



CS106A: Programming Methodologies

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 more education accessible



Chris Piech



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

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Head TA: Julia Daniel



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Section Leaders



**Luciano
Gonzalez**



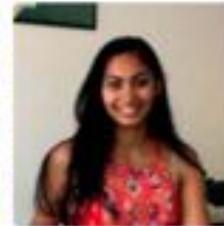
**Maggie
Davis**



**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**

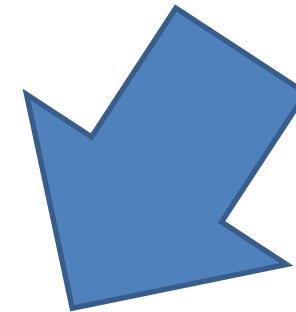
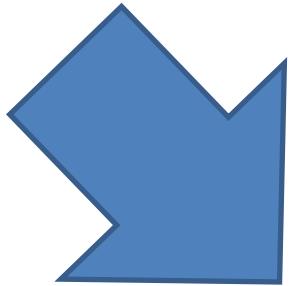


**Vineet
Kosaraju**

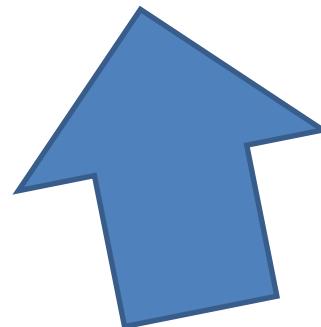
Course mechanics

(this is a light version. Please read the handout
for details).

Course Website



<http://cs106a.stanford.edu>



Prerequisite Test



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Lectures and Sections

- Weekly 50-min section led by awesome section leaders (the backbone of the class!)
- Signups begin on Thursday at 5:00pm and close Sunday at 5:00pm



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Office Hours



LaIR: 7pm until 11pm Sunday through Thursday
(starting next 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.
- ✓ +** Satisfies all requirements of the assignment.
- ✓** Meets most requirements, but with some problems.
- ✓ -** Has more serious problems.
- Is even worse than that.
- Better than nothing.



What we will ask you to do

Section Participation

10%

Final
30%

Midterm

15%

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Assignments
45%

*Two free late days



Optional Contest



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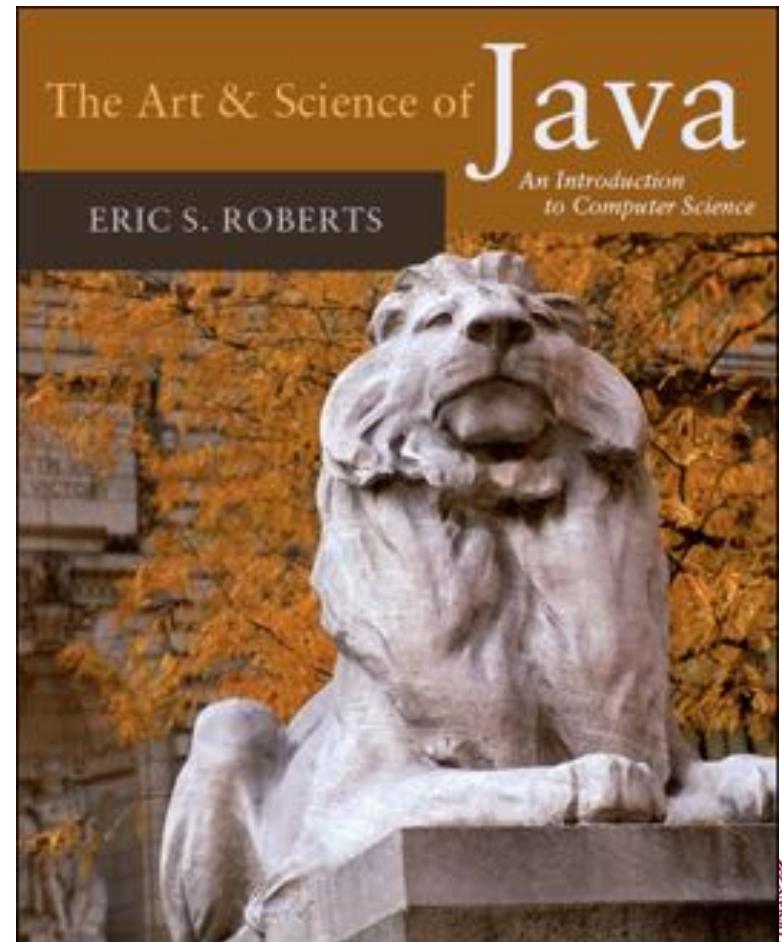
Textbook

The Art & Science of Java by Eric Roberts

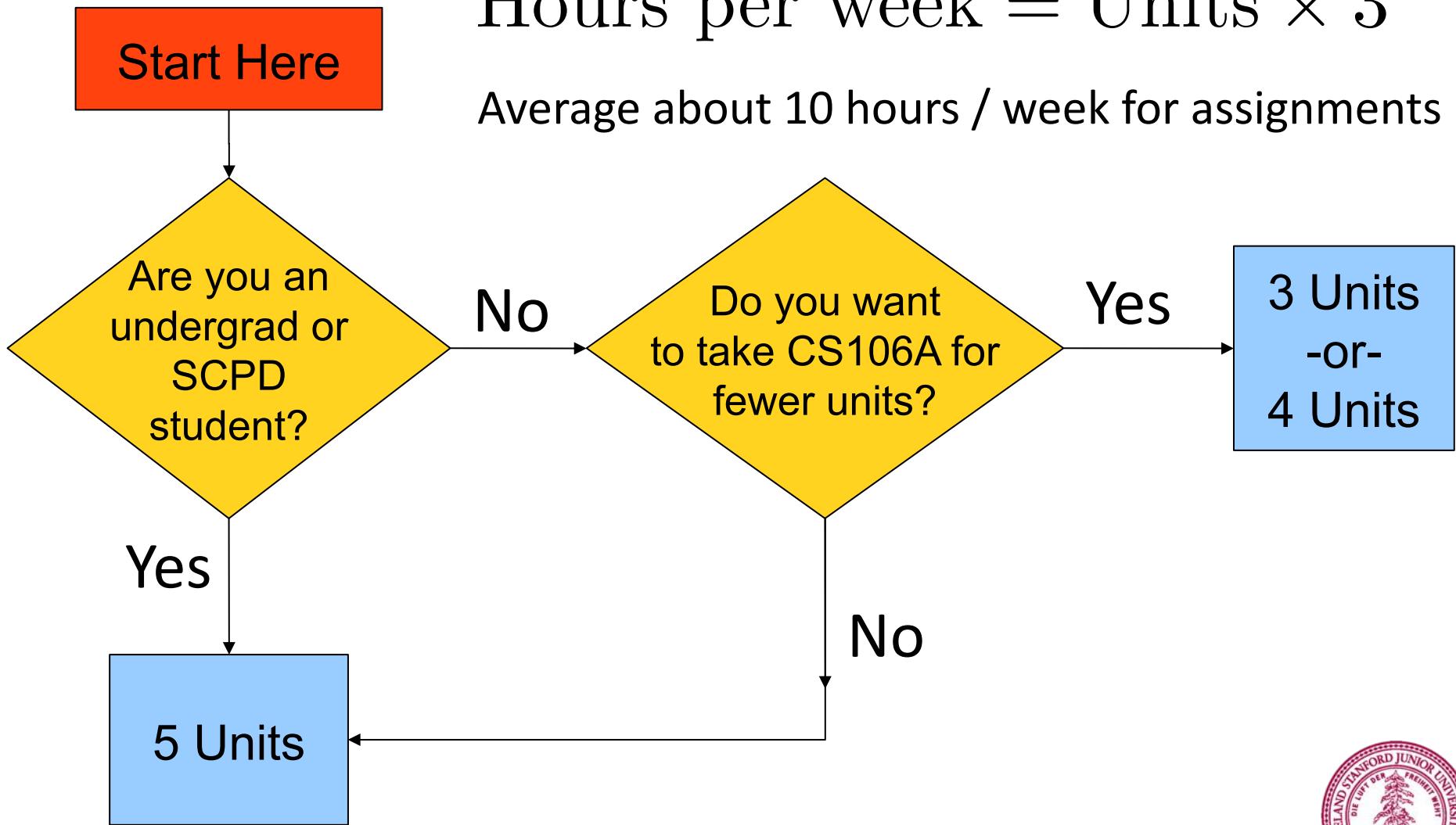
- written here at Stanford
- tailored to this course
- a valuable reference
- usable on open-book exams

Karel the Robot Learns Java

- First week of material



CS106A Units



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



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 Java 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

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Consumer Applications



Autonomous Surgery

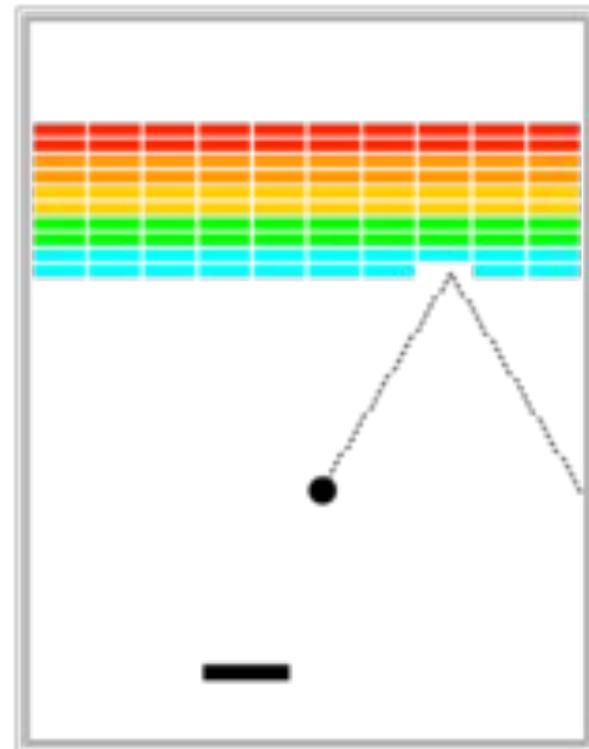
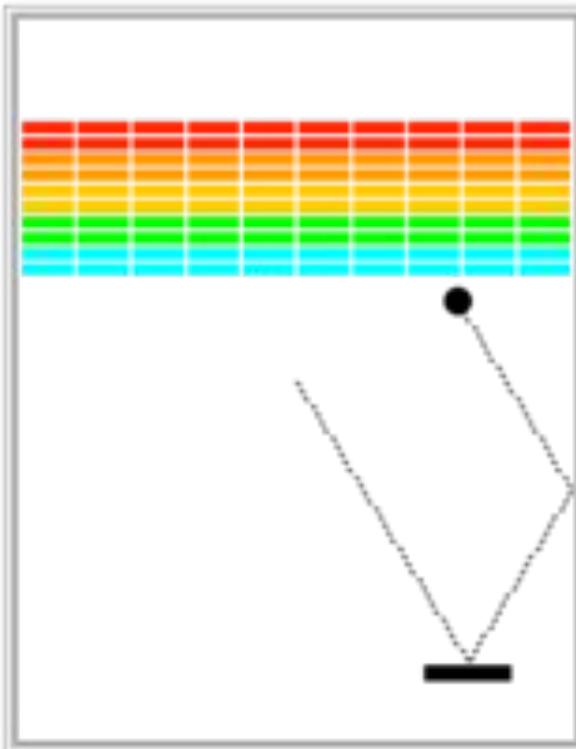


Self Driving Car

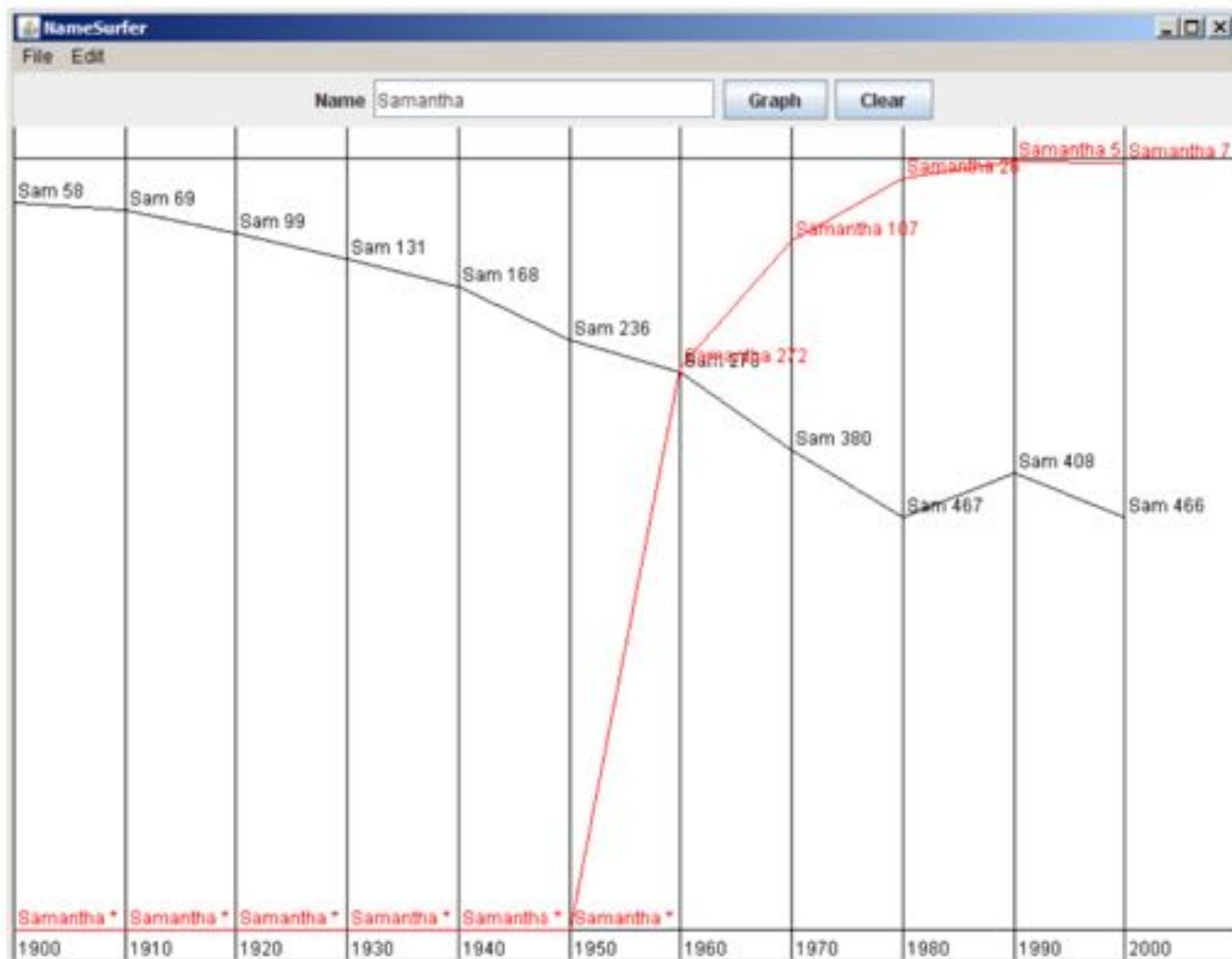


If only we could program self
driving cars...

Graphical Games



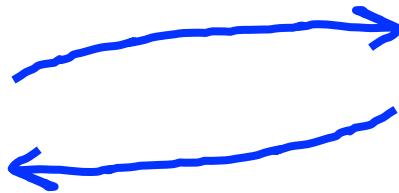
Data Visualization



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Internet Based Program



```
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



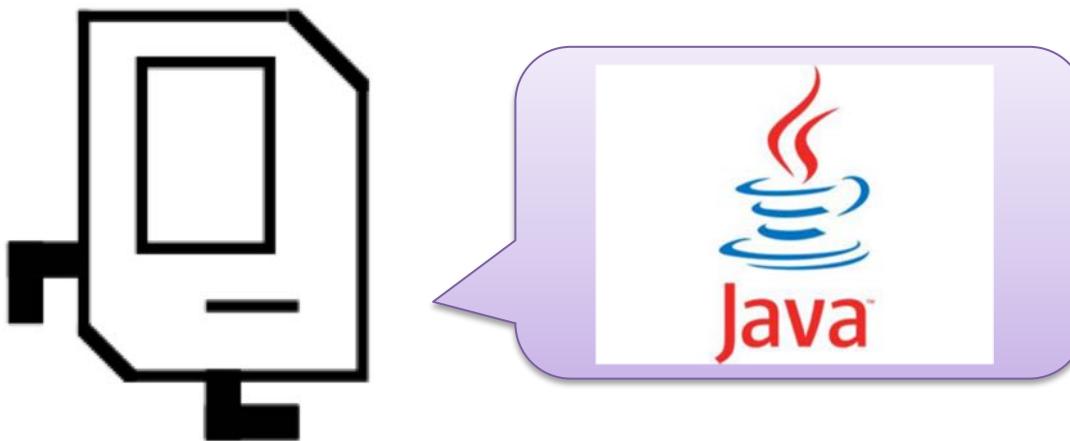
Meet Karel the Robot



Good morning



Karel Speaks Java



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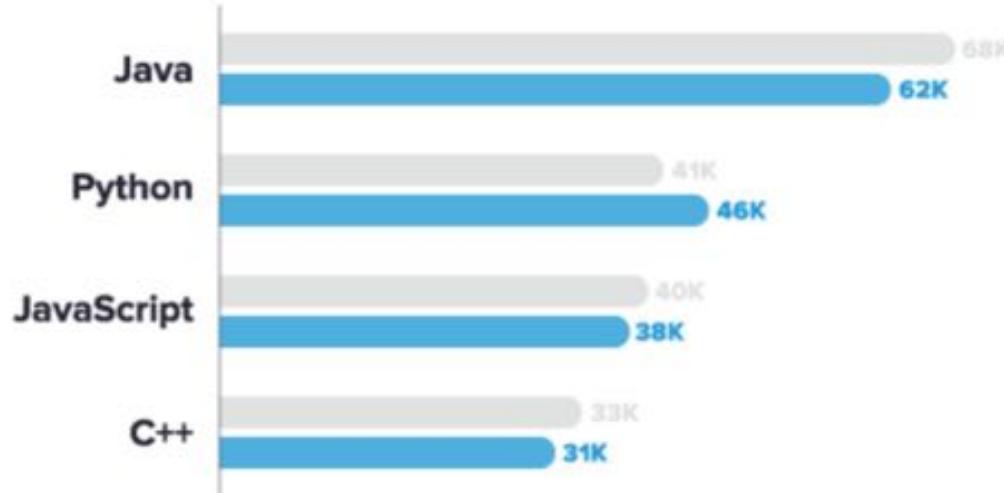


Why Java?

1

Job postings containing top languages

Indeed.com - November, 17th 2017

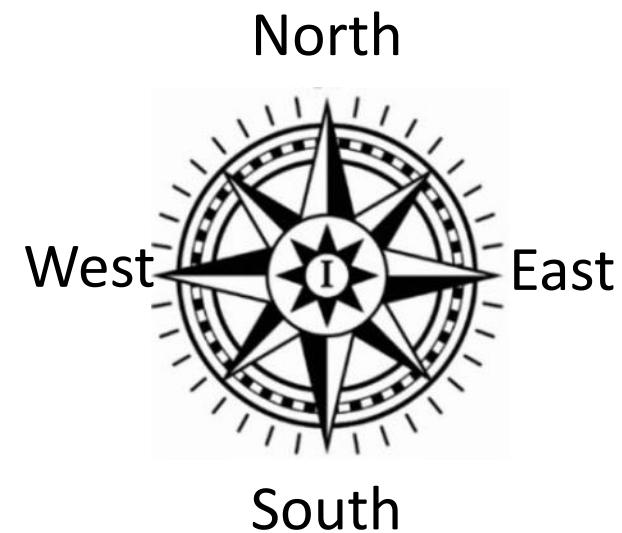


2

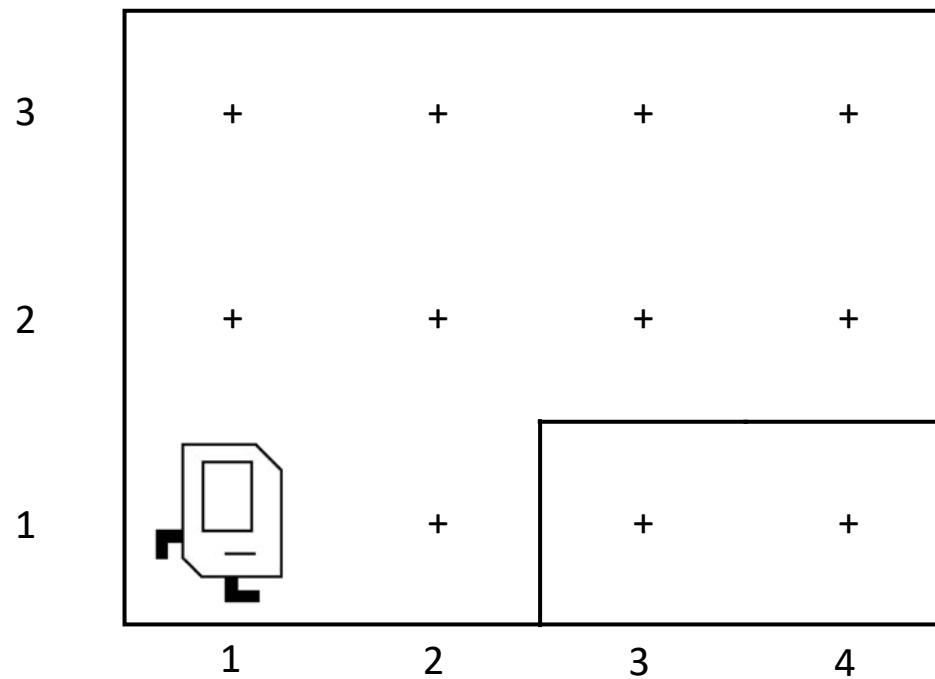


Karel's World

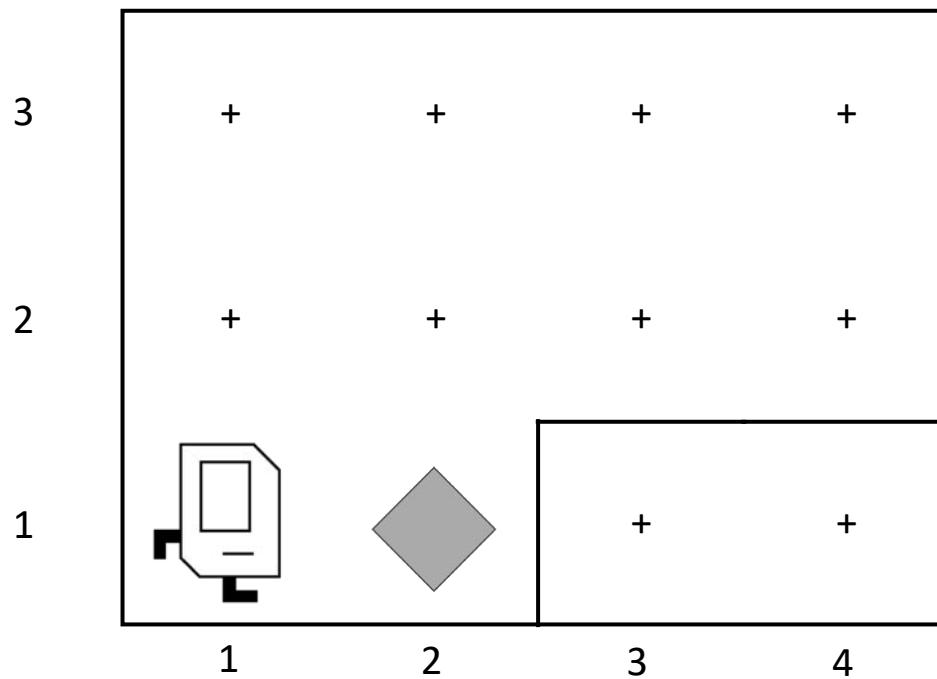
3	+	+	+	+	
2	+	+	+	+	
1		+	+	+	
	1	2	3	4	5



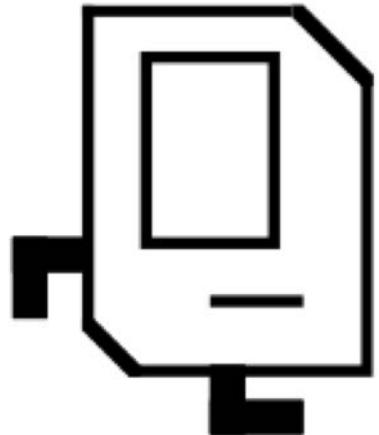
Walls



Beepers



Knows Four Commands



move();

turnLeft();

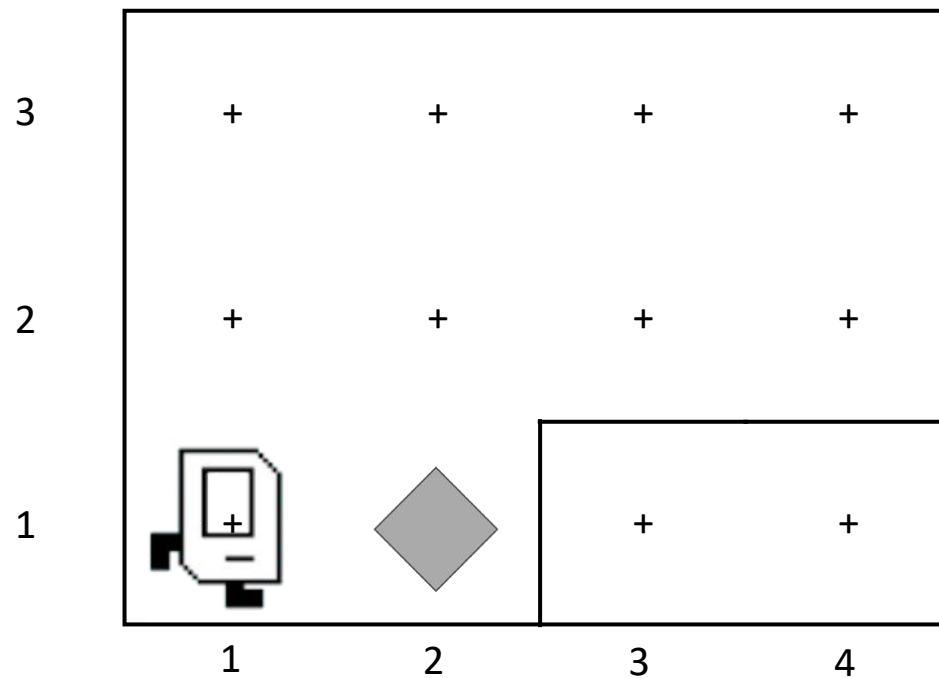
putBeeper();

pickBeeper();

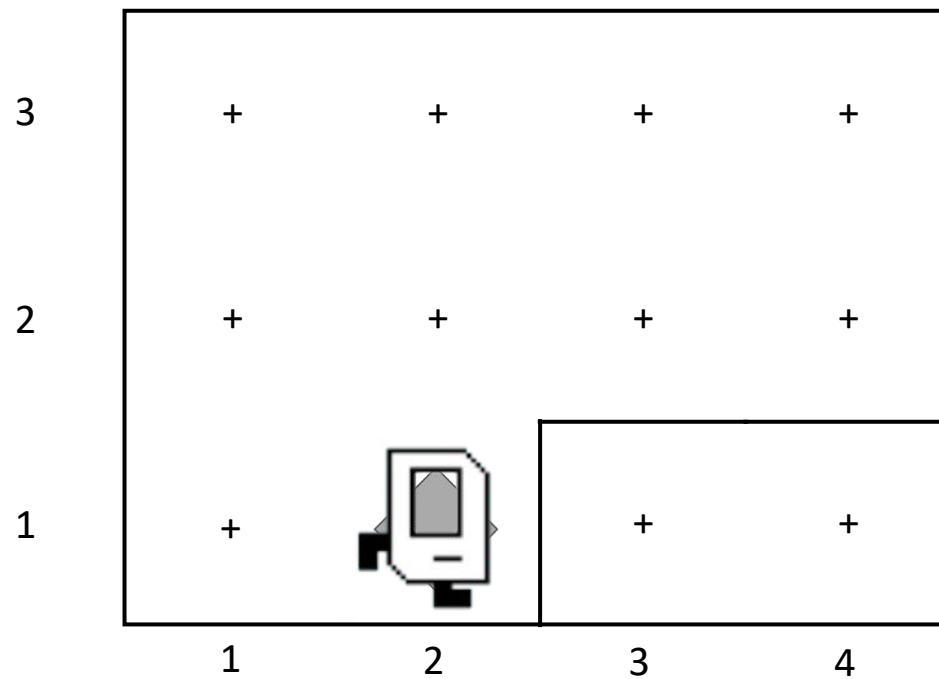


move();

move();

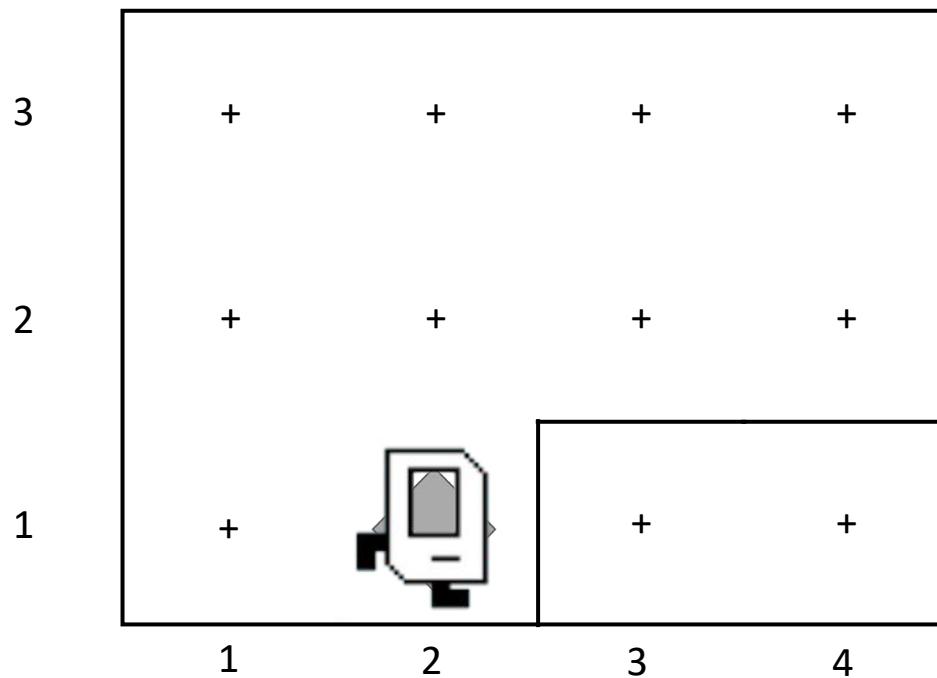


move();

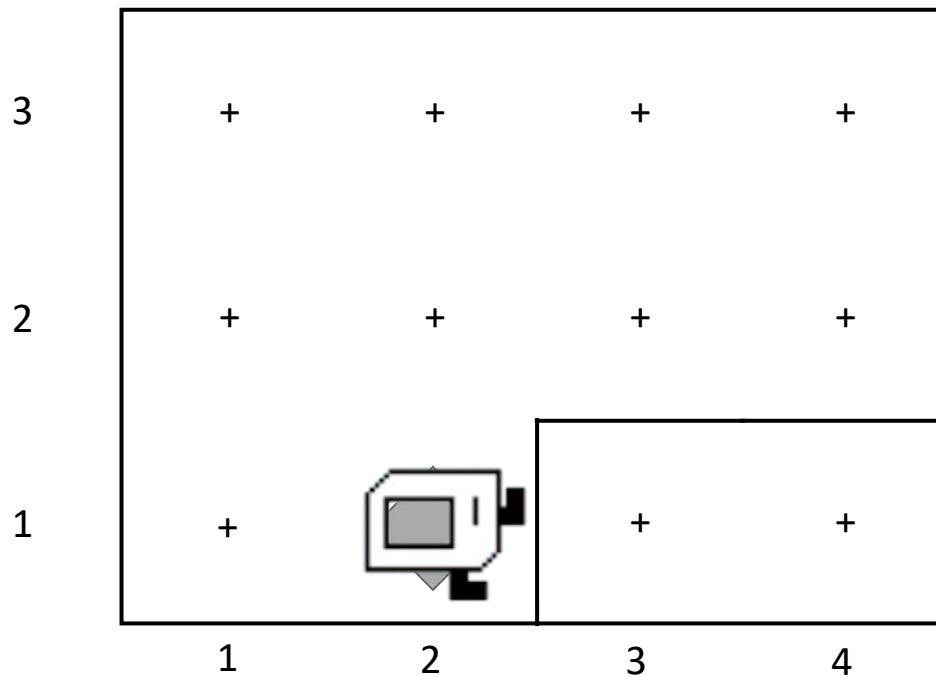


turnLeft();

turnLeft();

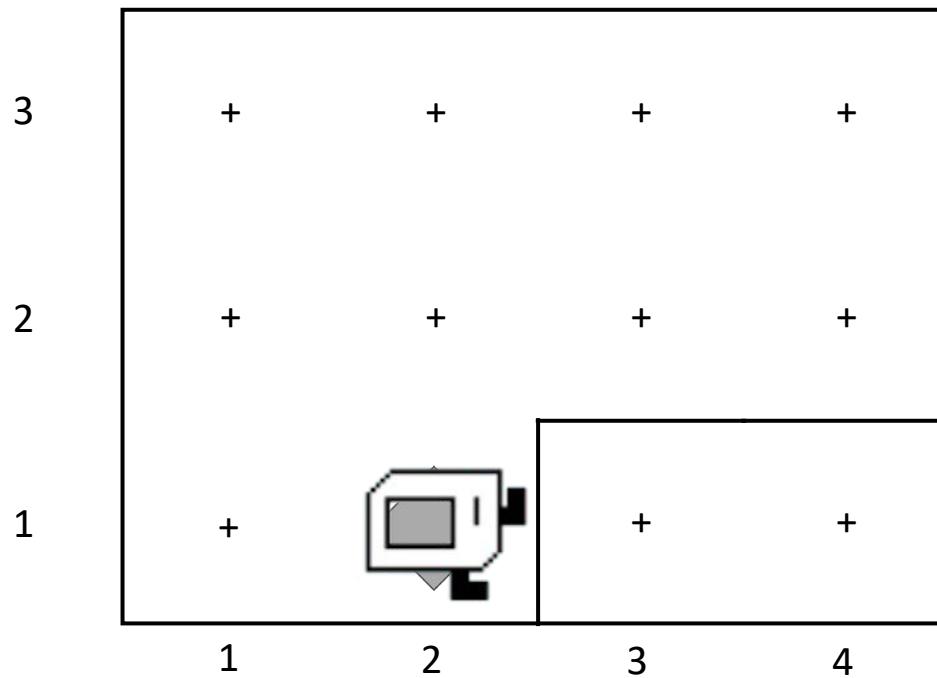


turnLeft();

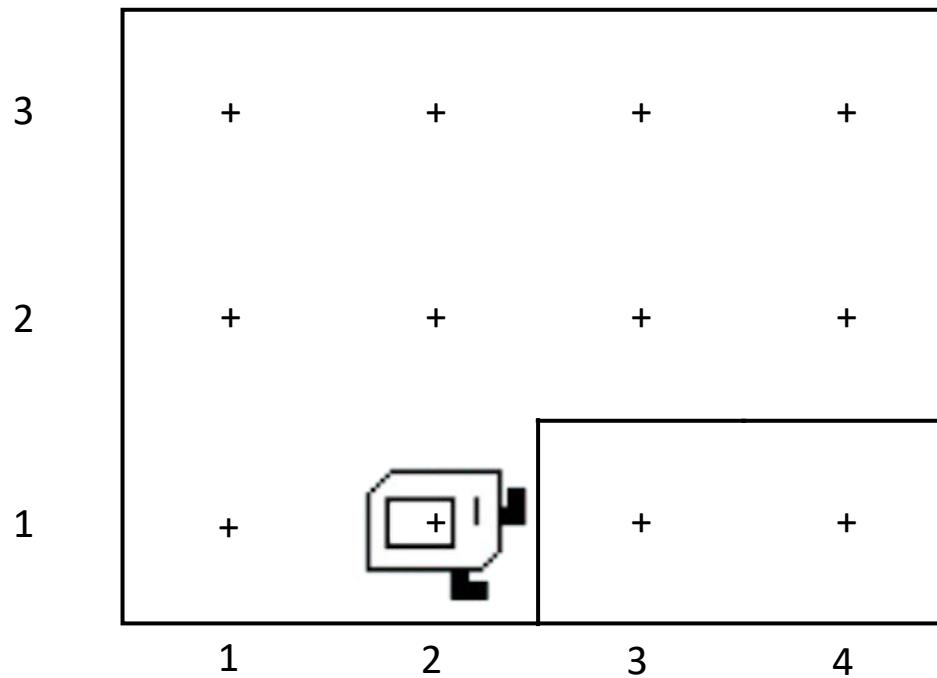


pickBeeper();

pickBeeper();

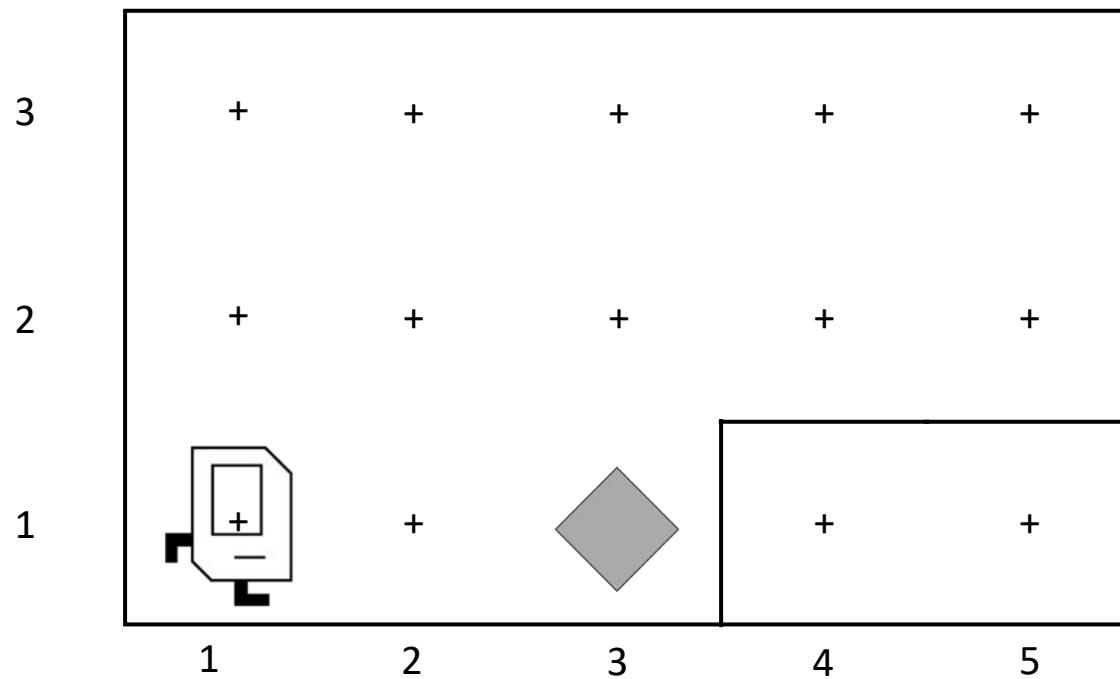


pickBeeper();

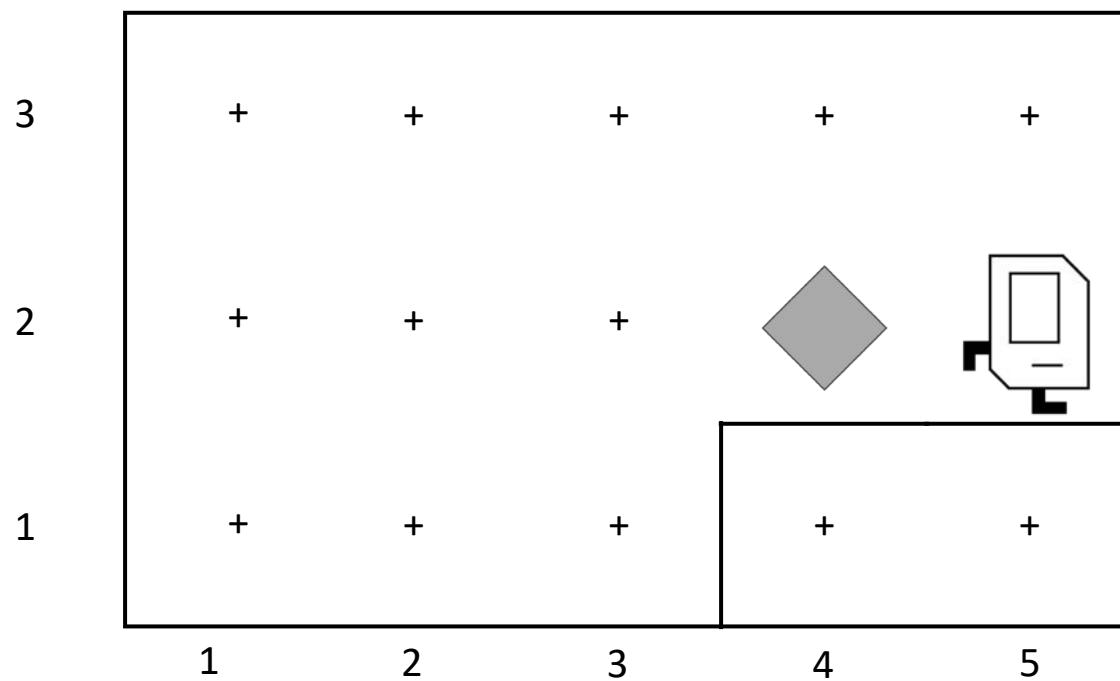


Make Sense?

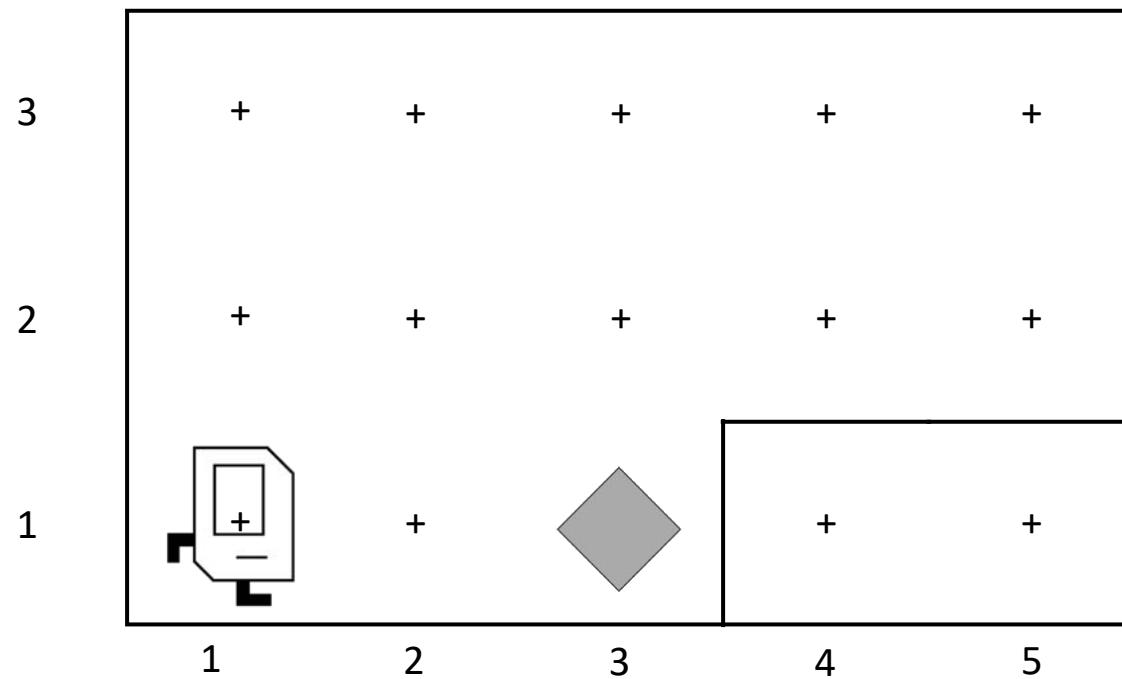
First Challenge



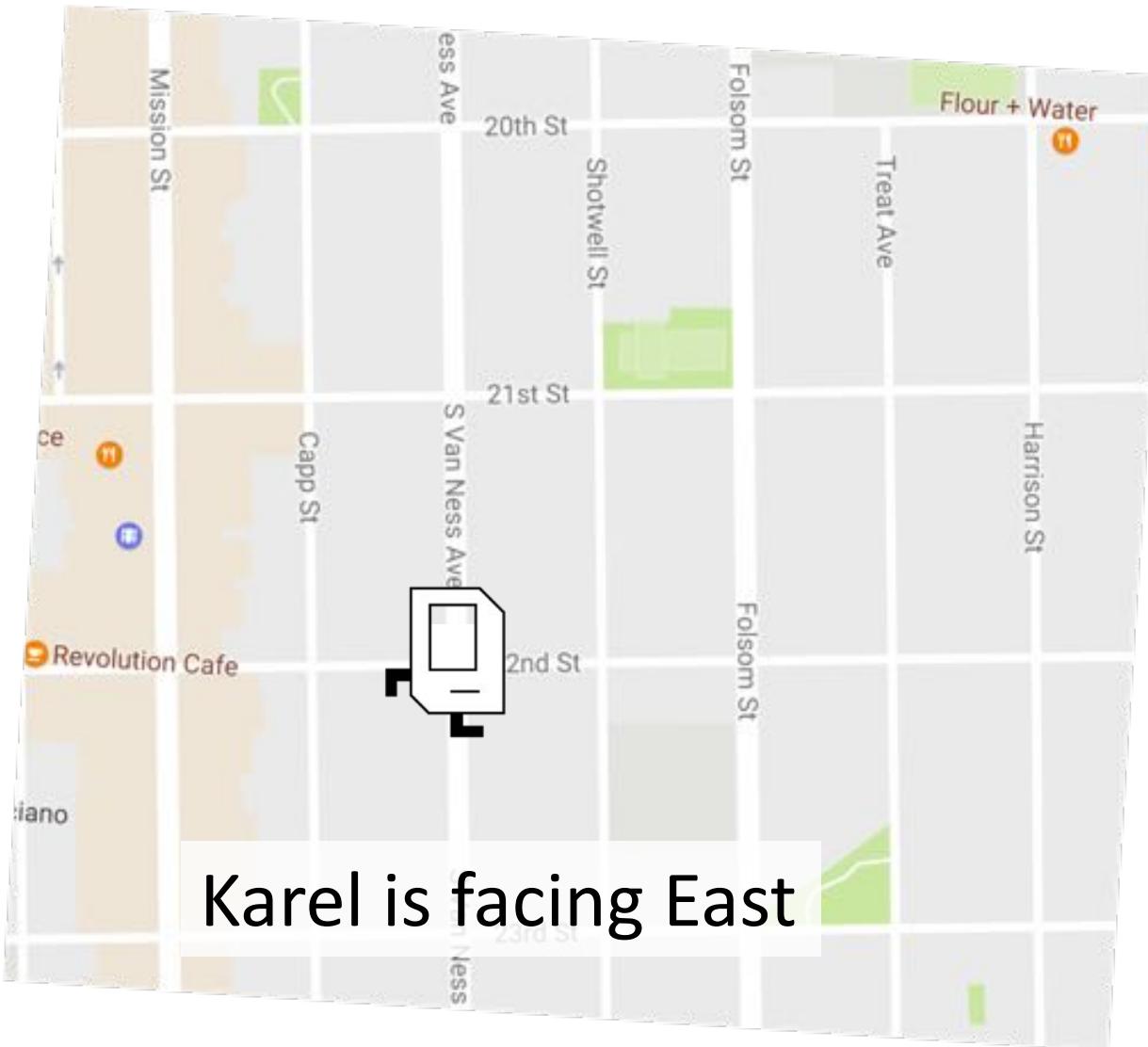
First Challenge



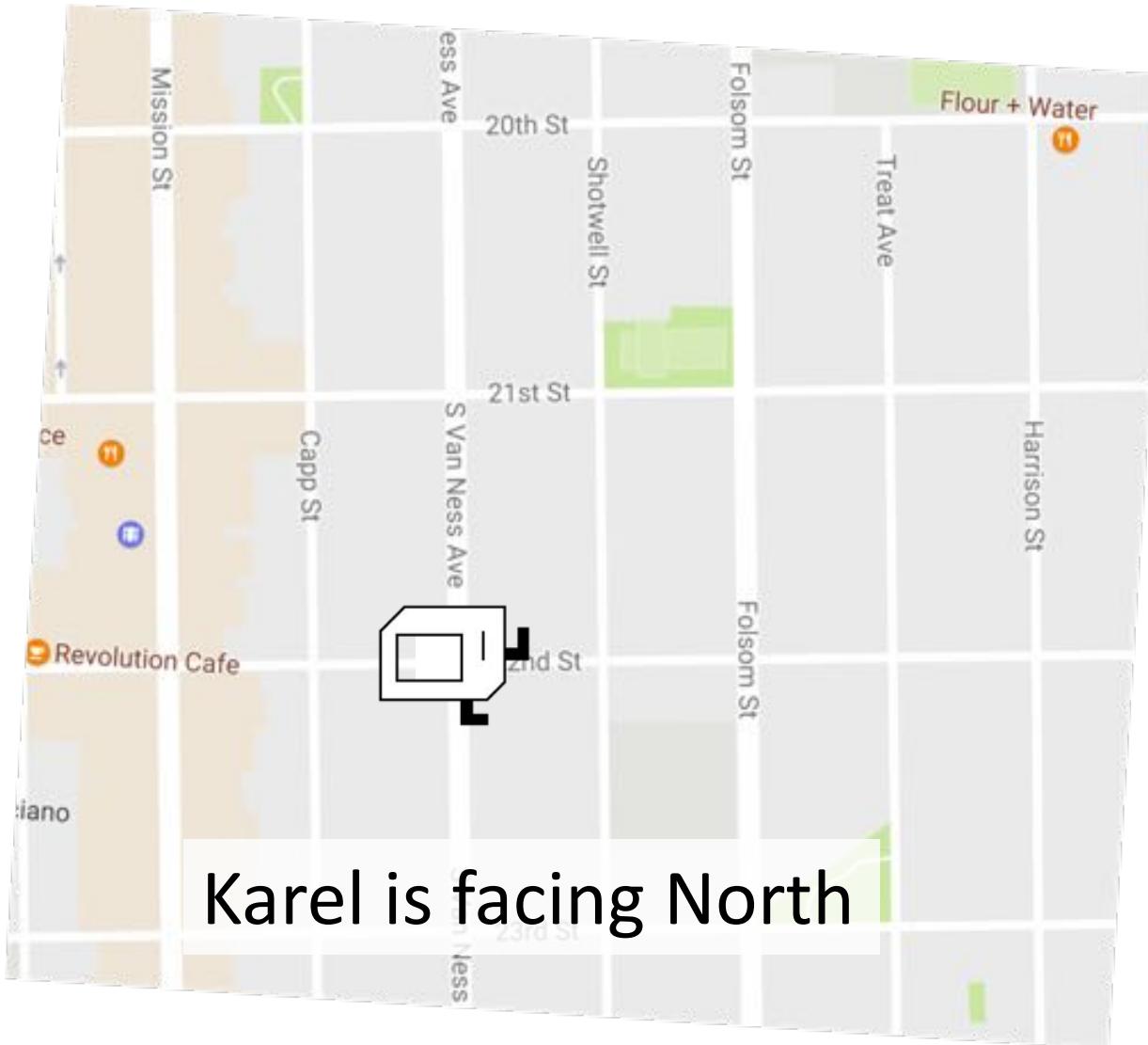
Bird's Eye View



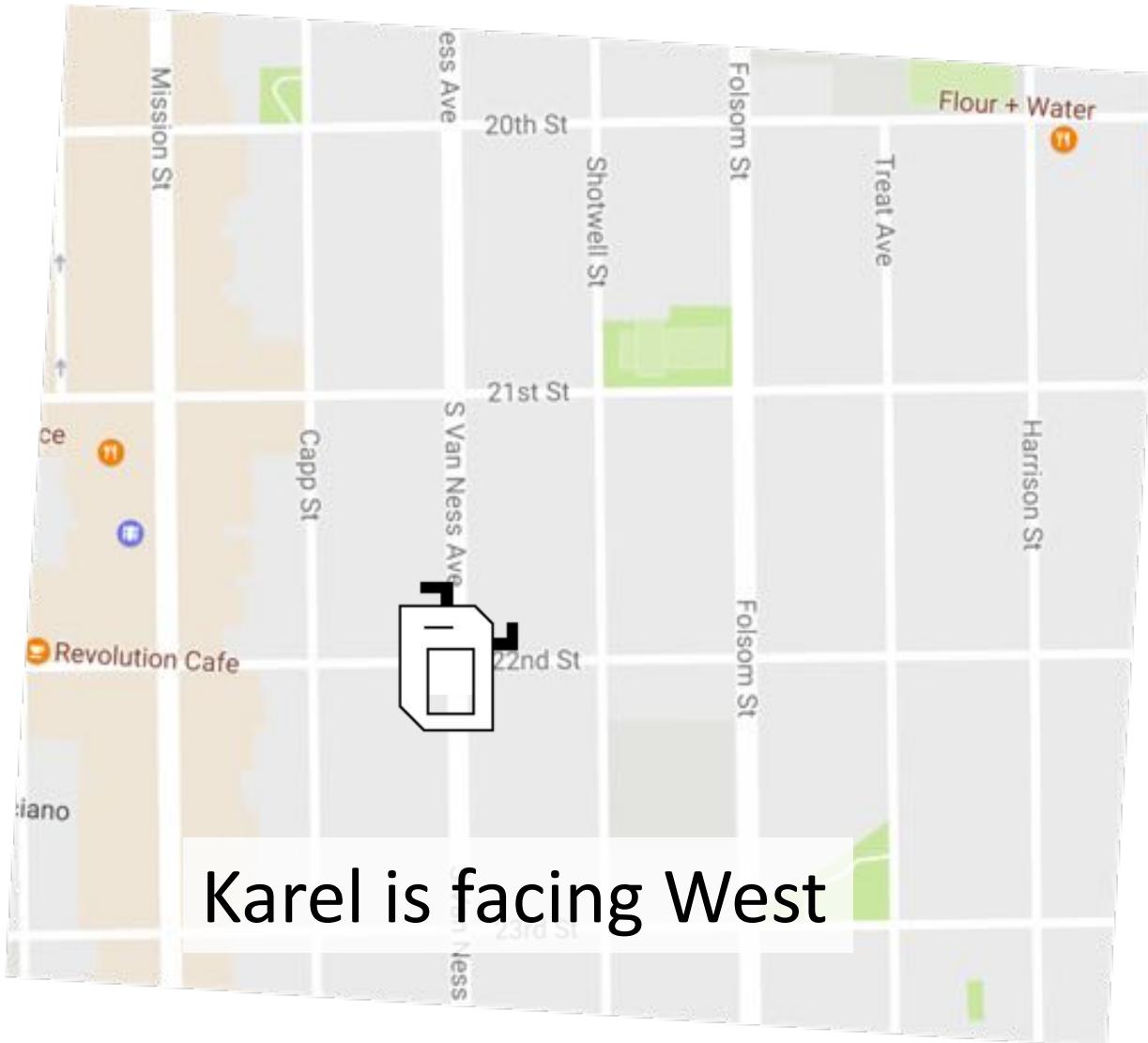
Bird's Eye View



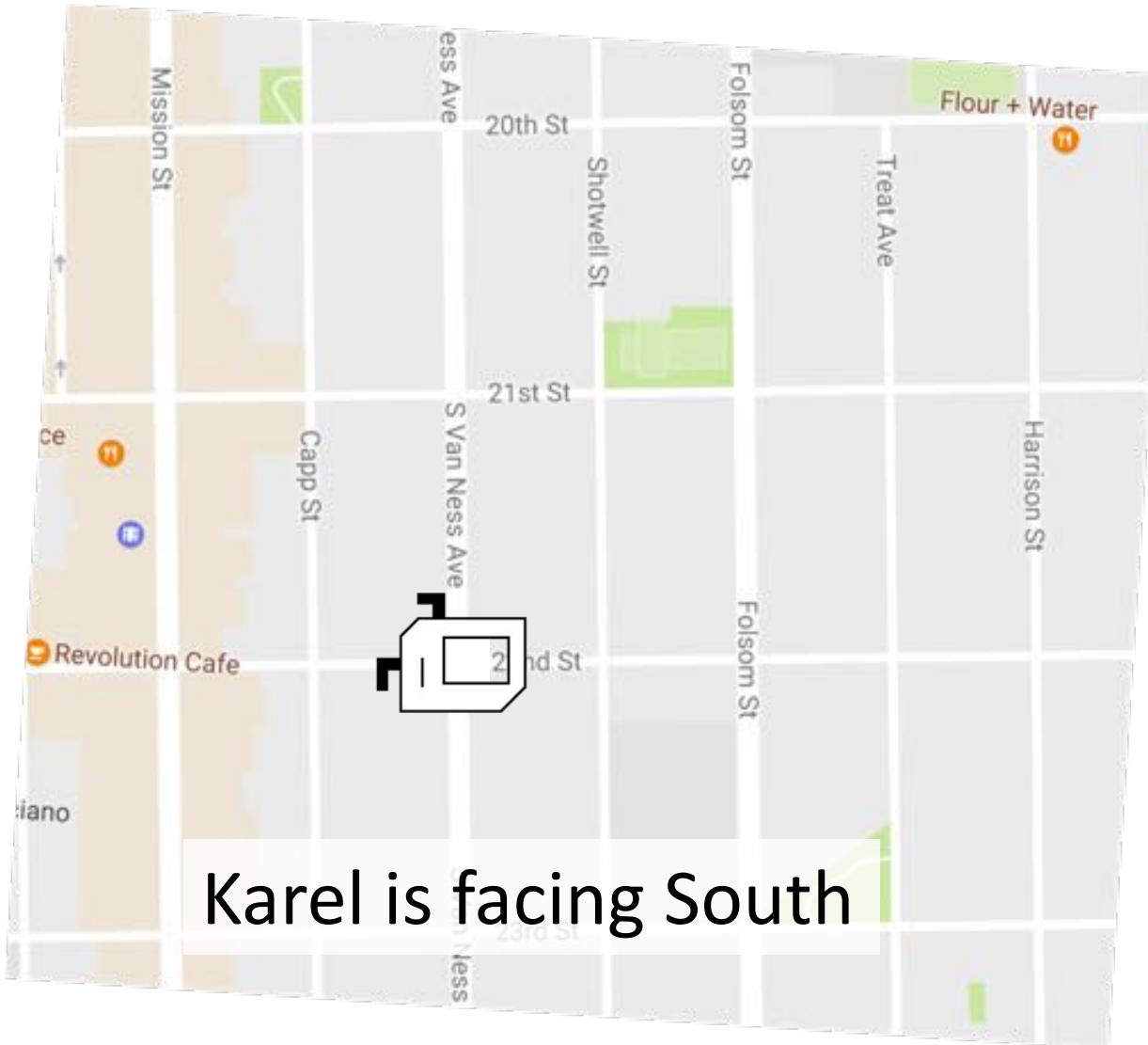
Turn Left



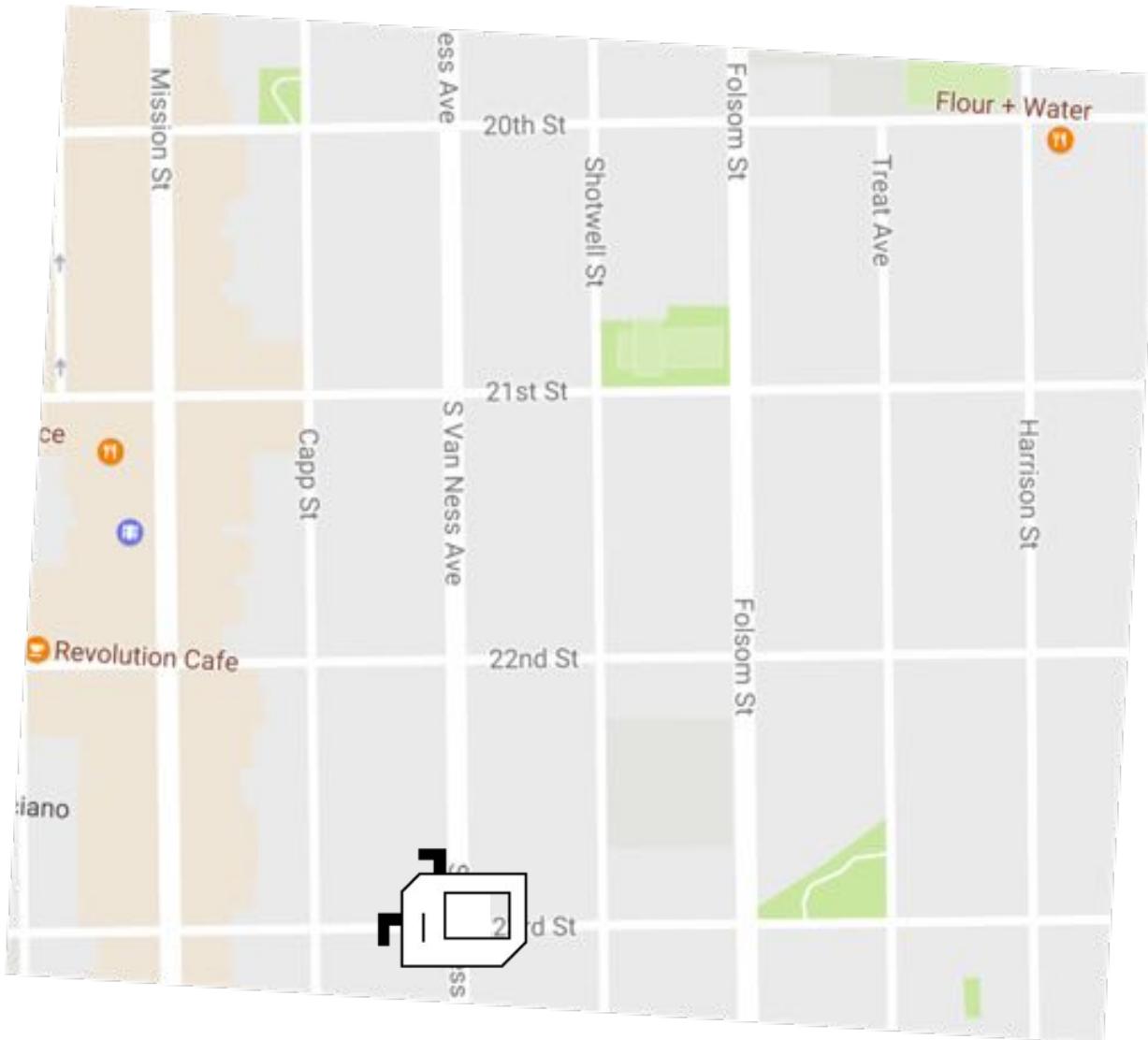
Turn Left



Turn Left



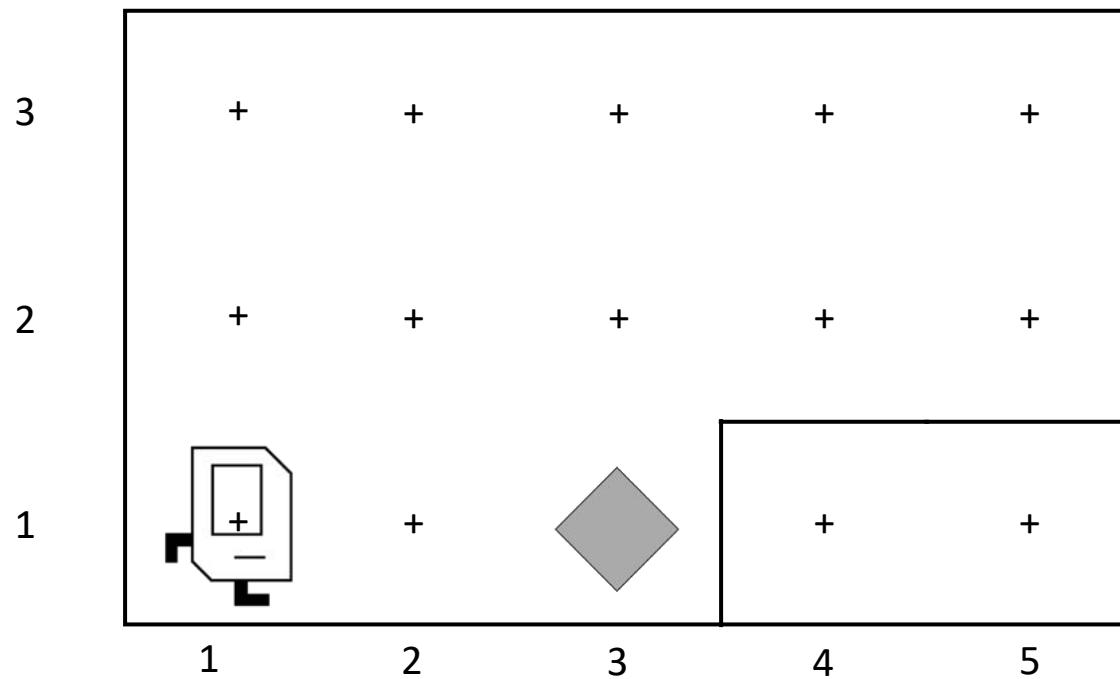
Move



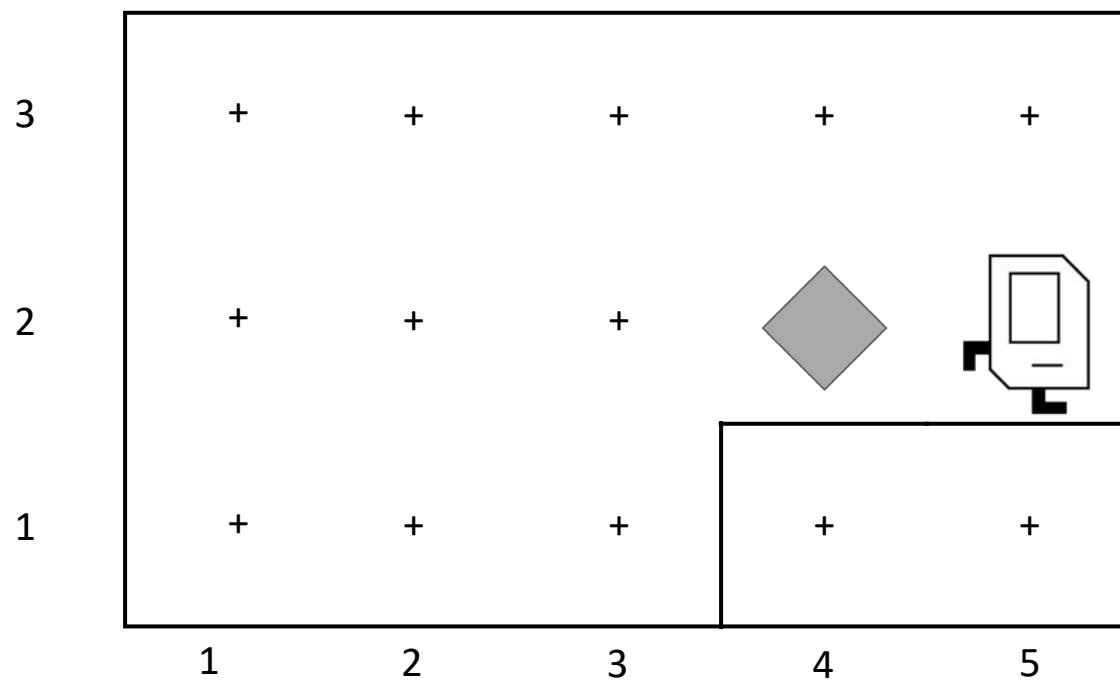
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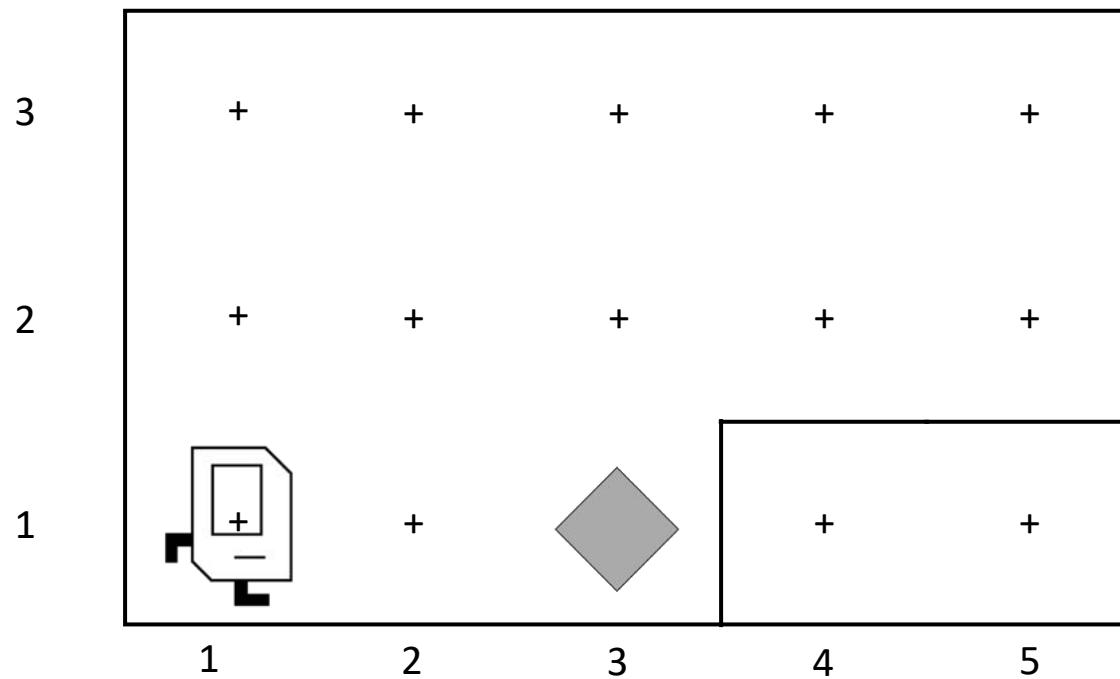
First Challenge



First Challenge



First Challenge



Learn By Doing





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Method Definition

```
private void name( ) {  
    method statements  
}
```

This adds a new
command to Karel's
vocabulary



Anatomy of a Program

Import Packages

Program



Anatomy of a Program

Import Packages

```
public class OurKarelProgram extends Karel {
```

```
}
```



Anatomy of a Program

Import Packages

```
public class OurKarelProgram extends Karel {
```

run method

helper methods

}



Anatomy of a Program

Import Packages

```
public class OurKarelProgram extends Karel {  
  
    public void run() {  
        move();  
        pickBeeper();  
        move();  
        turnLeft();  
        move();  
        turnRight();  
        move();  
        putBeeper();  
        move();  
    }  
}
```

helper methods

}



Anatomy of a Program

Import Packages

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    private void turnRight() {  
        turnLeft();  
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        turnLeft();  
    }  
}
```



Anatomy of a Program

```
import stanford.karel.*;  
  
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```



Anatomy of a Program

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    }  
  
    private void turnRight() {  
        turnLeft();  
        turnLeft();  
        turnLeft();  
    }  
}
```

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



Anatomy of a Program

```
import stanford.karel.*;  
  
public class OurKarelProgram extends Karel {  
  
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        move();  
    }  
  
    private void turnRight() {  
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        turnLeft();  
    }  
}
```

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



Anatomy of a Program

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import stanford.karel.*;  
  
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        putBeeper();  
        move();  
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}
```

This line of code gives the
name of the method
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Anatomy of a Program

```
import stanford.karel.*;  
  
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    private void turnRight() {  
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    }  
}
```

This is called a **code block**



Anatomy of a Program

```
import stanford.karel.*;  
  
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Anatomy of a Program

```
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    private void turnRight() {  
        turnLeft();  
        turnLeft();  
        turnLeft();  
    }  
}
```

This is also called a
code block



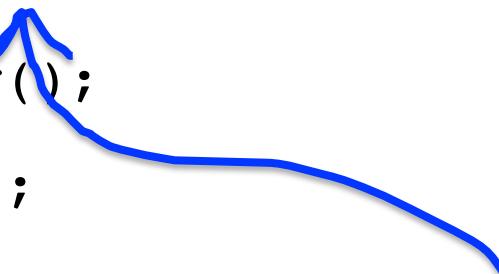
Anatomy of a Program

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    private void turnRight() {  
        turnLeft();  
        turnLeft();  
        turnLeft();  
    }  
}
```



The run method is “public” so that
Eclipse can call it.



Anatomy of a Program

```
import stanford.karel.*;  
  
public class OurKarelProgram extends Karel {  
  
    public void run() {  
        move();  
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        move();  
        turnRight();  
        move();  
        putBeeper();  
        move();  
    }  
  
    private void turnRight() {  
        turnLeft();  
        turnLeft();  
        turnLeft();  
    }  
}
```

The turnRight method is “private” to indicate it is only visible to our current program.



Why Study CS?

Joy of Building



Interdisciplinary



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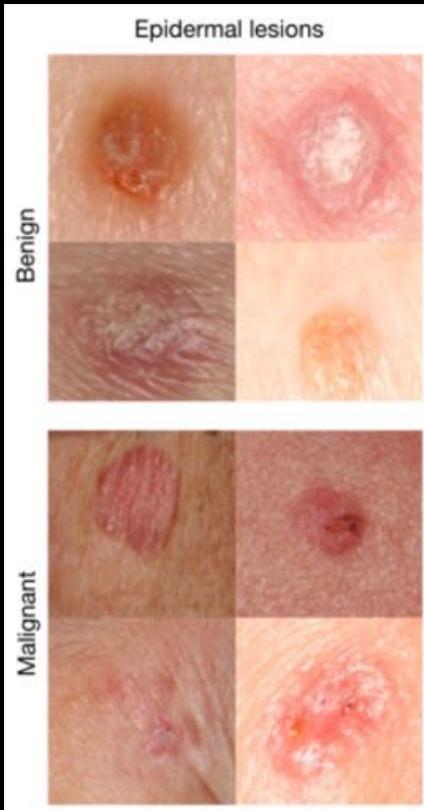
Closest Thing To Magic



Now is the Time



Now is the Time



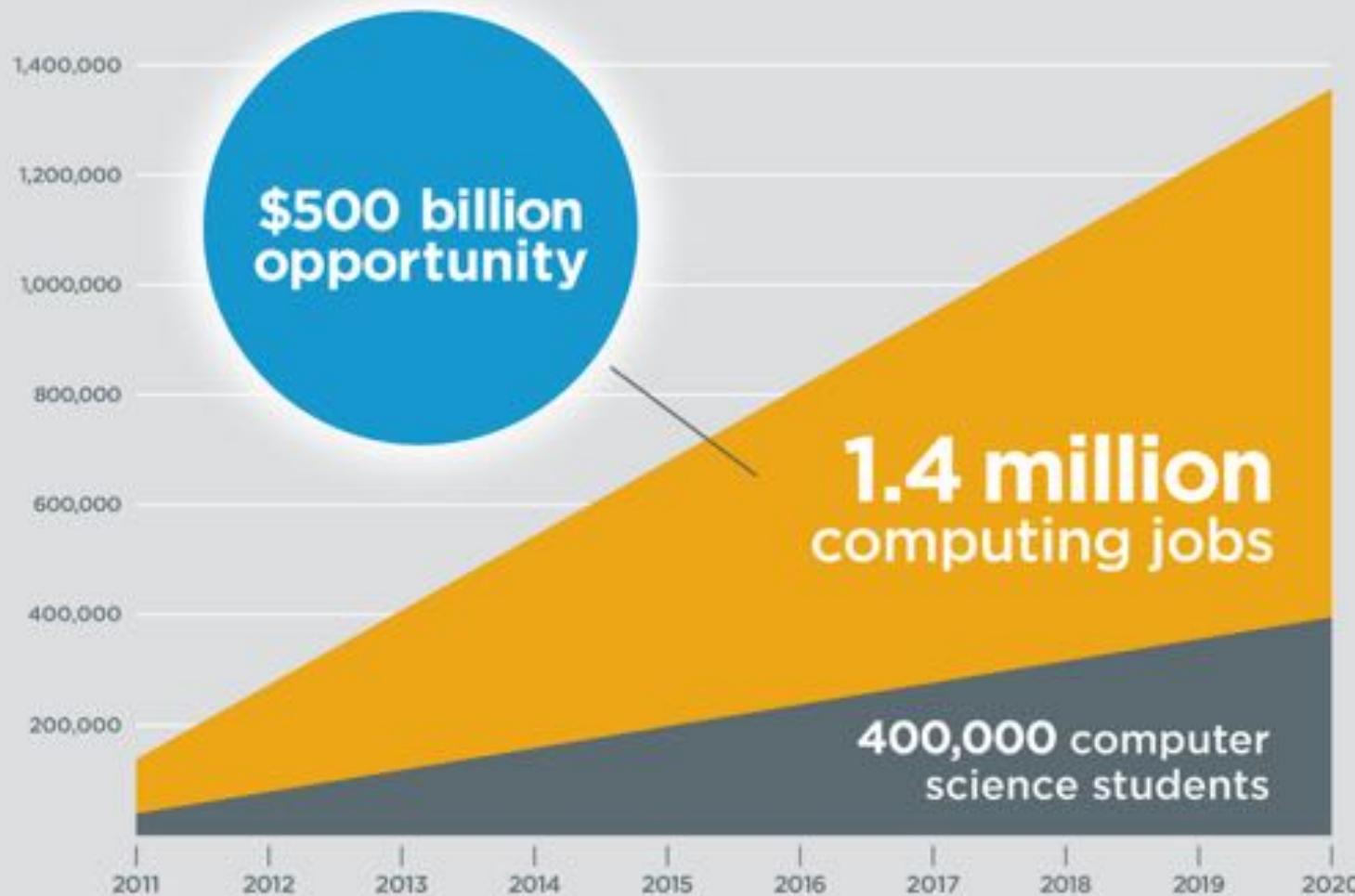
A machine learning algorithm performs **better than** the best dermatologists.

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

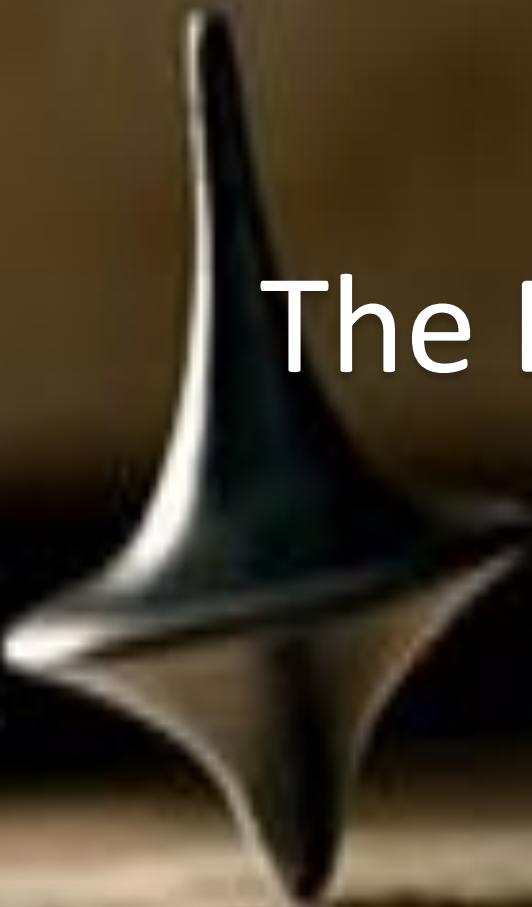
1,000,000 more jobs than students by 2020



Everyone is Welcome



The End

A silver toppling star, a traditional Chinese toy, is shown in mid-fall against a dark background. It consists of a central vertical rod with four curved arms extending from its sides. The star is positioned vertically, with the arms pointing downwards.

The End?