



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: Nick Troccoli



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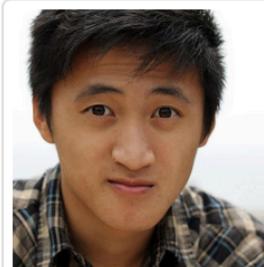
Section Leaders



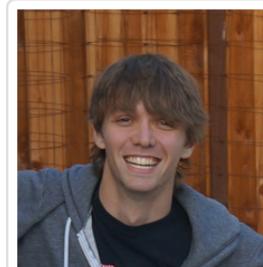
Alisha



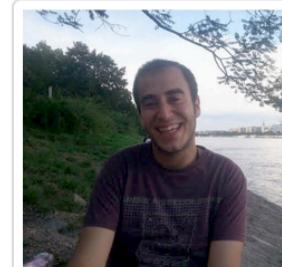
Amy



Brian



Bryce



Çağatay



Dilara



Göktuğ



Julia



Kerem



Kevin



Pınar Ö



Şahin



Pınar Y



Nick

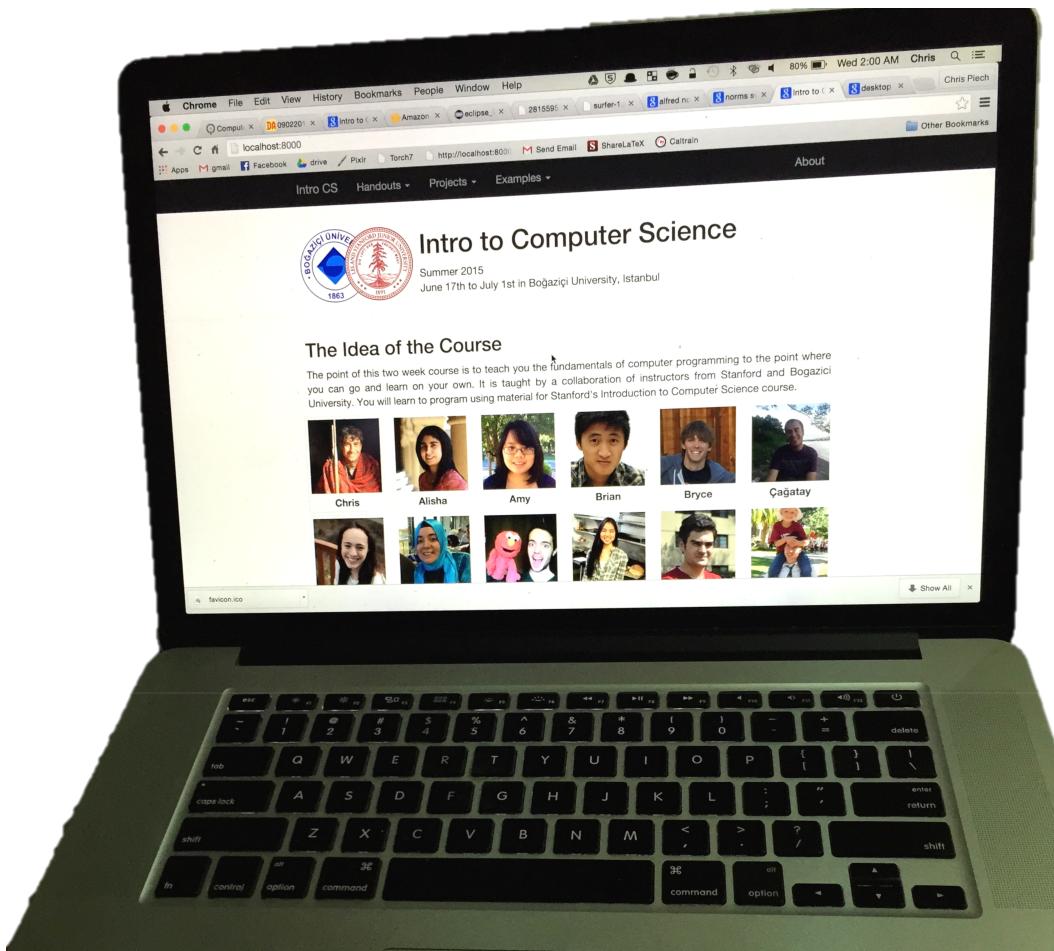


Asena



Who are you?

Prerequisite Test

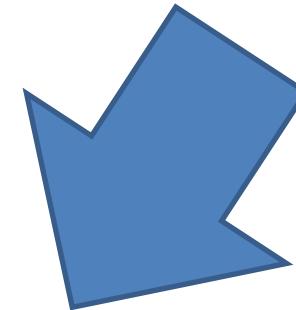
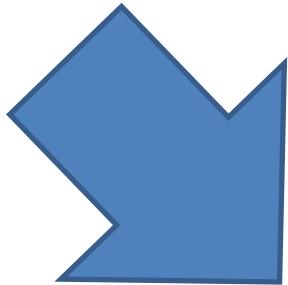


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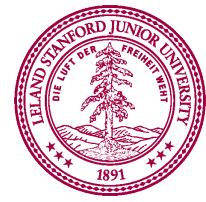
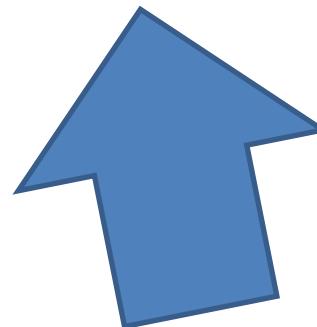


Course mechanics
(this is a light version. Please read the handout
for details).

Course Website



<http://cs106a.stanford.edu>



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



Piech, CS106A, Stanford University

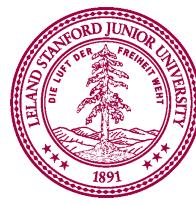


Office Hours



LaIR: 6pm until midnight Sunday through Thursday
(starting next Sunday)

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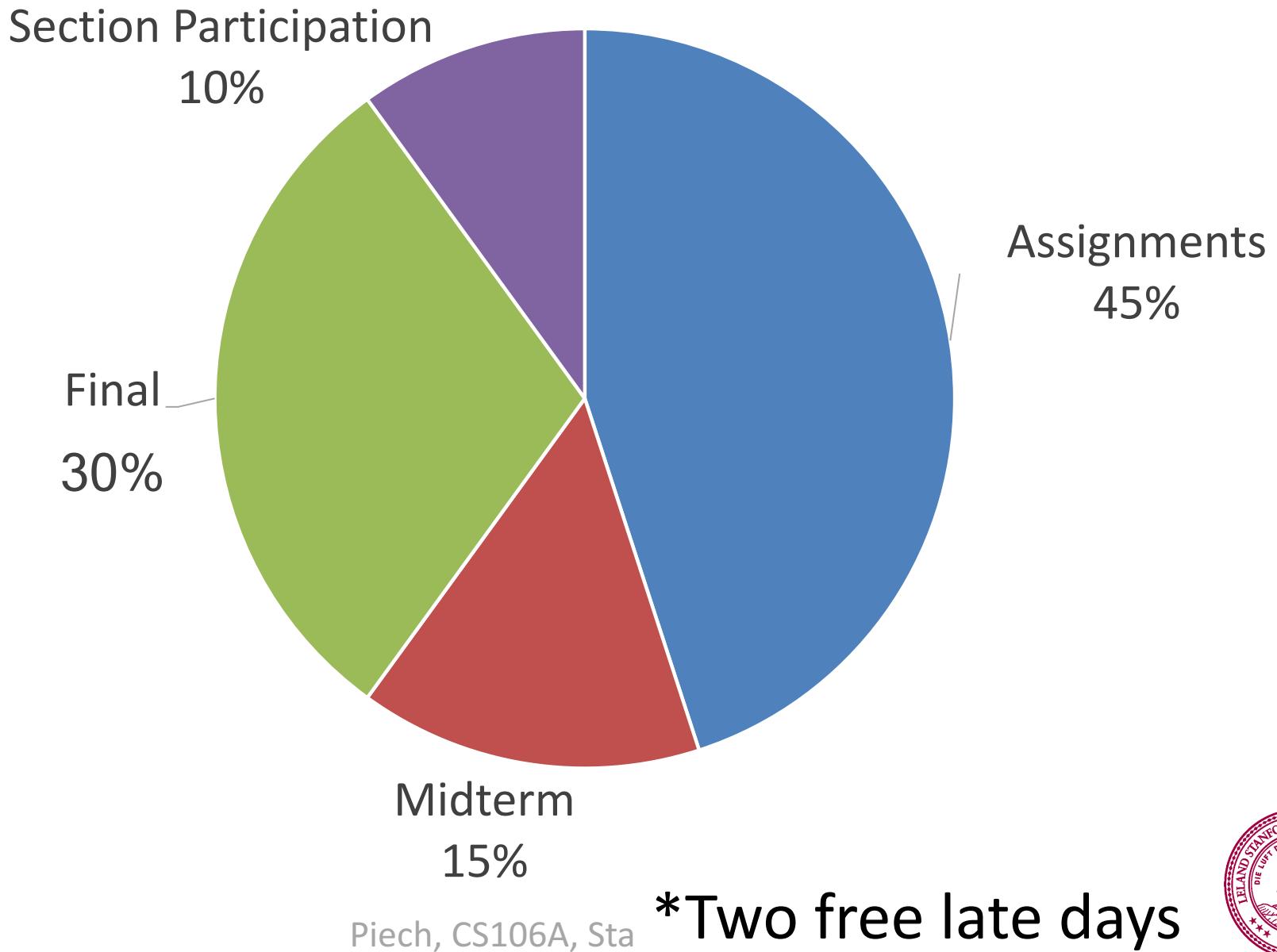
Grading Scale

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



Optional Contest



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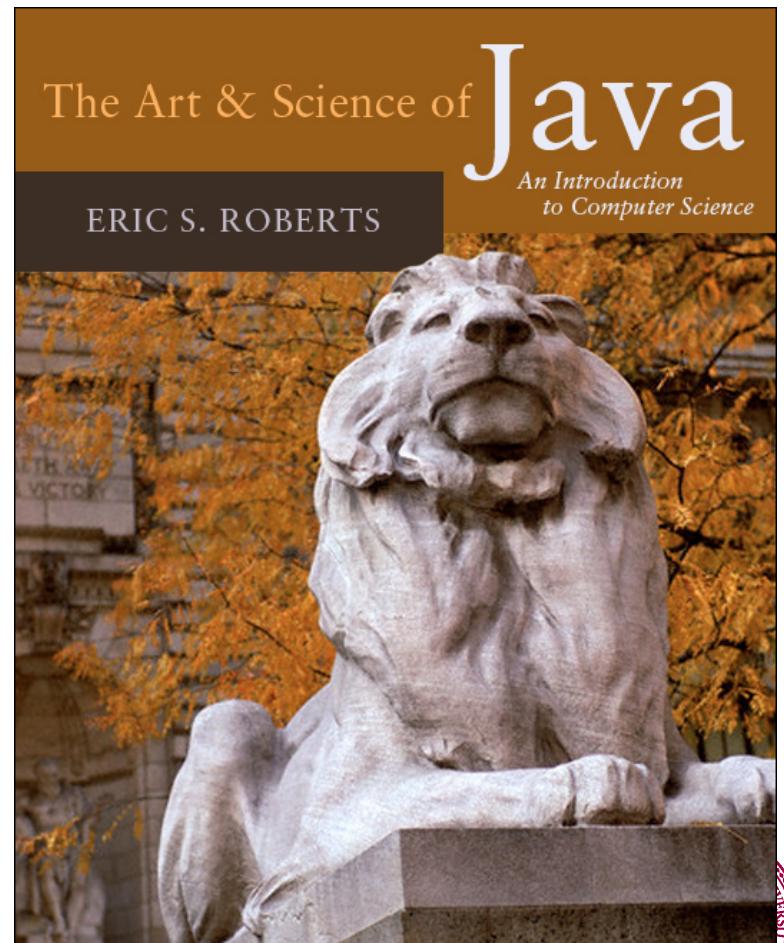
Textbook

The Art & Science of Java by Eric Roberts

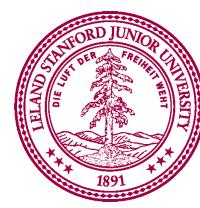
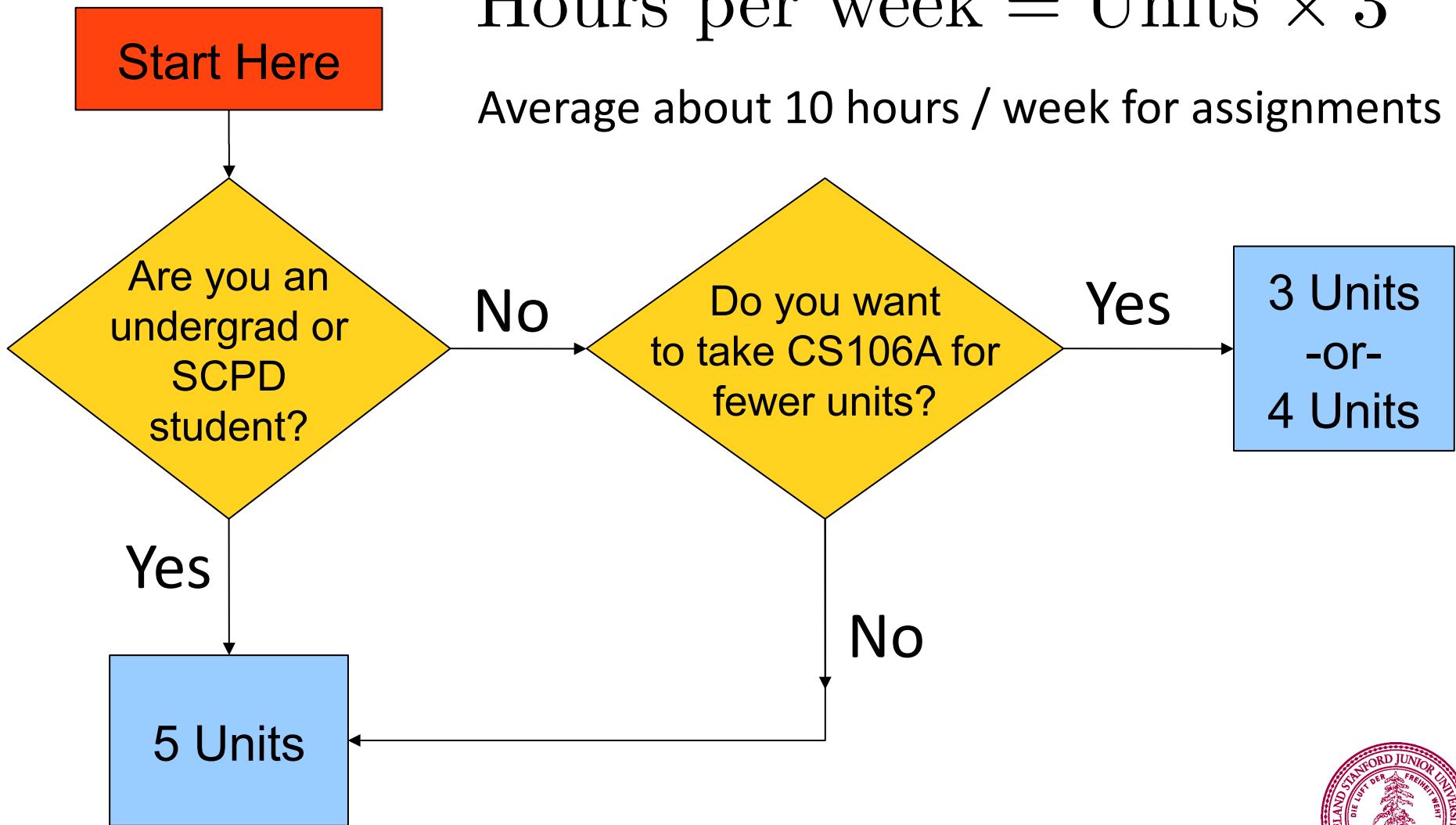
- written here at Stanford
- tailored to this course
- a valuable reference
- usable on open-book exams

Karel the Robot Learns Java

- First week of material



CS106A Units



Lectures are Online

Stanford Center for Professional Development | Chris Piech

https://mvideox.stanford.edu/Course/825

Stanford University | Chris James Piech (cpiech) | Log Out

Stanford | Center for Professional Development | Graduate Courses | Seminars | Previews | Tech Support

cx ClassX engineered for engineers [Learn more >>](#)

Programming Methodology
CS106A



Watch Now: Wednesday, December 7, 2016

Course Details

Course Description [View License](#)

This introduction to the engineering of computer applications emphasizes modern software "D's" of development: Design,

Course Sessions (29): [Show All](#)

Day/Date:	Watch Online:	Duration:
Wednesday December 7, 2016	WATCH NOW	00:48:08
Monday December 5, 2016	WATCH NOW	00:48:19

Week 11 +

Week 10 +

Week 9 +

Week 8 +

classx.stanford.edu/Home?Graduate=1

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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

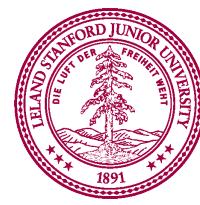
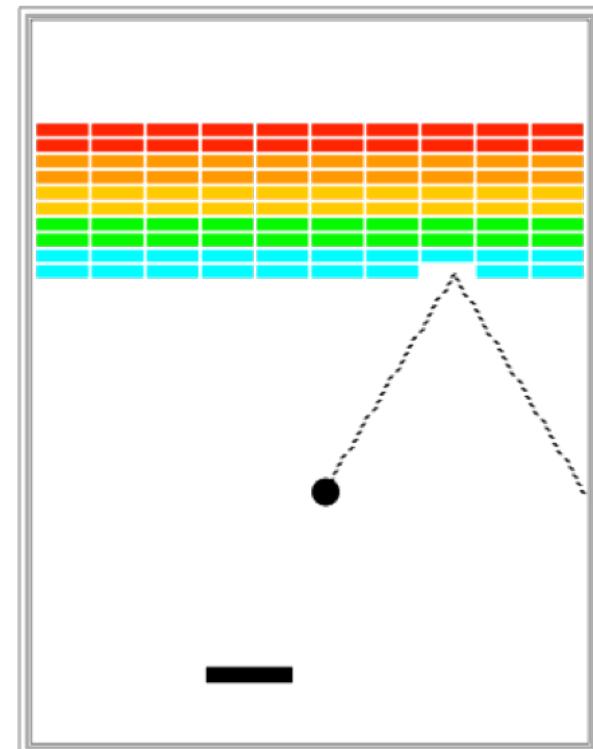
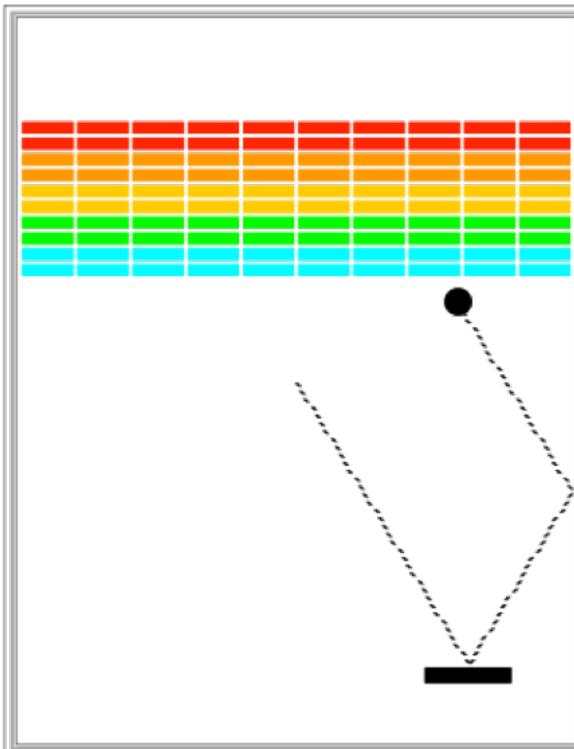
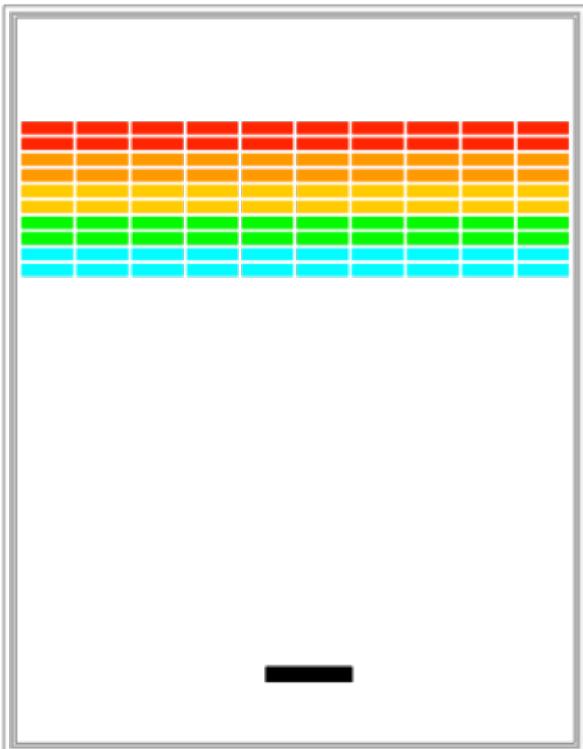


Self Driving Car

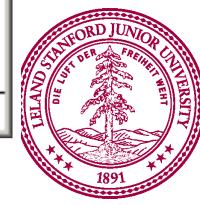
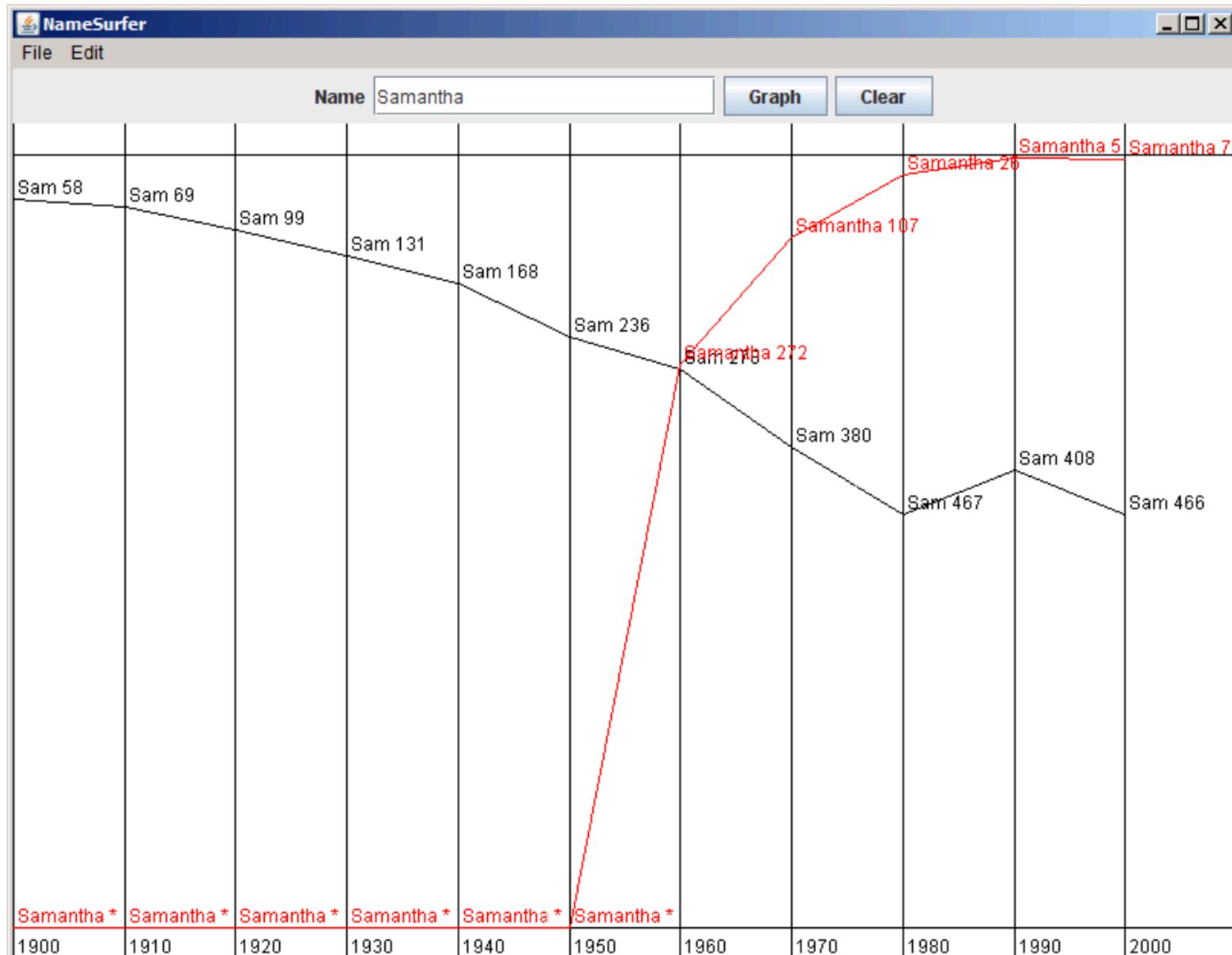


If only we could program self
driving cars...

Graphical Games



Data Visualization



Mini Facebook

FacePamphlet

File Edit

Name Add Delete Lookup

Mehran Sahami

Friends:



coding like a fiend

Change Status

MehranS.jpg

Change Picture

Mehran Sahami

Add Friend

Mehran Sahami is coding like a fiend

Displaying Mehran Sahami

Piech, CS106A, Stanford University



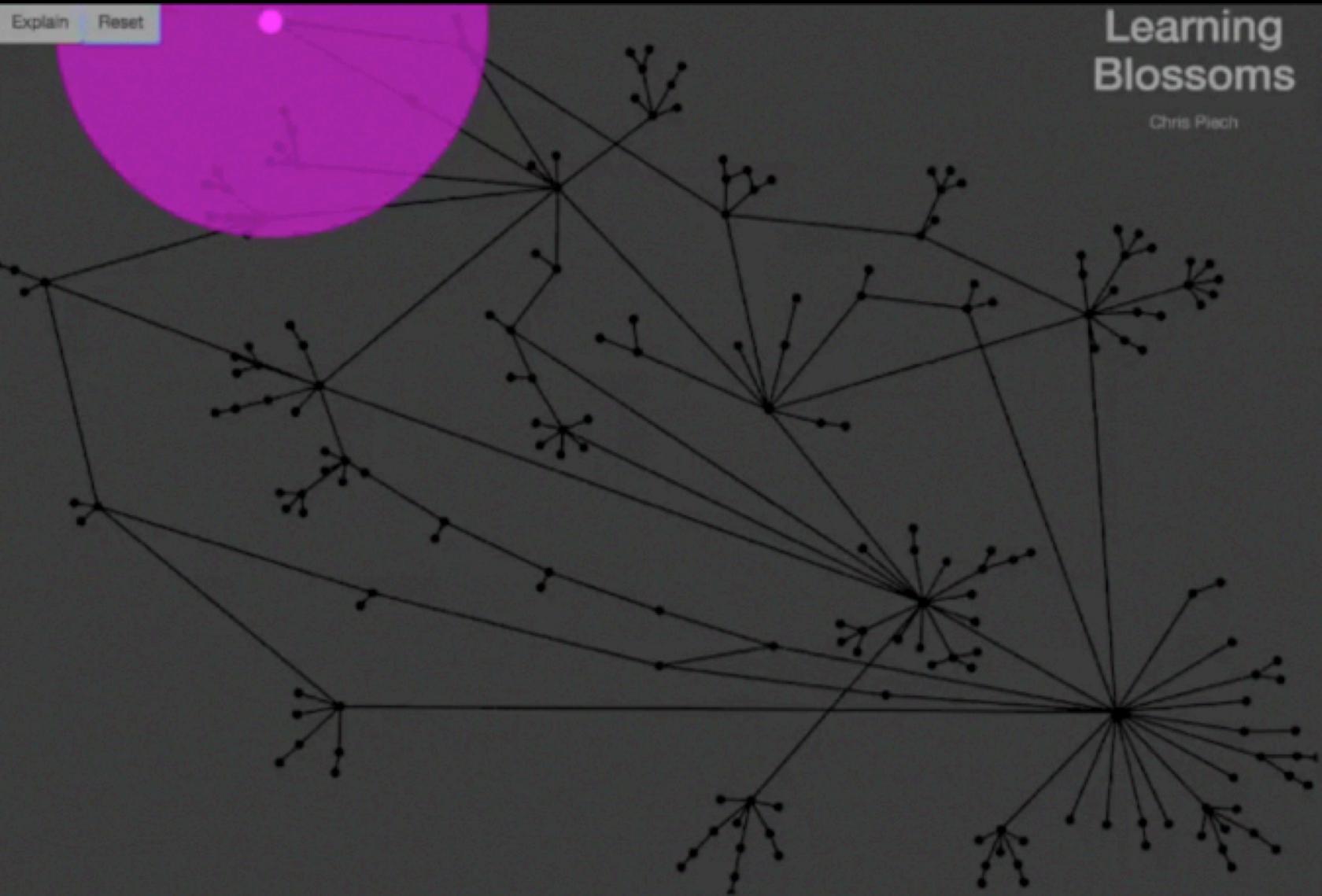
Strive for Everyone to Succeed



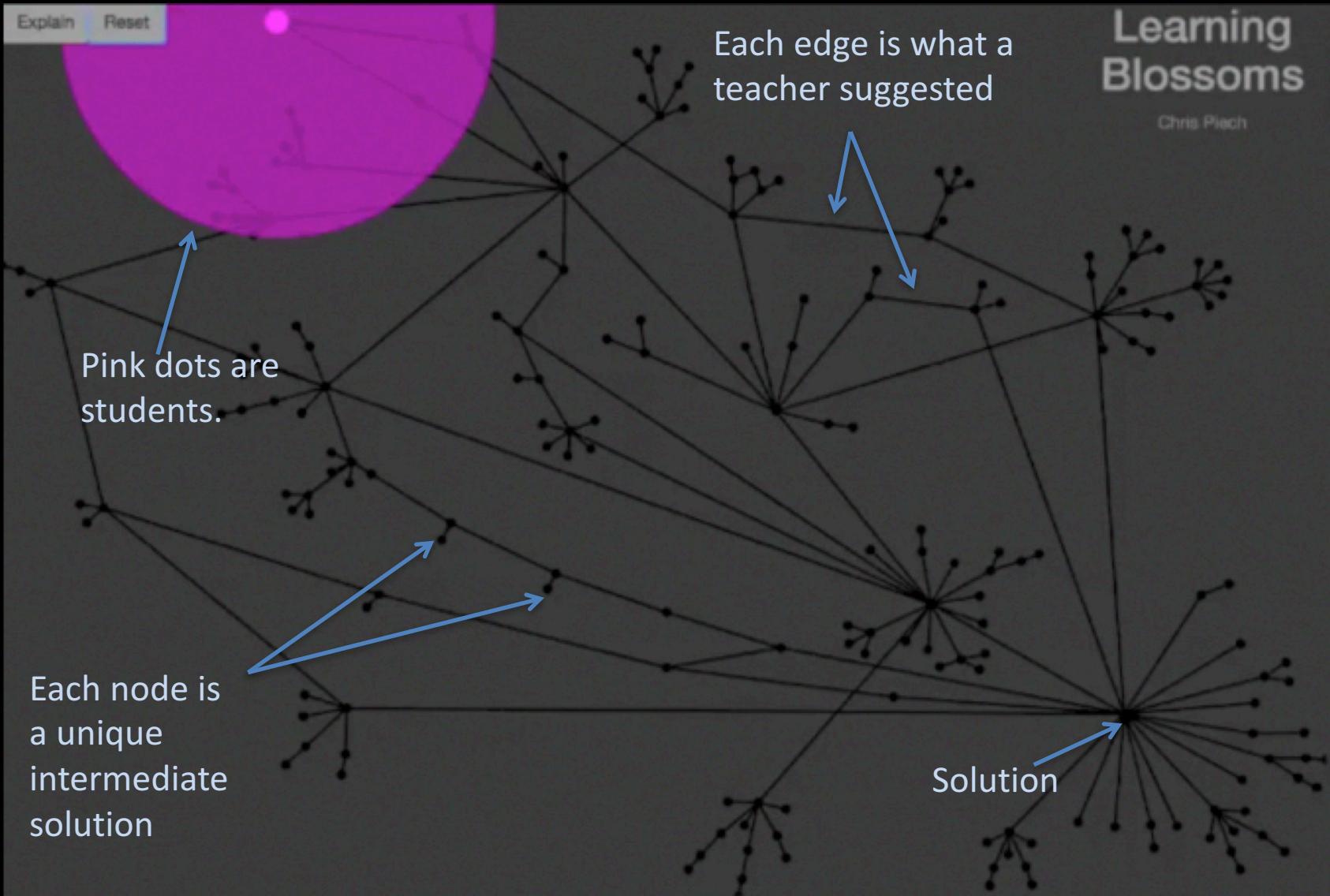
Art of Computer Science



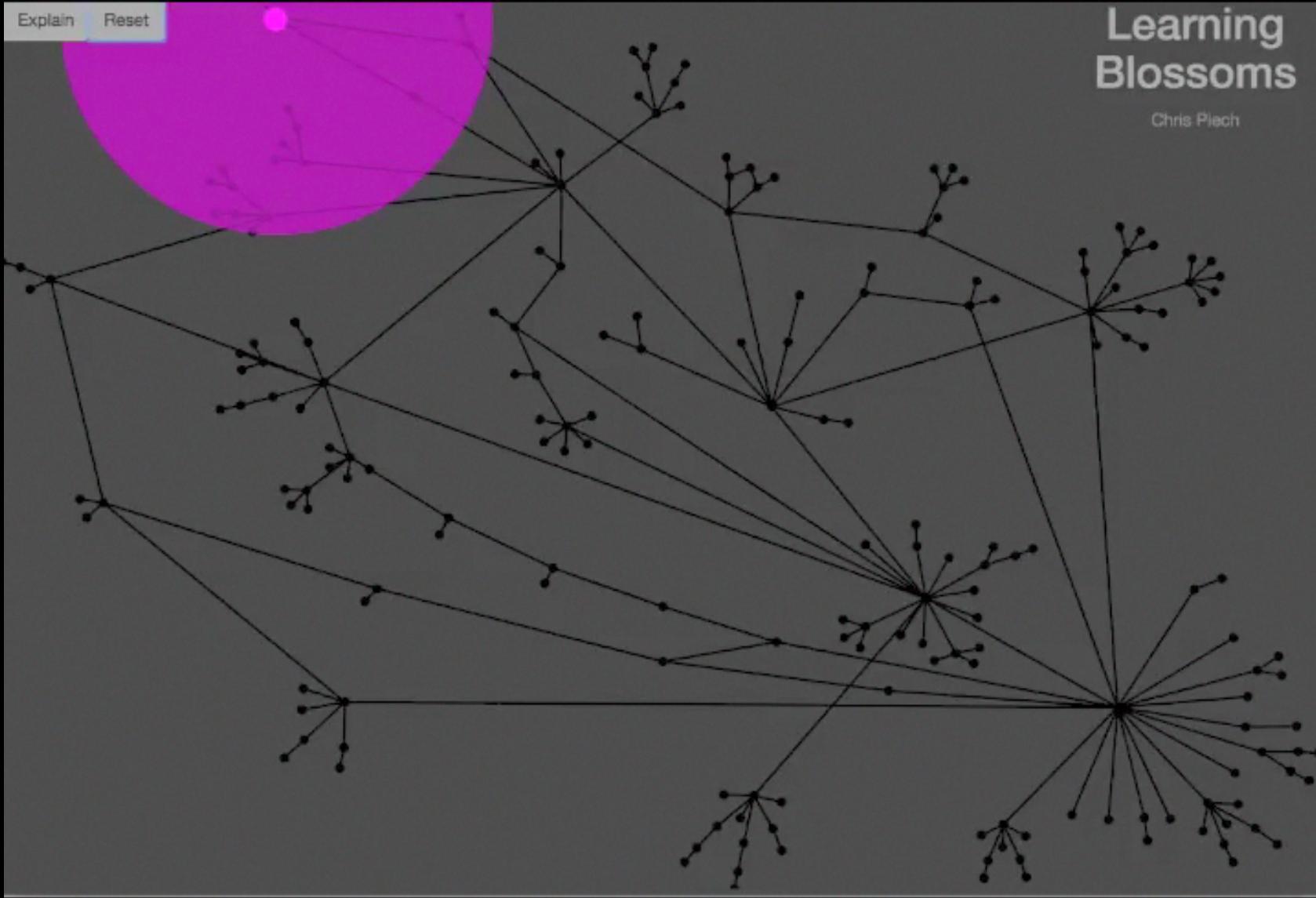
Something cool



Autonomously Generating Hints by Inferring Problem Solving Policies
Chris Piech, Mehran Sahami, Jonathan Huang, Leo Guibas

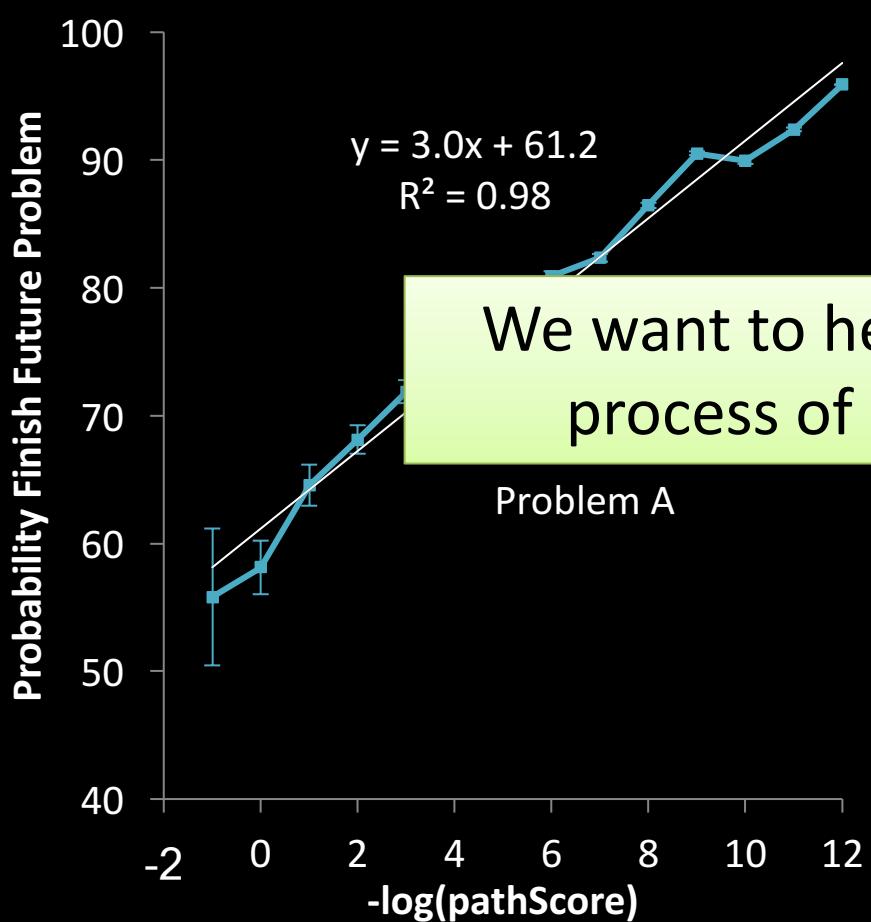


Autonomously Generating Hints by Inferring Problem Solving Policies
Chris Piech, Mehran Sahami, Jonathan Huang, Leo Guibas

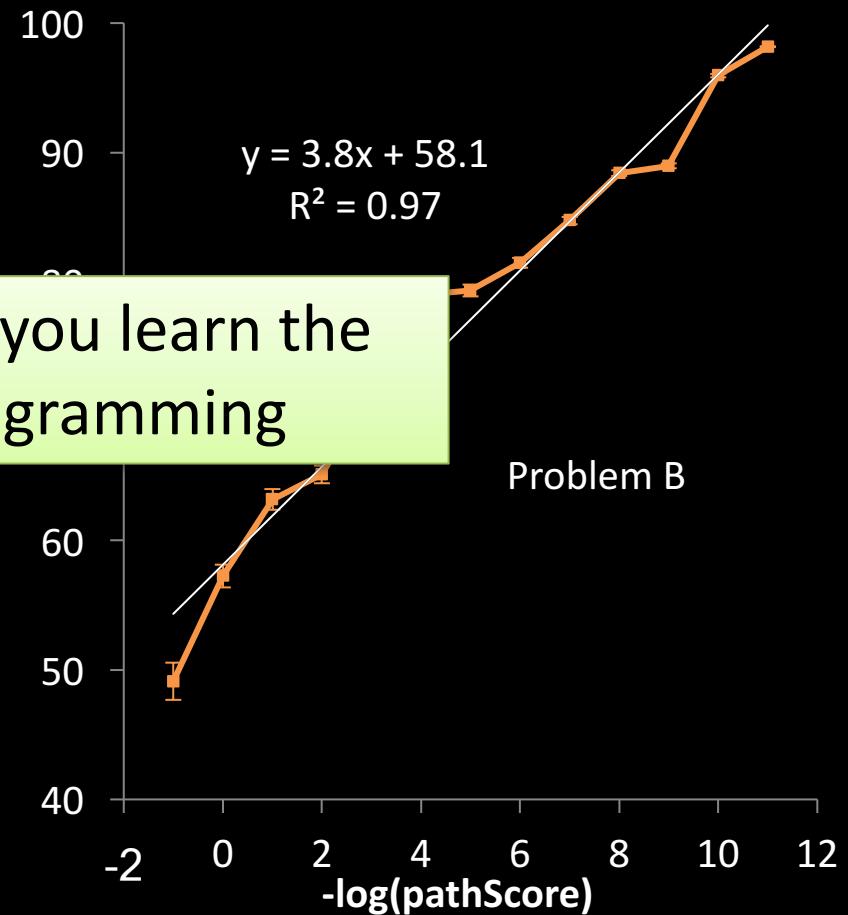


Autonomously Generating Hints by Inferring Problem Solving Policies
Chris Piech, Mehran Sahami, Jonathan Huang, Leo Guibas

Process Predicts Future



We want to help you learn the
process of programming



Effect is large and logarithmic.

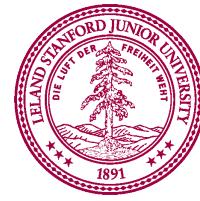
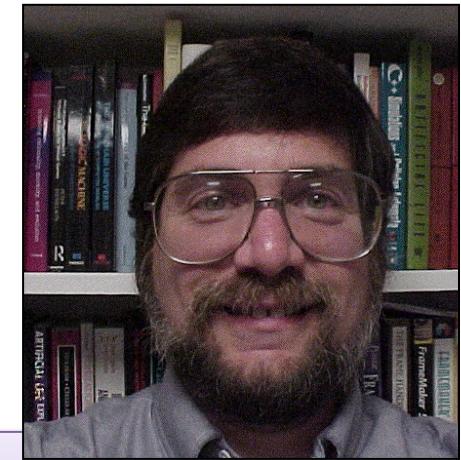
Lets Get Started



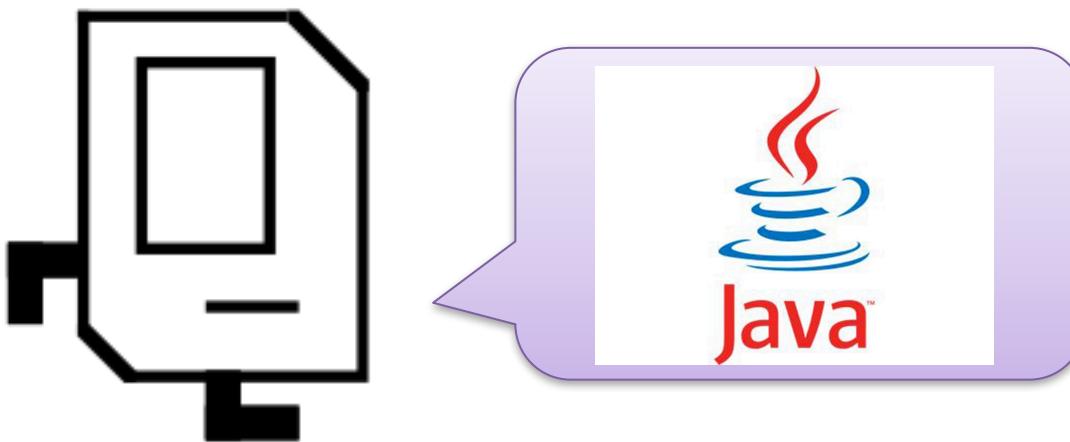
Meet Karel the Robot



Good morning



Karel Speaks Java



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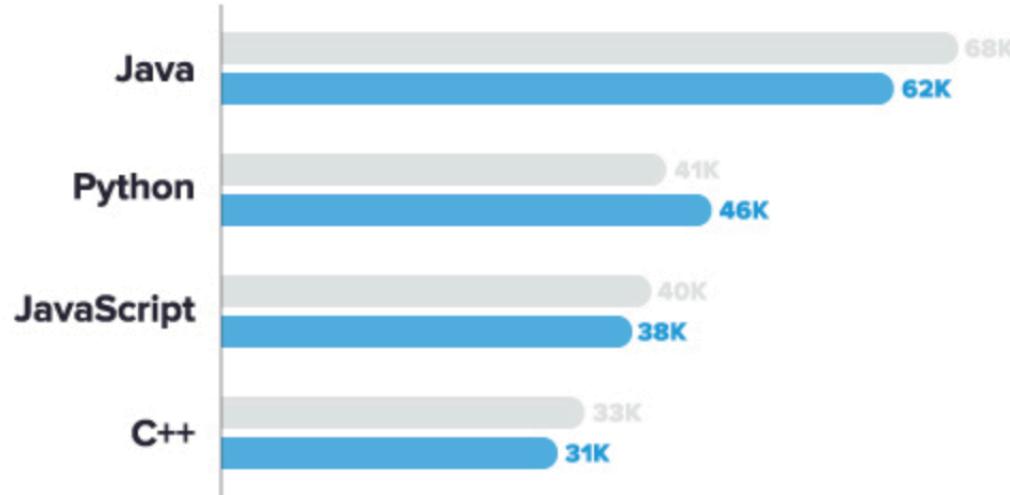


Why Java?

1

Job postings containing top languages

Indeed.com - November, 17th 2017

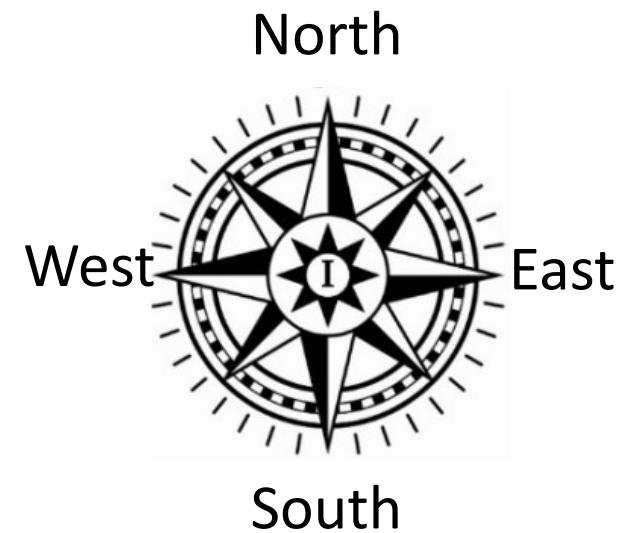


2

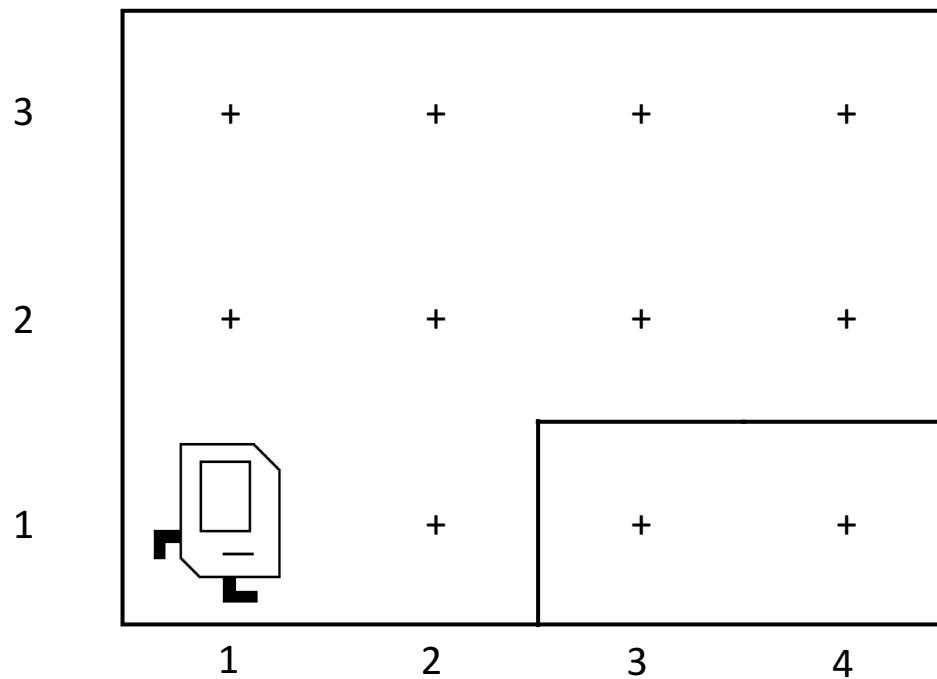


Karel's World

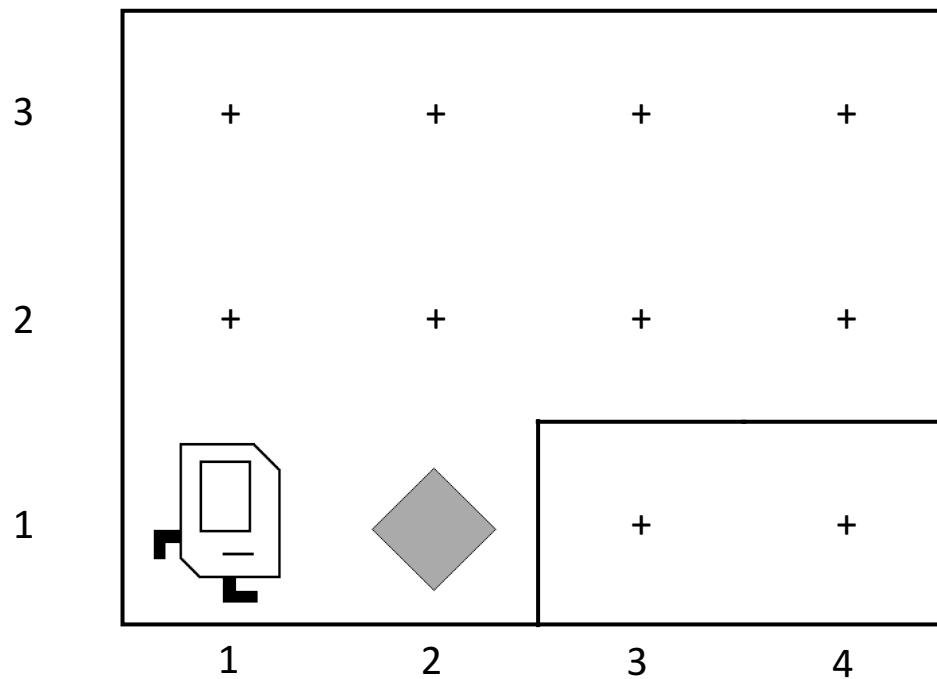
3	+	+	+	+	
2	+	+	+	+	
1		+	+	+	
	1	2	3	4	5



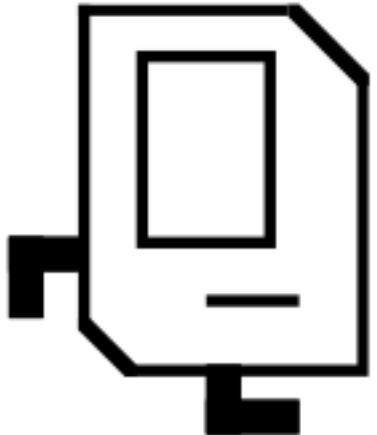
Walls



Beepers



Knows Four Commands



`move();`

`turnLeft();`

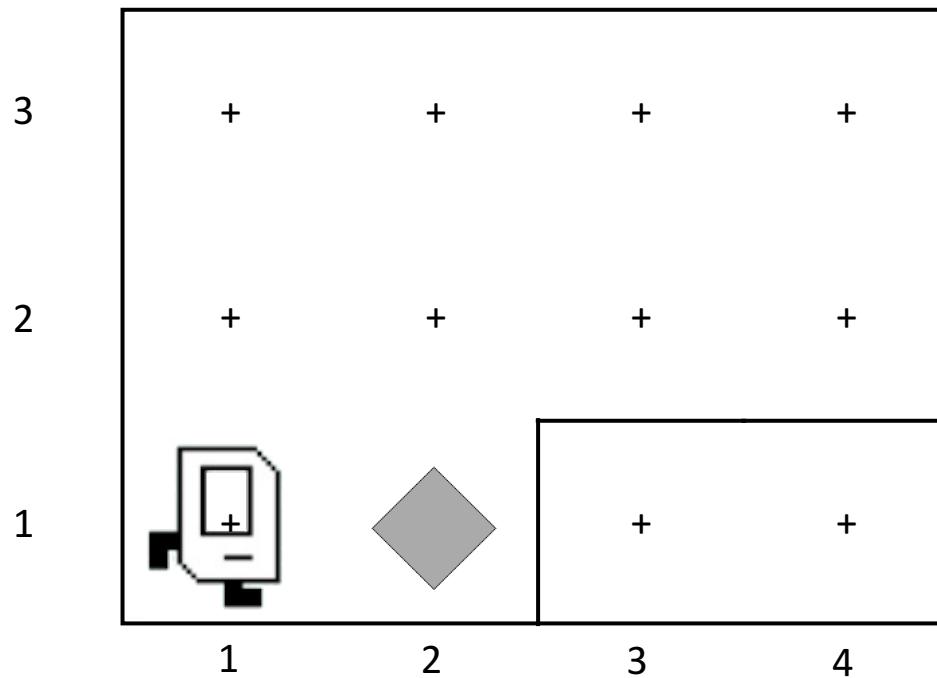
`putBeeper();`

`pickBeeper();`

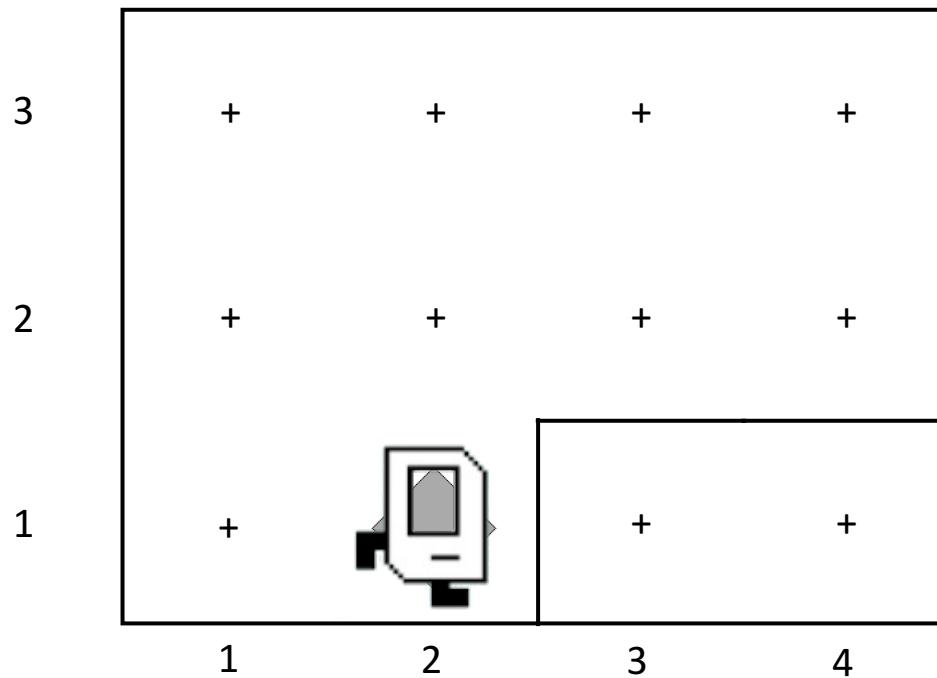


move();

move();

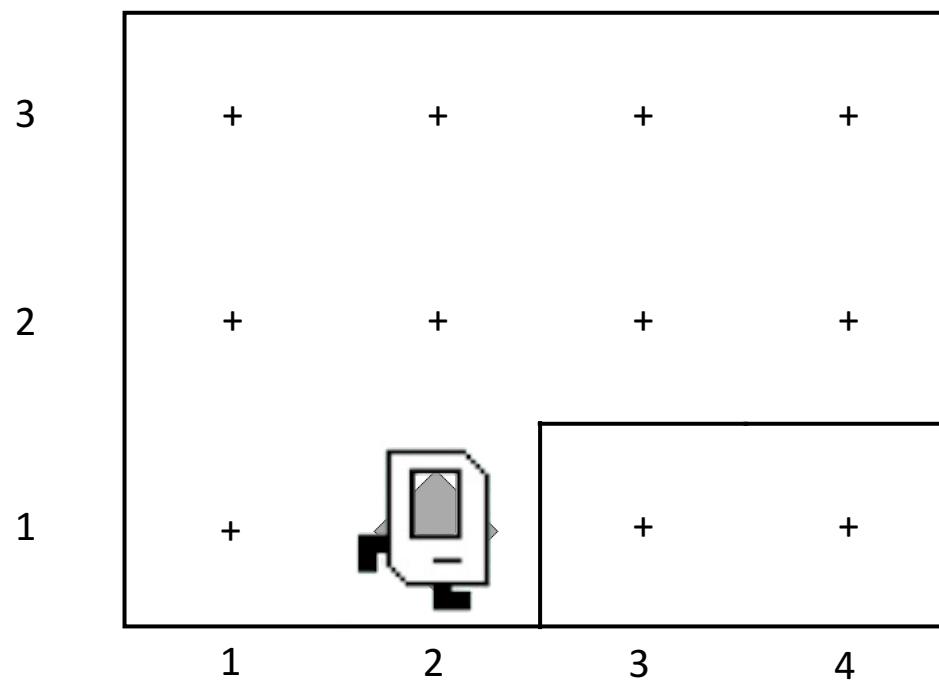


move();

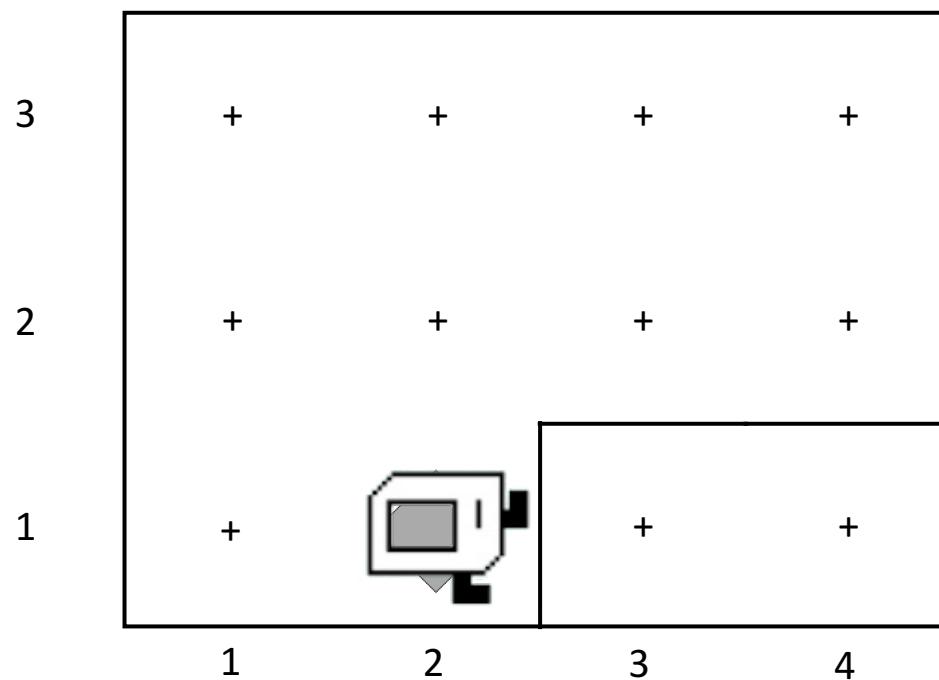


turnLeft();

turnLeft();

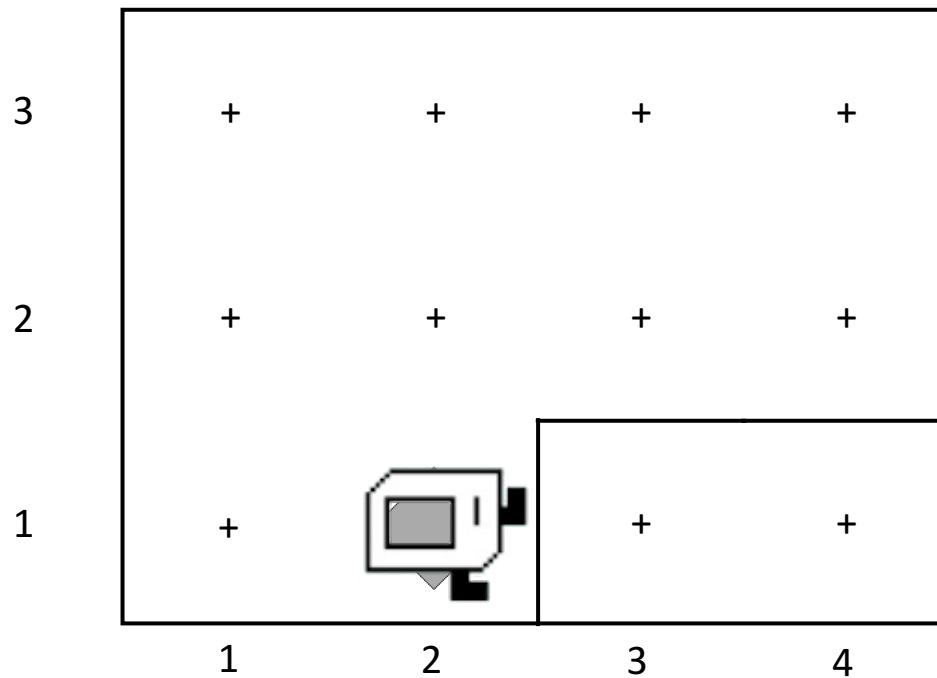


turnLeft();

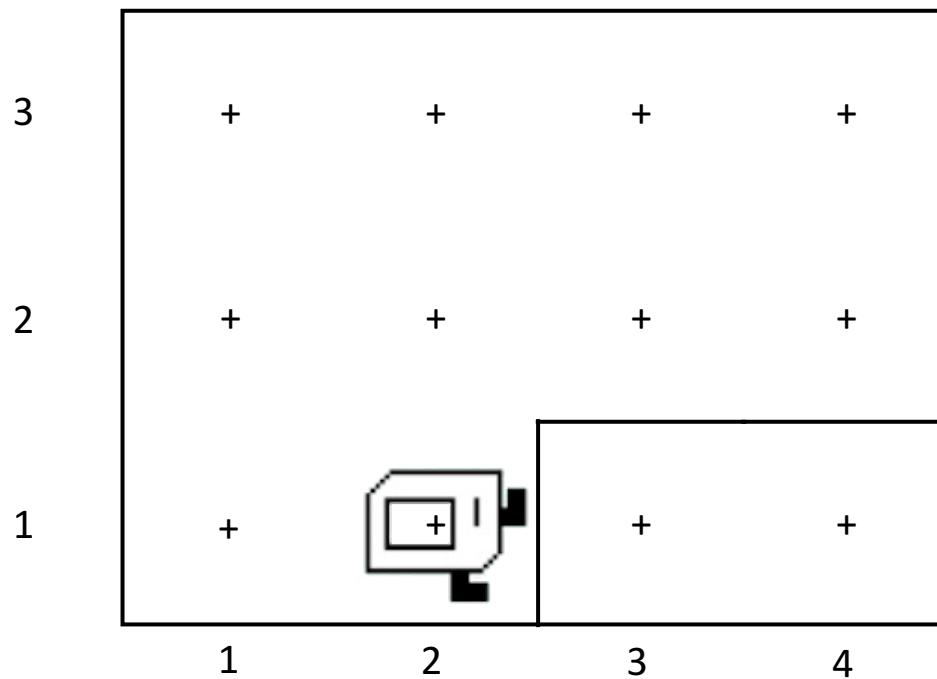


pickBeeper();

pickBeeper();

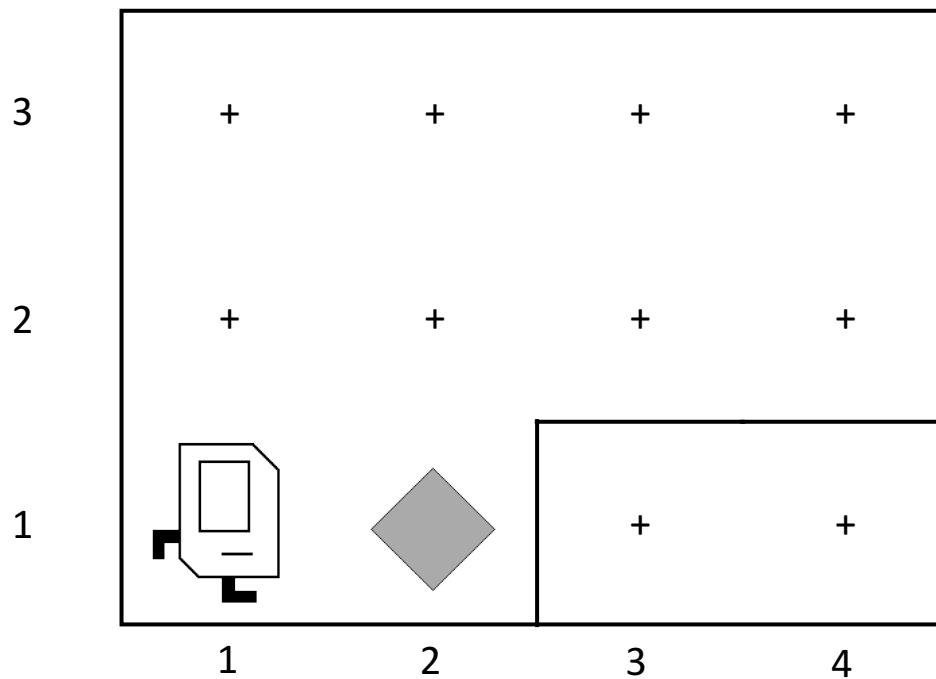


pickBeeper();

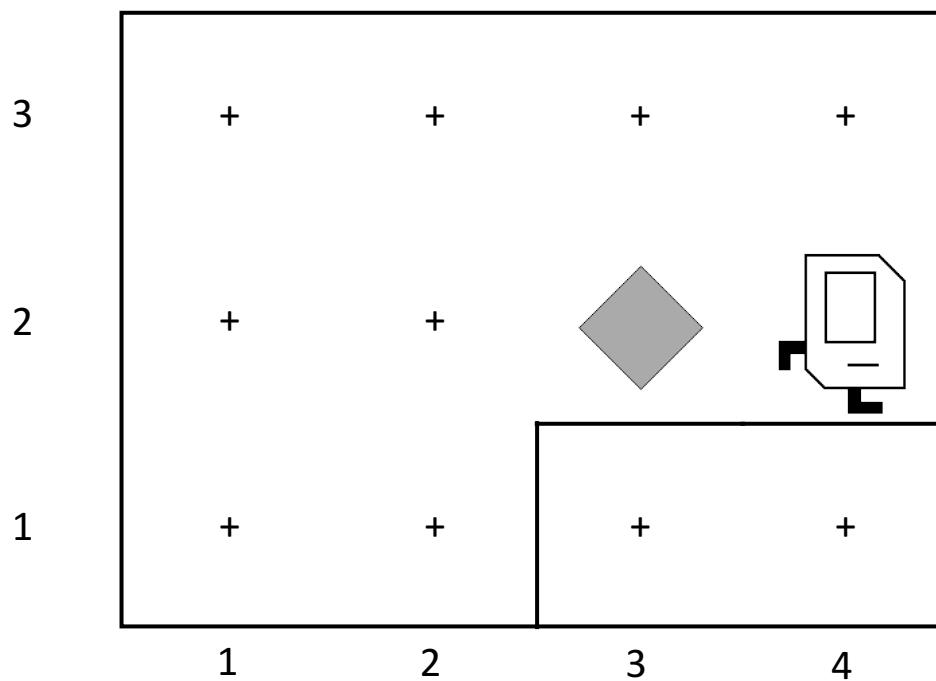


Make Sense?

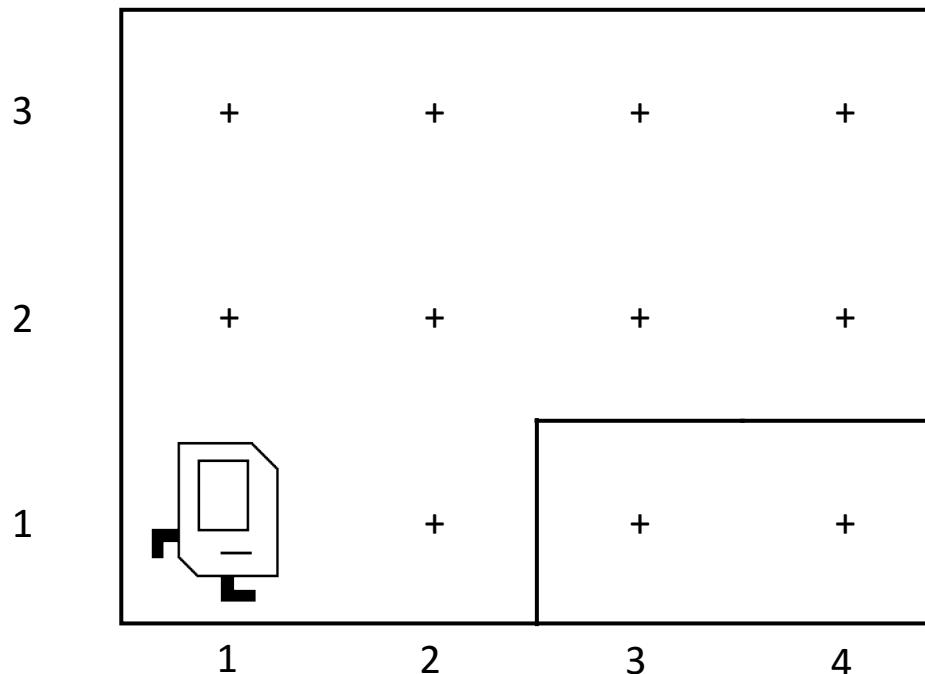
First Challenge



First Challenge



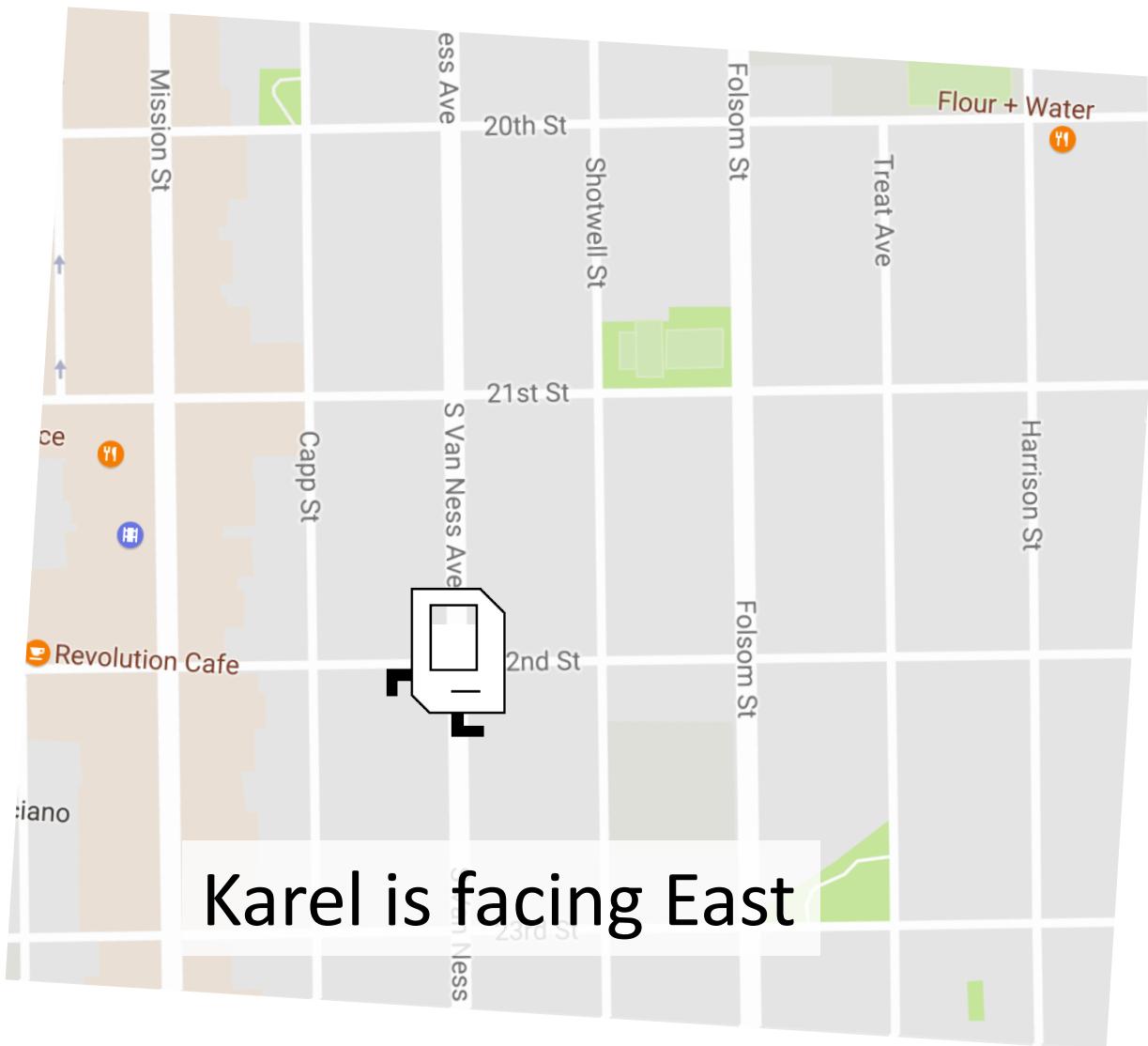
Bird's Eye View



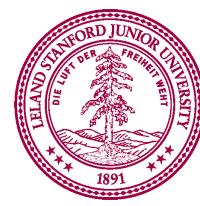
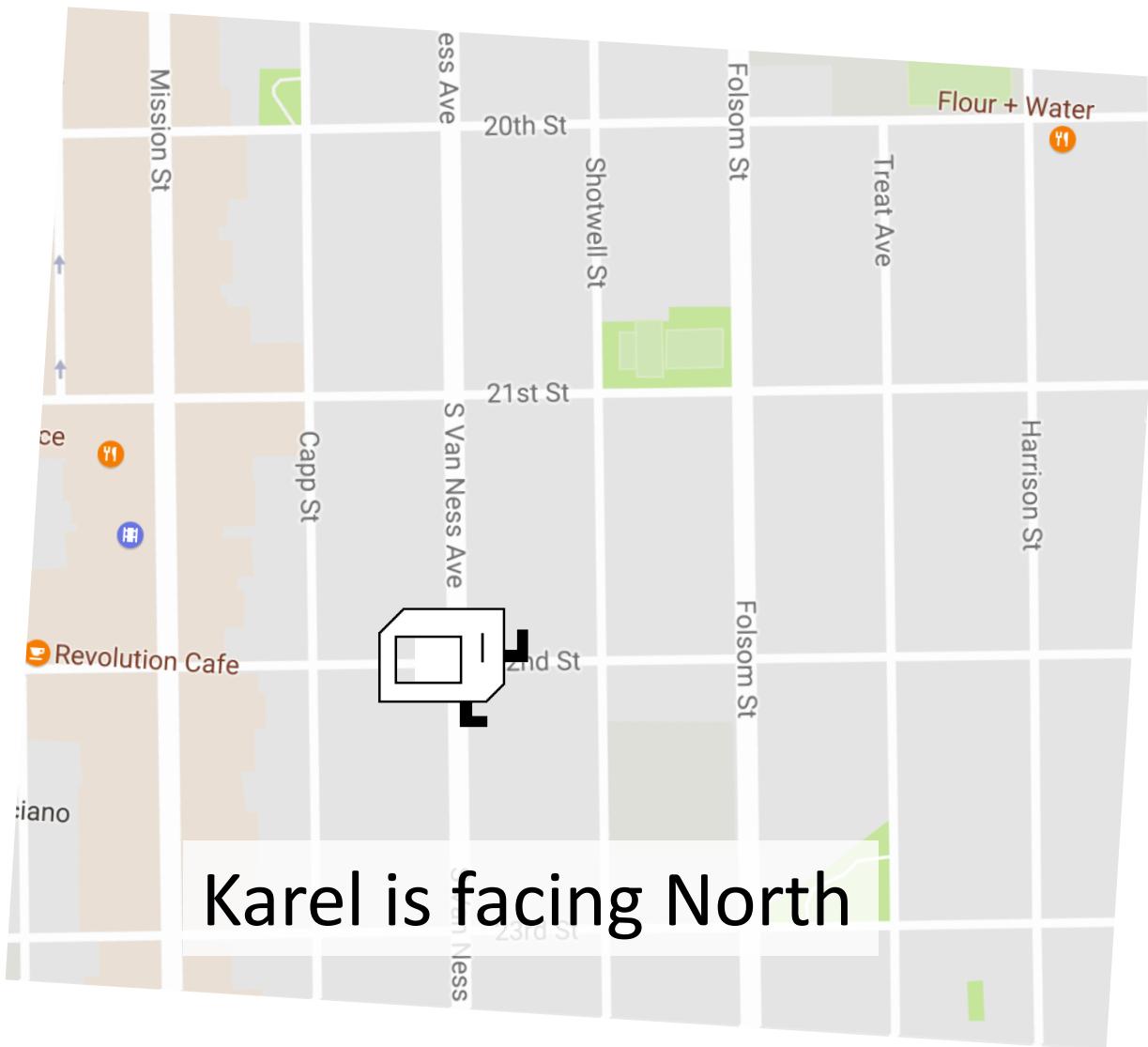
Karel is facing East



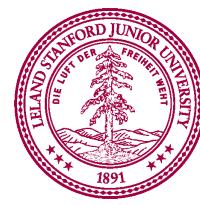
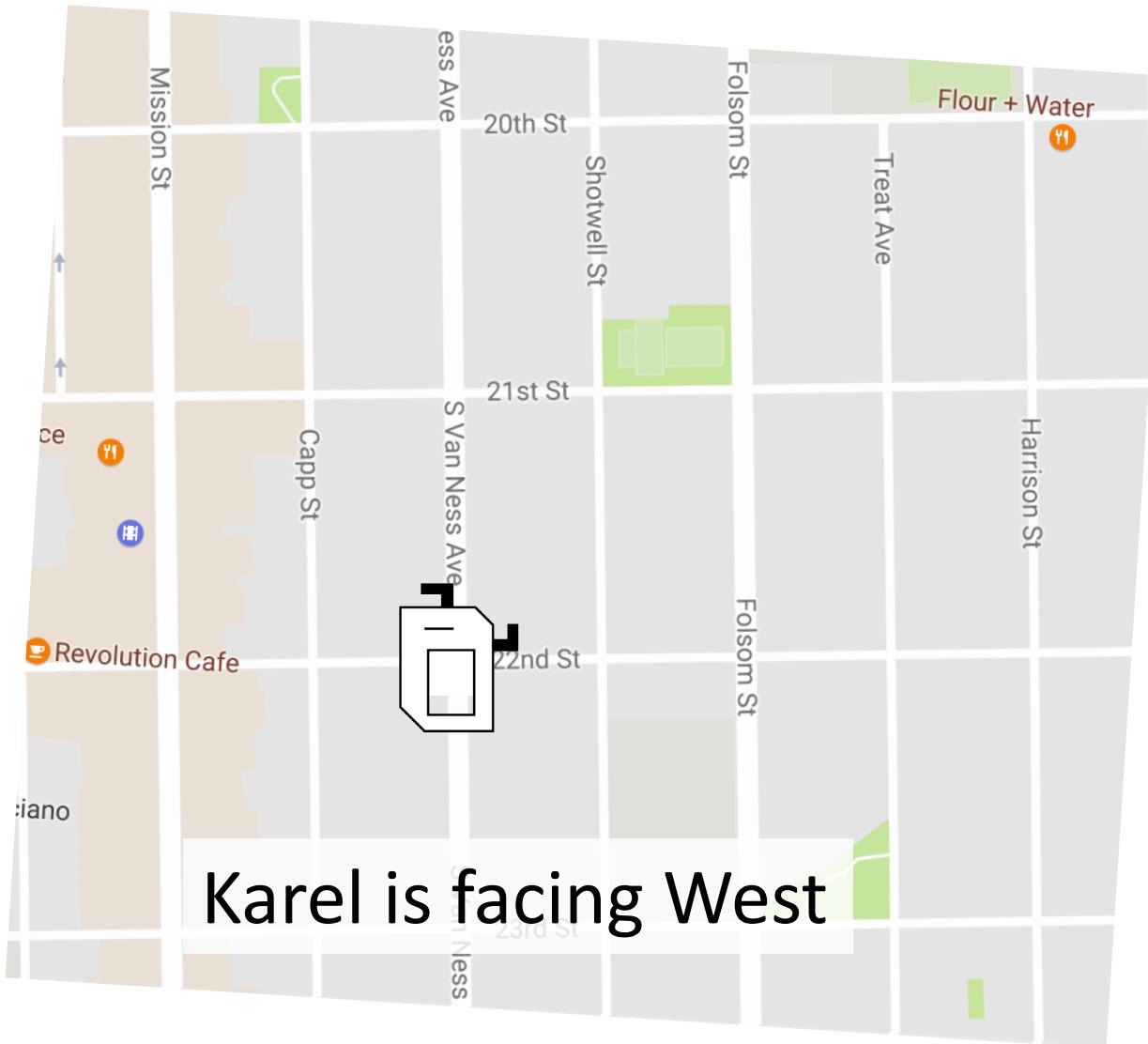
Bird's Eye View



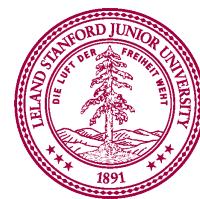
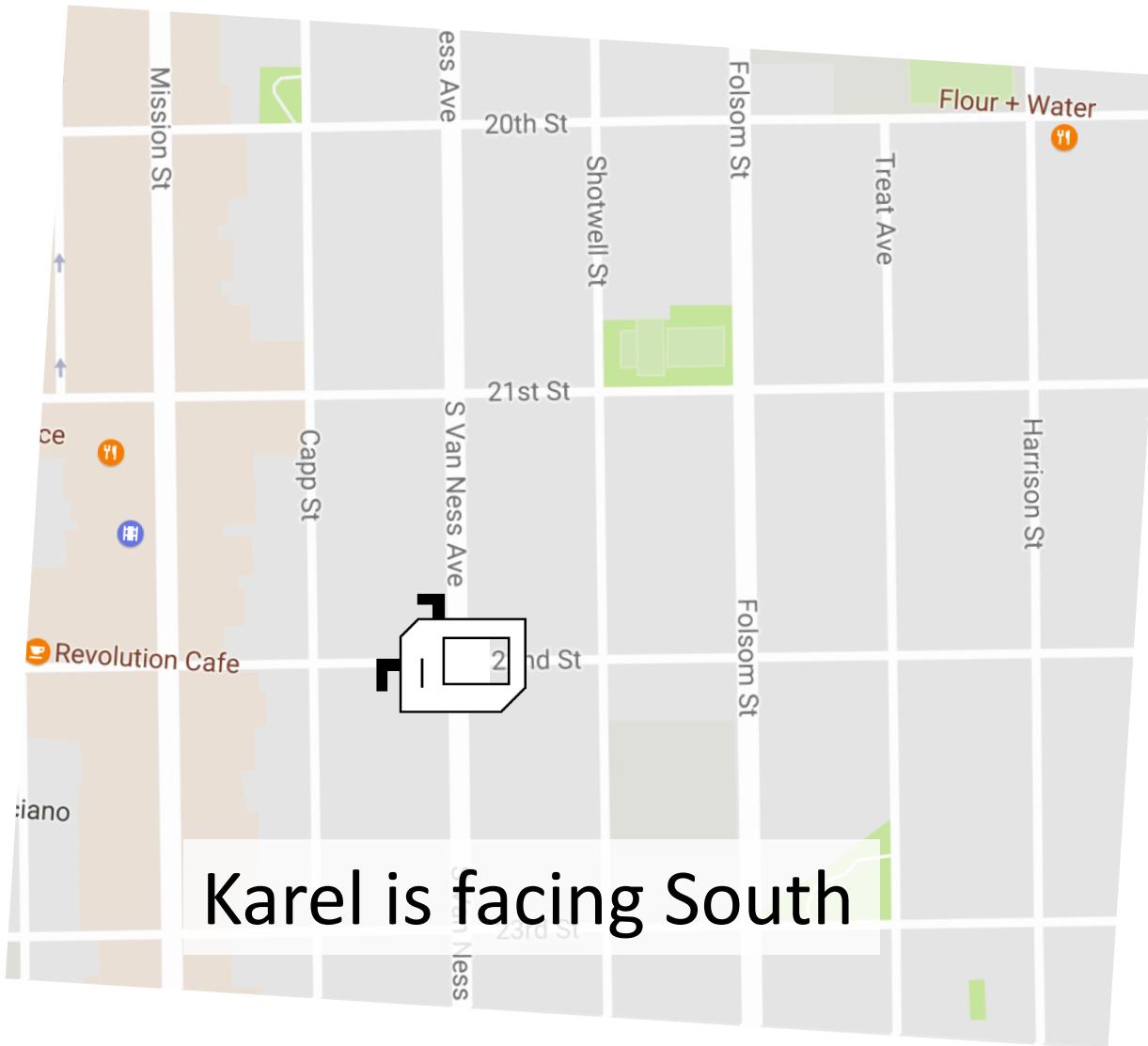
Turn Left



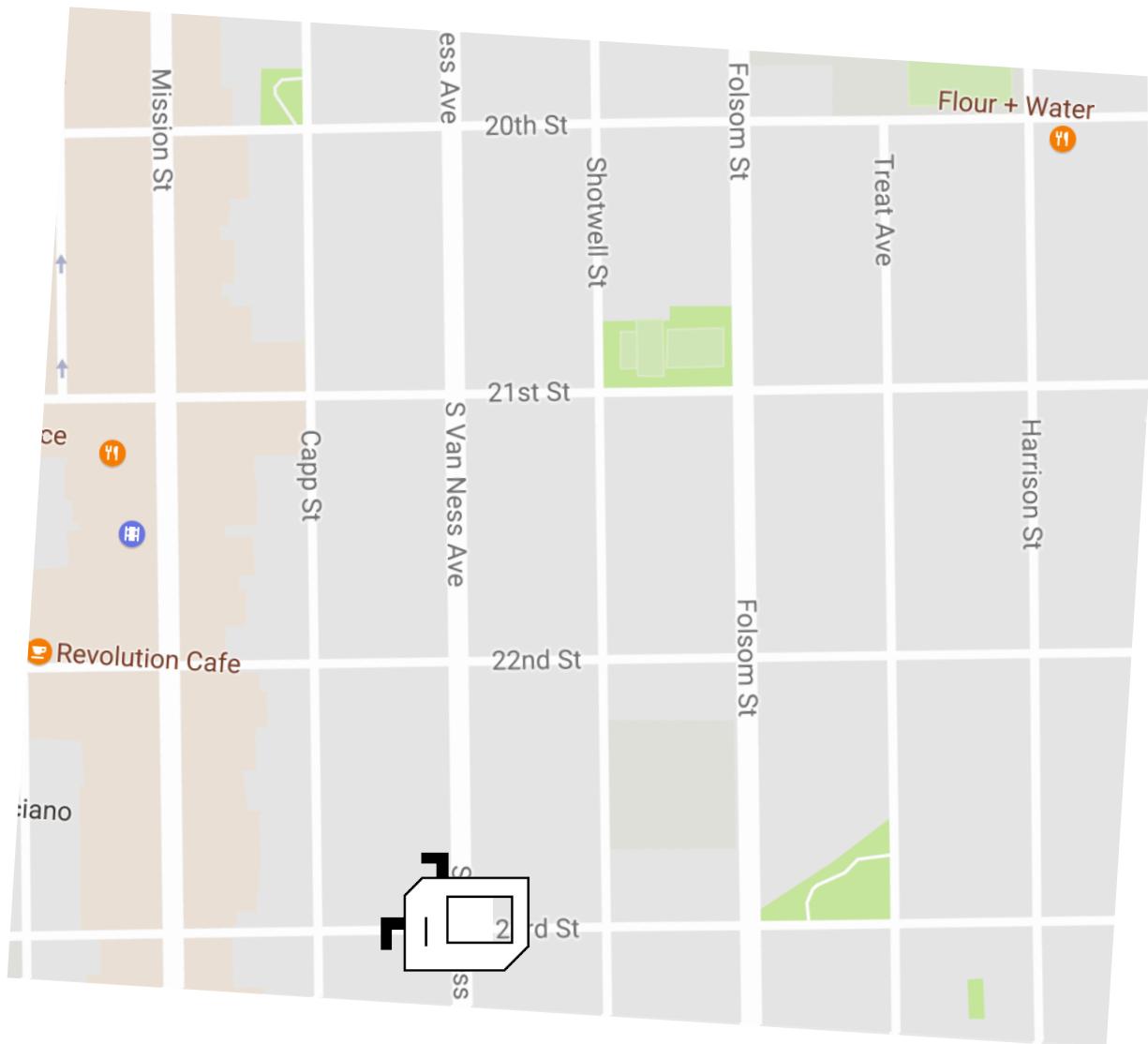
Turn Left



Turn Left



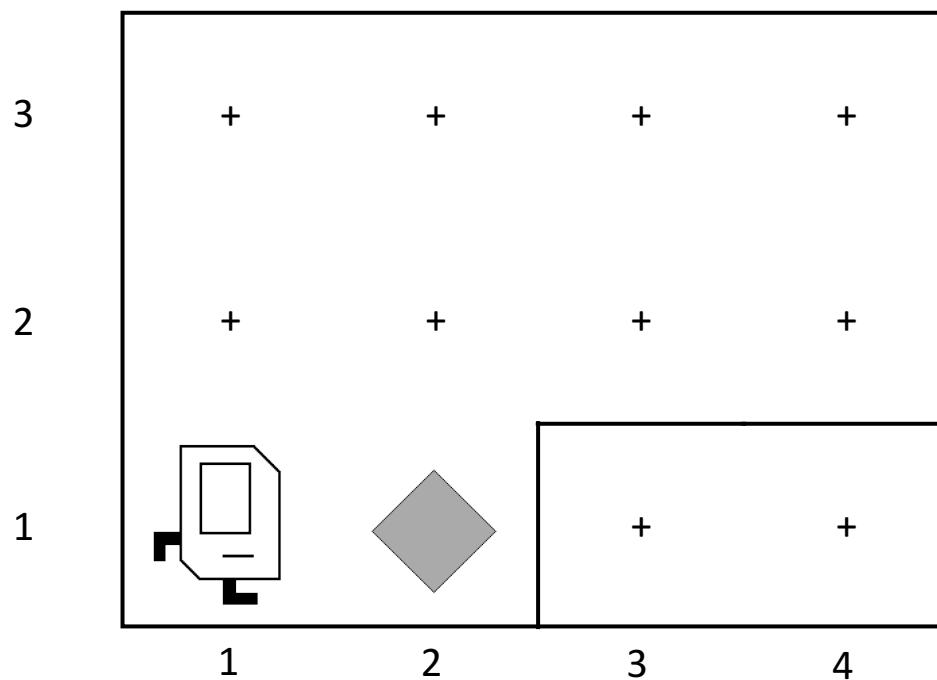
Move



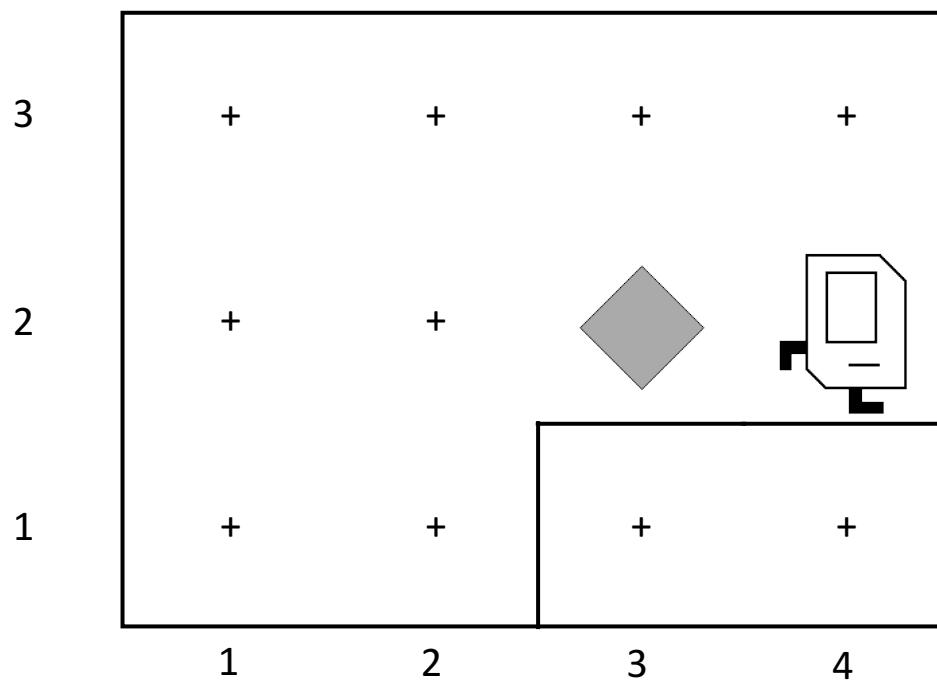
Piech, CS106A, Stanford University



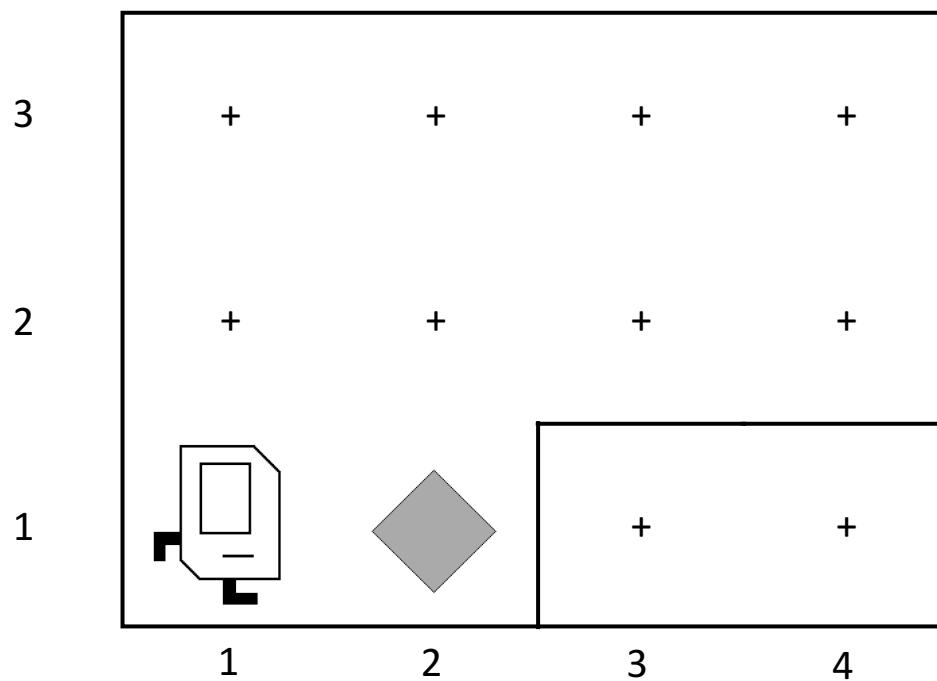
First Challenge



First Challenge



First Challenge



Learn By Doing





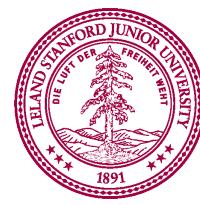
Piech, CS106A, Stanford University



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

}



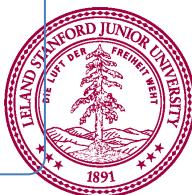
Anatomy of a Program

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

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



Anatomy of a Program

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



Anatomy of a Program

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

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



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();  
    }  
}
```

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



Anatomy of a Program

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

This is called a
code block



Anatomy of a Program

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

This is called a
code block



Anatomy of a Program

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

This is also called a
code block



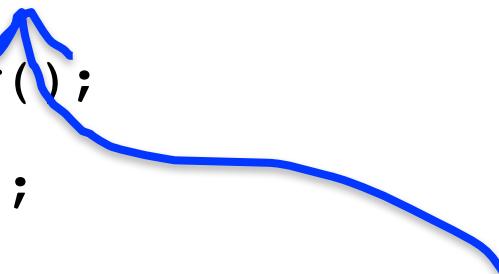
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        turnLeft();  
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    }  
}
```



Anatomy of a Program

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        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();  
        pickBeeper();  
        move();  
        turnLeft();  
        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?

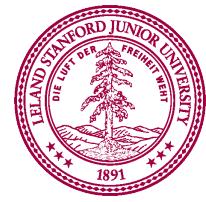
Joy of Building



Interdisciplinary



Piech, CS106A, Stanford University



Closest Thing To Magic

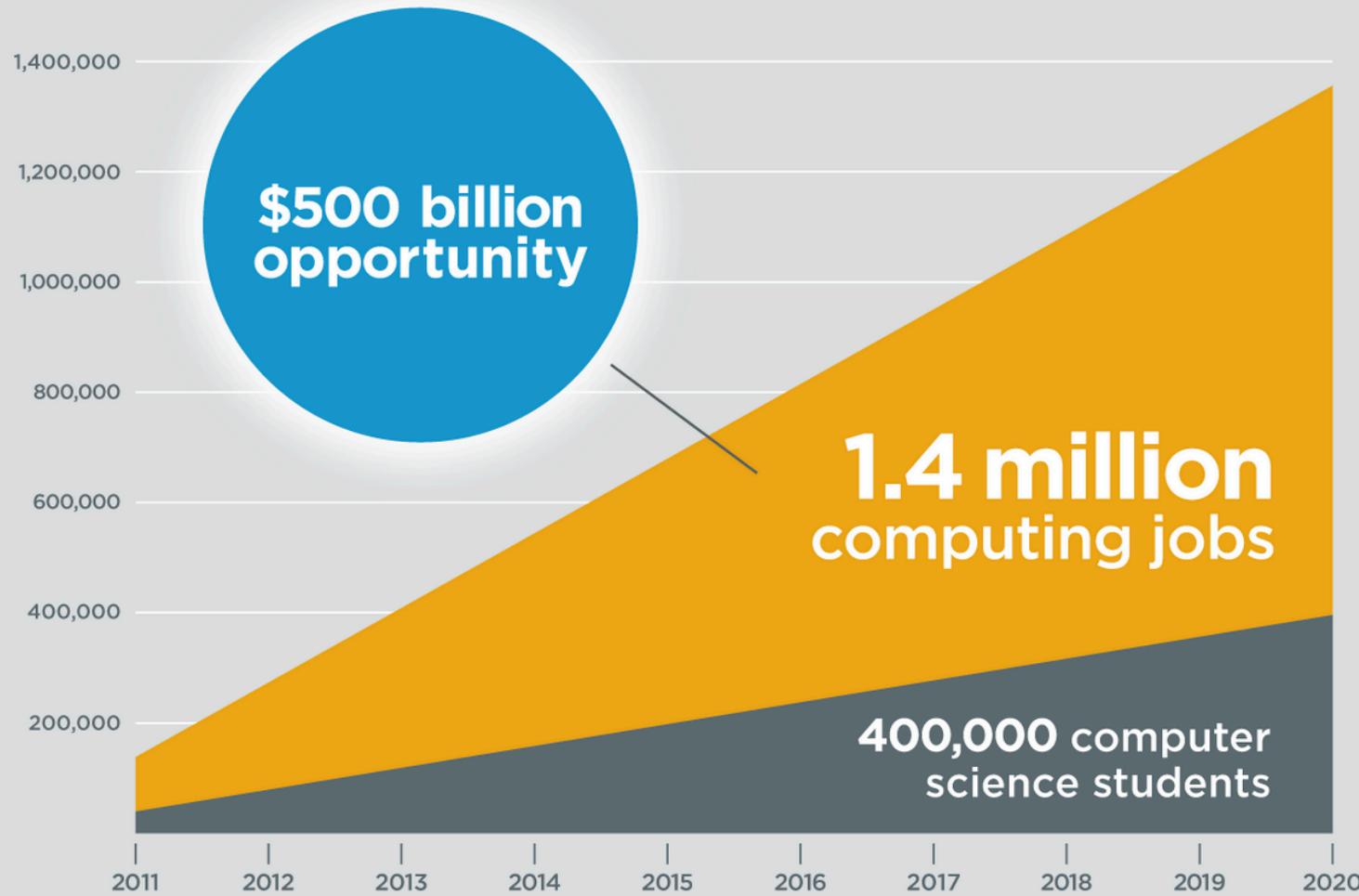


Now is the Time



Oh and Its Useful

1,000,000 more jobs than students by 2020



Everyone is Welcome



The End



The End?