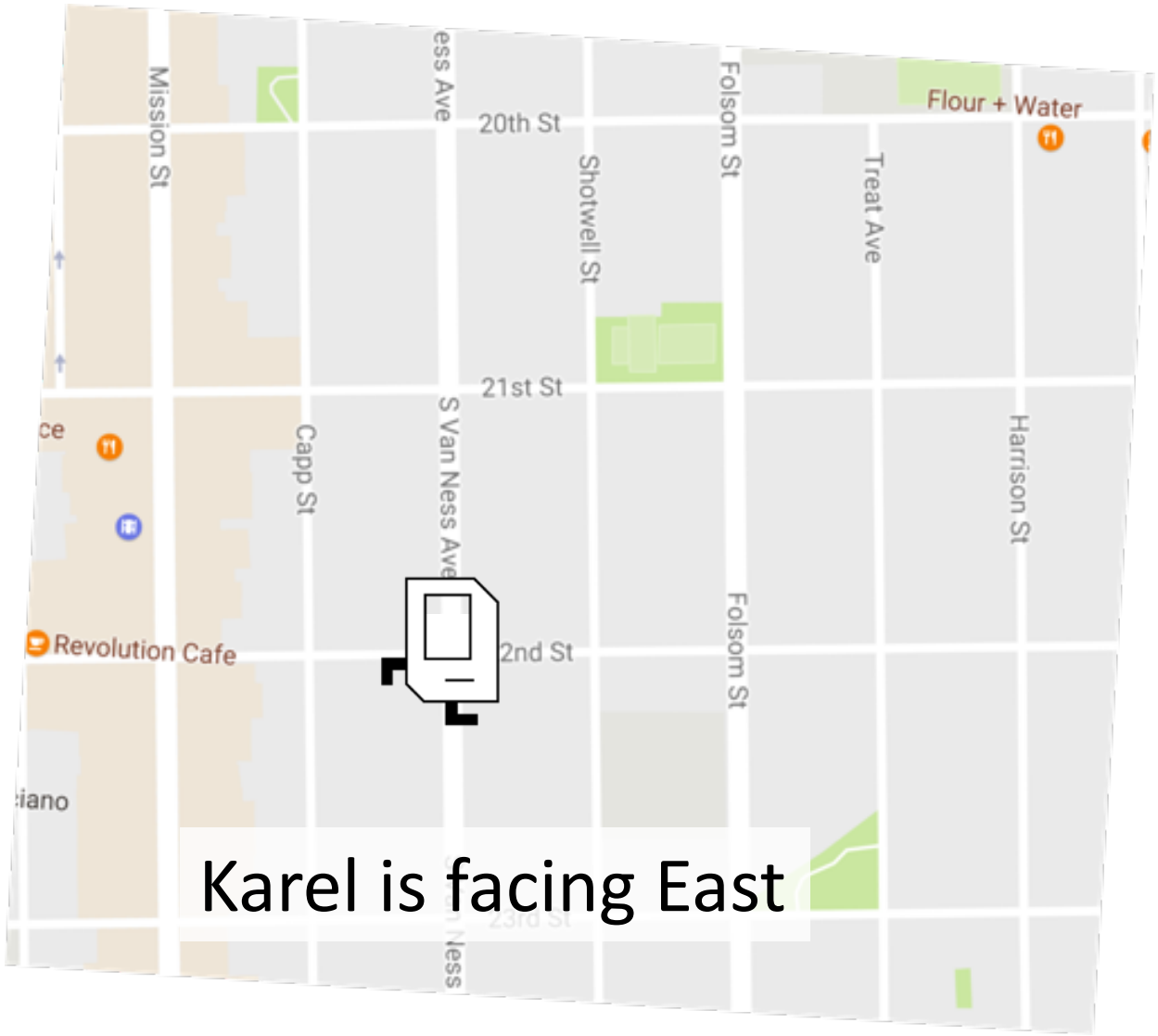
First Challenge



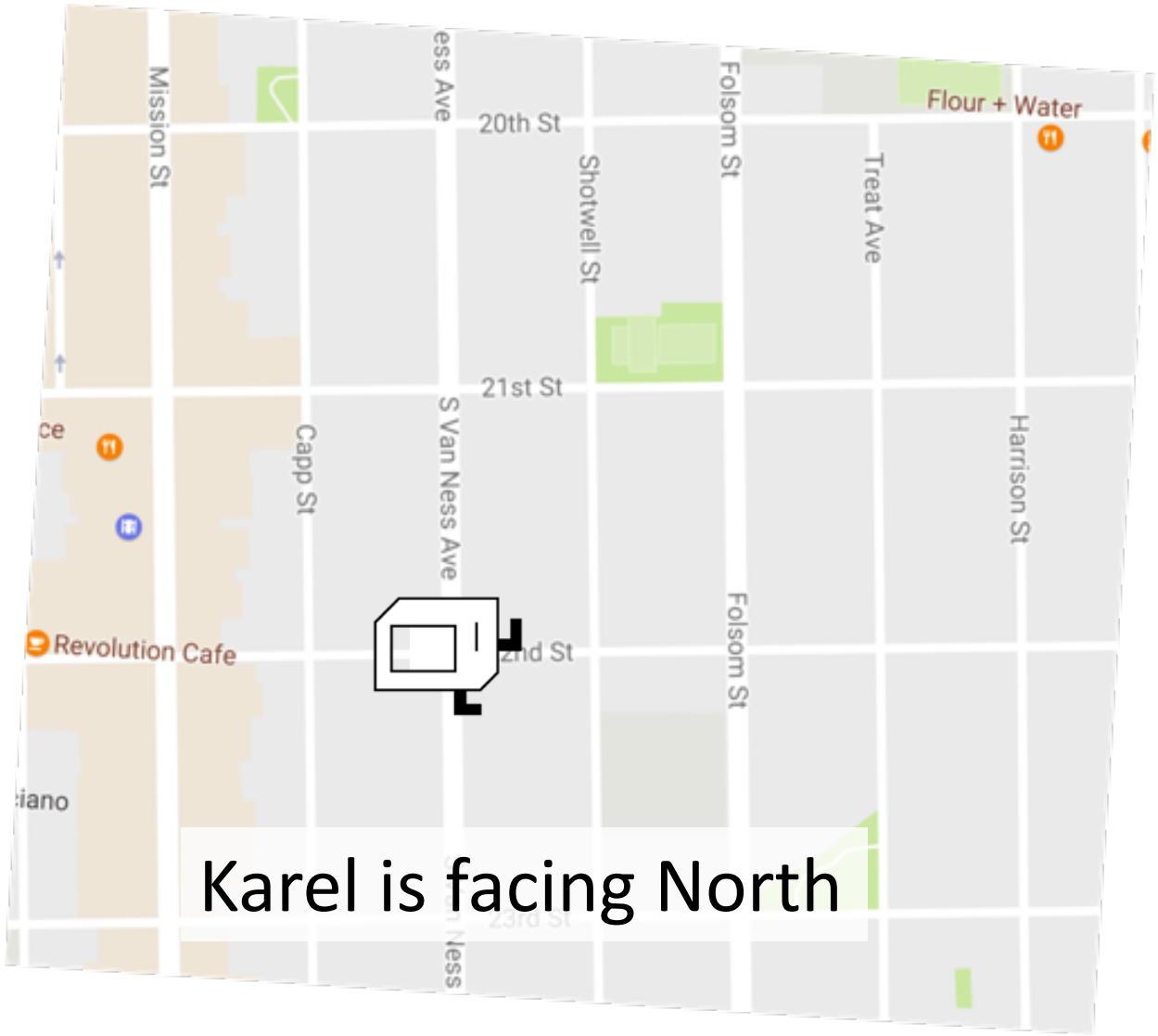
Bird's Eye View



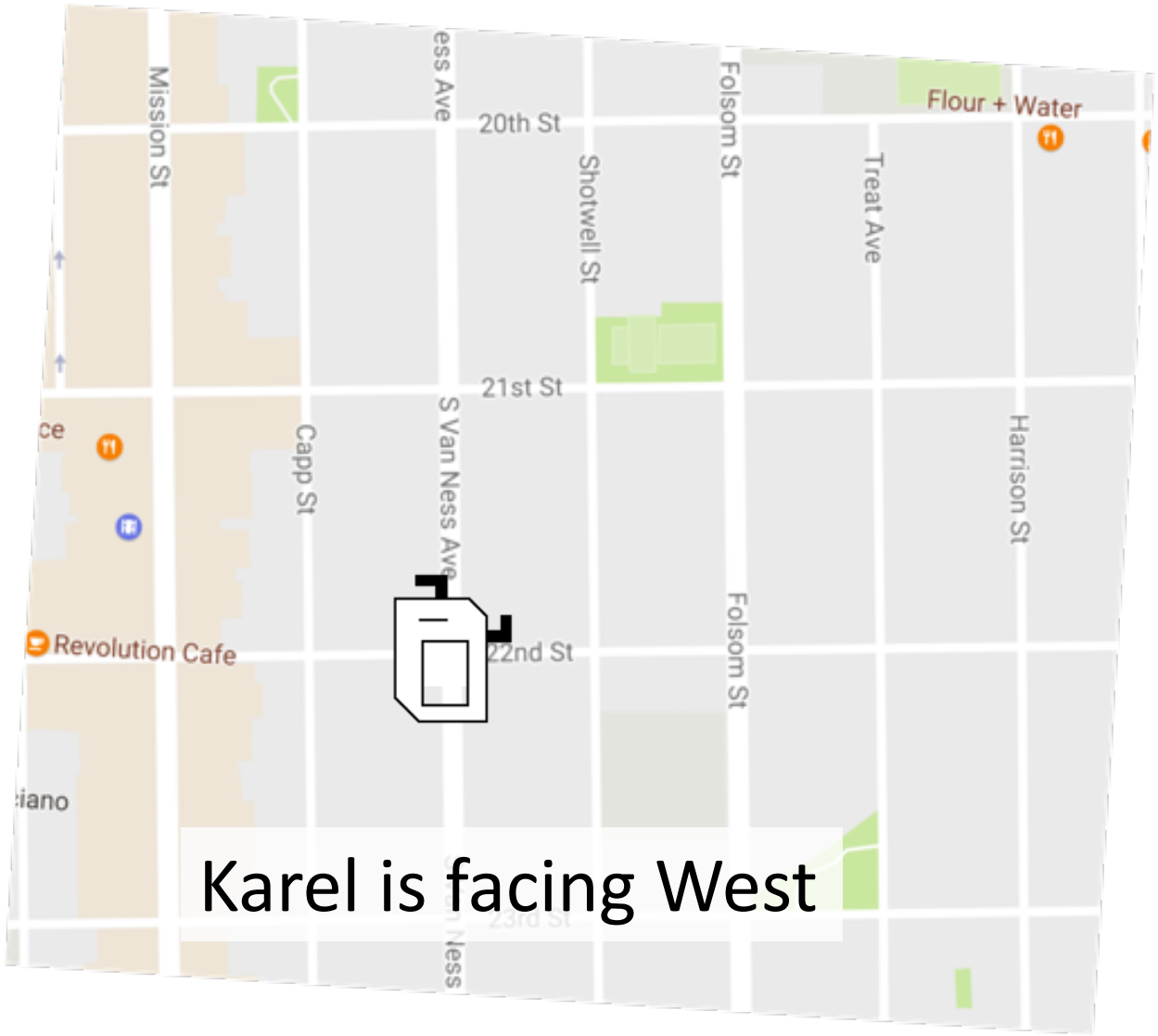
Bird's Eye View



Turn Left


Mission St
ess Ave
20th St
Shotwell St
Folsom St
Flour + Water
Treat Ave
21st St
Capp St
S Van Ness Ave
Harrison St
Revolution Cafe
Folsom St
Karel is facing North

Turn Left

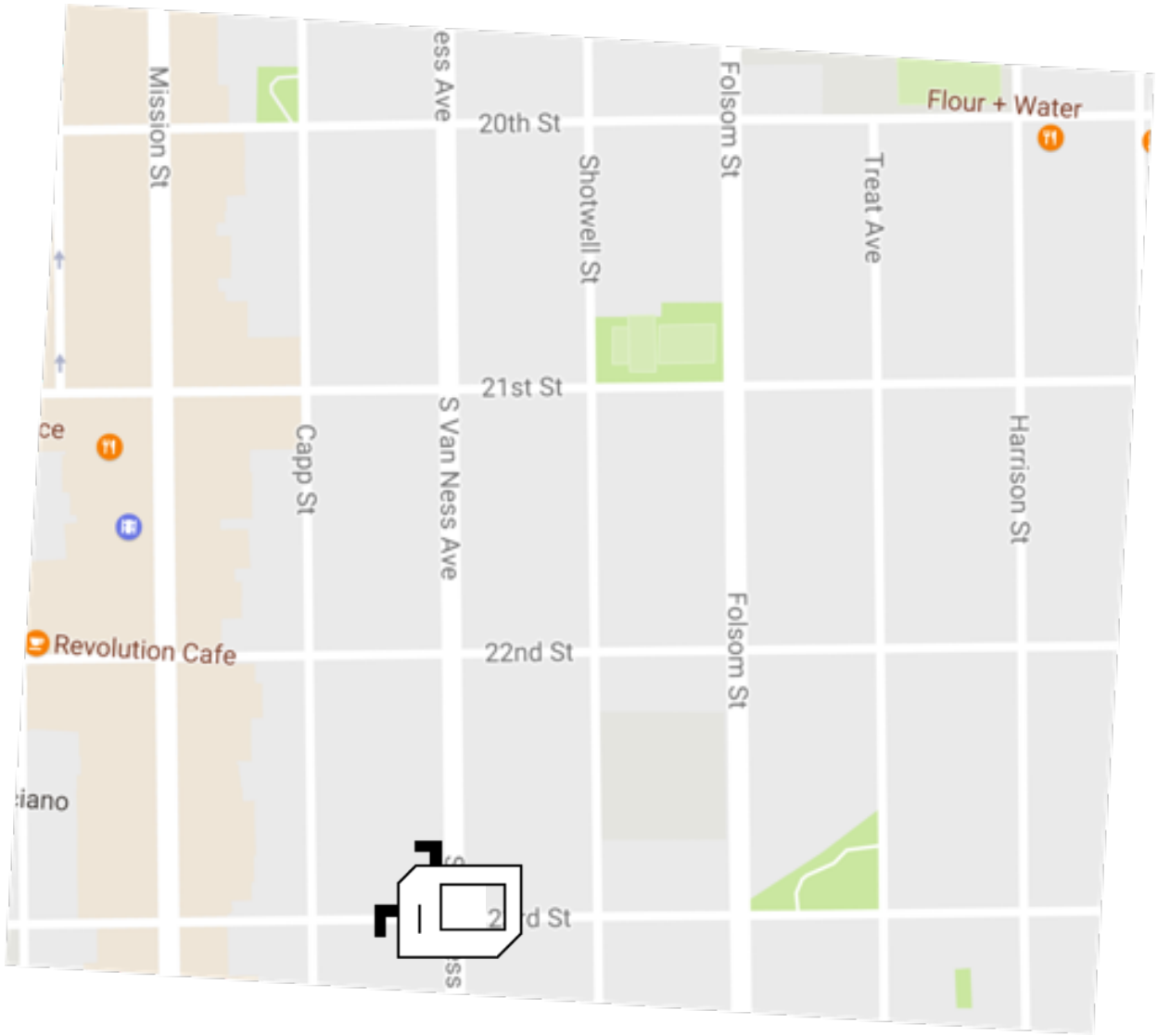


Karel is facing West

Turn Left


Mission St
ess Ave
20th St
Shotwell St
Folsom St
Treat Ave
Flour + Water
21st St
Capp St
S Van Ness Ave
Harrison St
Revolution Cafe
Folsom St
Karel is facing South

Move


Mission St
ess Ave
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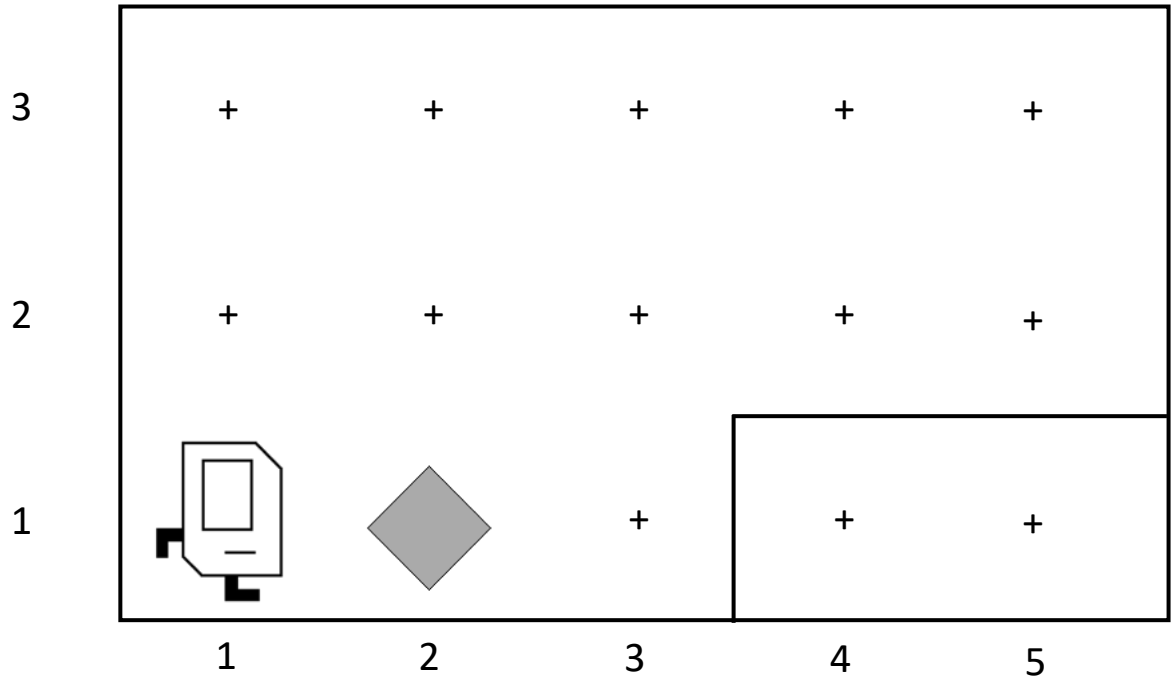
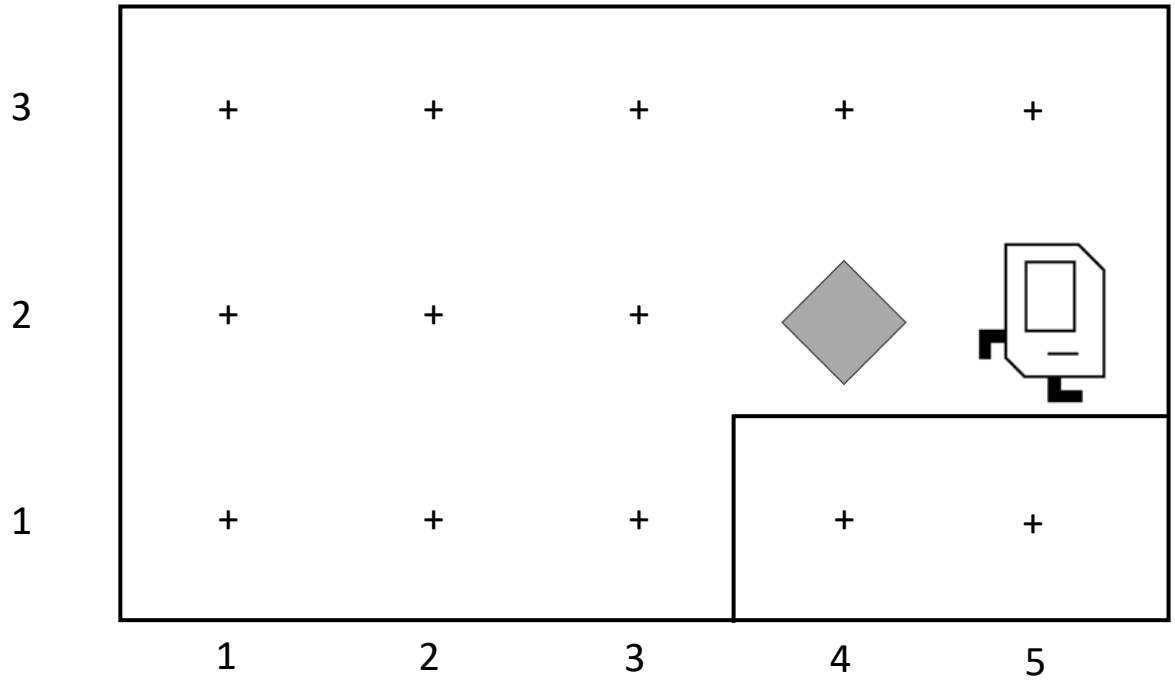
Shotwell St
Folsom St
Treat Ave
Flour + Water
21st St
Capp St
S Van Ness Ave
Harrison St
Revolution Cafe
22nd St
Folsom St

First Challenge



First Challenge



Learn By Doing


PC
PyCharm
The Python IDE
for Professional
Developers
DOWNLOAD
Full-fledged Professional or Free Community

Function Definition

```
def name():
    function statements
```

This adds a new command to Karels vocabulary

Anatomy of a Program

```
Import Packages
```

```
Program
```

Anatomy of a Program

```
Import Packages
```

Anatomy of a Program

```
Import Packages
```

```
main function
```

```
helper functions
```

```
start program
```

Anatomy of a Program

Import Packages

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

helper functions

start 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()
```

```
start 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()
```

Anatomy of a Program

```
from karel.stanfordkarel import *
```

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

def turn_right():
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Anatomy of a Program

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    turn_left()

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```

Anatomy of a Program

```
from karel.stanfordkarel import *

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()
```

This piece of the program's ***source code*** is called a ***function***.

Anatomy of a Program

```
from karel.stanfordkarel import *

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

if __name__ == "__main__":
    run_karel_program()
```

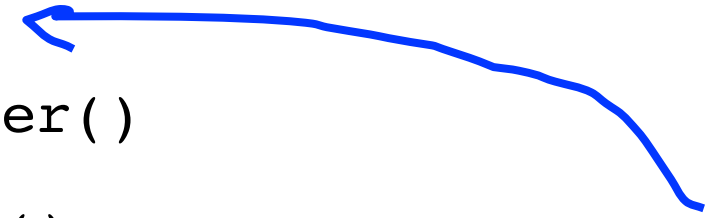

This line of code gives the ***name*** of the function (here, run)

Anatomy of a Program

```
from karel.stanfordkarel import *

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()
```

This line of code gives the ***name*** of the function (here, turn_right)

Anatomy of a Program

```
from karel.stanfordkarel import *

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()
```

This is called a ***code block***

Anatomy of a Program

```
from karel.stanfordkarel import *

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__":
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```

This is called a ***code block***

Anatomy of a Program

```
from karel.stanfordkarel import *

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()
```

This is called a ***code block***

Why Study CS?

Joy of Building

Interdisciplinary

Closest Thing To Magic

Now is the Time

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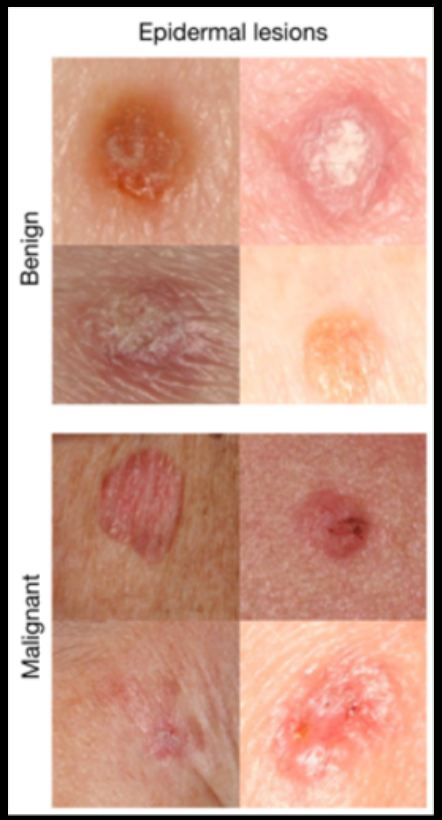
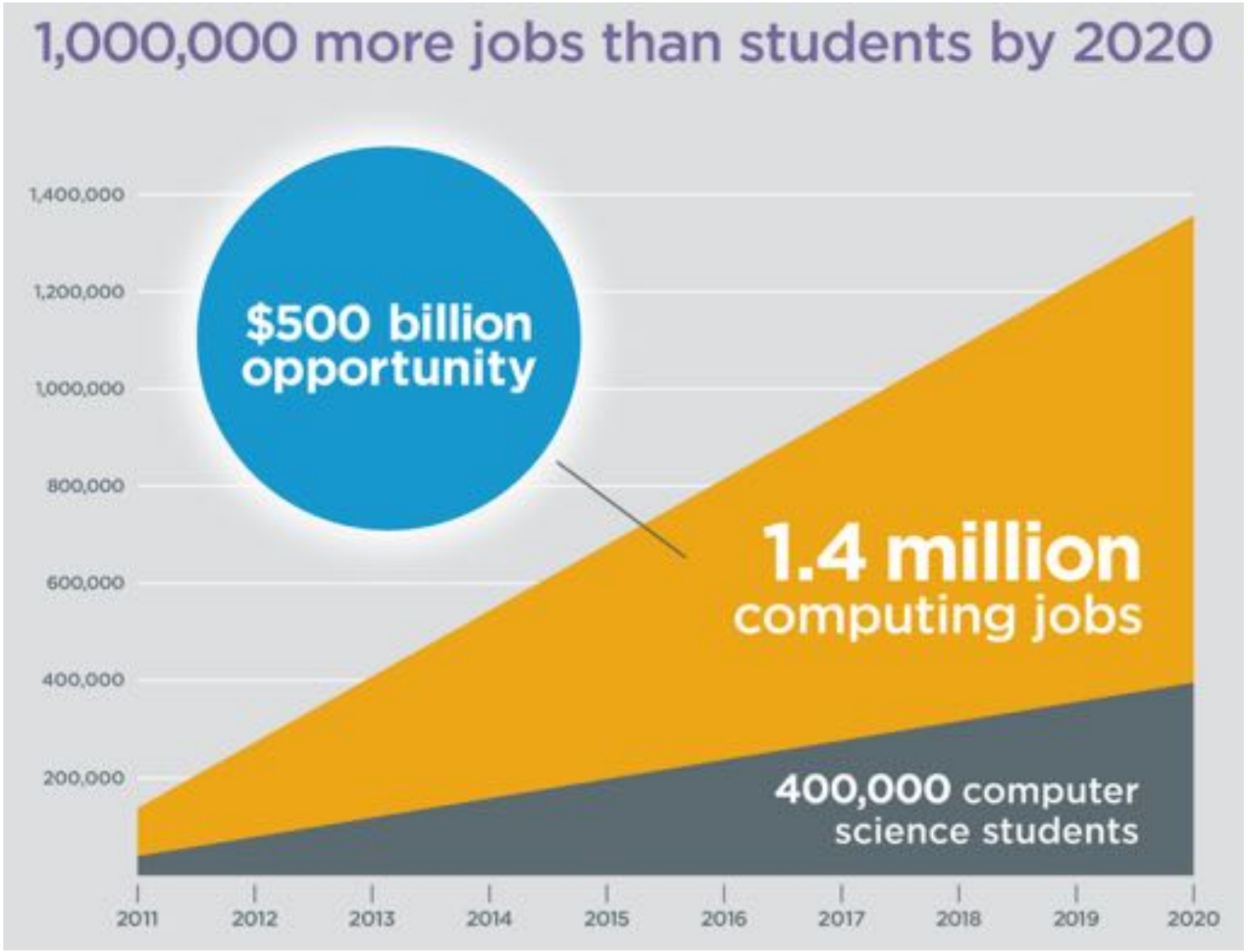


A machine learning algorithm performs **better than** the best dermatologists.

Developed this year, at Stanford.

Esteva, Andre, et al. "Dermatologist-level classification of skin cancer with deep neural networks." *Nature* 542.7639 (2017): 115-118.

Oh and Its Useful



Everyone is Welcome

The End


The End?