Announcements

- Assignment 6 due Tuesday at 10AM
  - No late days may be used

- No section next week, but still Office Hours & LaIR

- Final Exam
  - next Saturday, August 17th 8:30-11:30AM
  - Monday & Tuesday lectures: Final Review

- Blank code for today is on the website!
Plan for Today

- Next Classes & Resources
- Programming Languages
- Automation
- Machine Learning & NLP
Next Classes at Stanford

CS106A → CS106B → CS109 + CS103 → Further Study
Next Classes at Stanford

CS106A → CS106B → CS109 + CS103

Further Study
Computational Biology
Next Classes at Stanford

CS106A → CS106B

CS109 + CS103

Further Study

The Internet
Next Classes at Stanford

CS106A → CS106B

CS109 + CS103

Further Study

ML / AI
Next Classes at Stanford

- CS106A → CS106B
- CS109 + CS103

Further Study

Data science
Next Classes at Stanford

CS106A → CS106B

CS109 + CS103 → Human-Computer Interaction

Further Study
Next Classes at Stanford

CS106A → CS106B

CS109 + CS103

Further Study

And More!
All of the following non-Stanford resources and recommendations are personal recommendations of the instructors and do not necessarily represent the opinions of Stanford University.
Non-Stanford Resources

A Few Free Online Programming Classes:

- Codecademy
- Khan Academy: Computing Lessons

A Few Free Coding Challenge Websites:

- CodeStepByStep
- edabit
- Project Euler problems

*And even more... explore on your own and see what you find!*
Programming Languages

Java

C# D

Erlang Scala F# ML

COBOL Assembly Scratch

JavaScript

ABAP Visual Basic Transact-SQL Clarion

OpenEdge ABL

FoxPro

Perl Logo Prolog

PostScript

C++ ColdFusion Forth

PL/SQL Ada

Lua Io Yacc

C ActionScript MATLAB

Delphi PL/I

Objective-C

Scheme Ruby Python

Haskell Go Fortran

Mathematica

Max/MS Pacman

Dart SAS Tic Tac Toe

Tcl Lisp

Groovy

Swift
How standards proliferate:

(See: A/C chargers, character encodings, instant messaging, etc)

**Situation:**
There are 14 competing standards.

14?! Ridiculous! We need to develop one universal standard that covers everyone’s use cases.

Yeah!

**Soon:**

**Situation:**
There are 15 competing standards.
ArrayList<Double> evens = new ArrayList<>();
for(int i = 0; i < 100; i++) {
    if(i % 2 == 0) {
        evens.add(i);
    }
}
println(evens);

Prints [0, 2, 4, 6, 8, 10, 12, ...]
Vector evens;
for(int i = 0; i < 100; i++) {
    if(i % 2 == 0) {
        evens.add(i);
    }
}
cout << evens << endl;

Prints [0, 2, 4, 6, 8, 10, 12, ...]
evens = []
for i in range(100):
    if i % 2 == 0:
        evens.append(i)

print(evens)

Prints [0, 2, 4, 6, 8, 10, 12, ...]
```javascript
var evens = []
for(var i = 0; i < 100; i++) {
  if(i % 2 == 0) {
    evens.push(i)
  }
}
console.log(evens)
```

Prints [0, 2, 4, 6, 8, 10, 12, ...]
What Else is Out There?

We wanted to show you some other super cool examples of what code can do!

Sounds like fun!
Many things are automated as to minimize the need for human intervention!

Can automation help a customer?

Can automation clean your room?

Can automation open and edit files on your computer?
Demo
import pyautogui

# Enables failsafe
pyautogui.PAUSE = 1
pyautogui.FAILSAFE = True

pyautogui.click()

# Use spotlight to open Chrome
pyautogui.hotkey('command', ' ')  
pyautogui.typewrite('Hello World!', interval=0.1)
PyAutoGui is a python library that allows you to automate different computer actions!

Using a few lines of code, you can automate clicks, typing, keyboard shortcuts, and more!

Installation Instructions here

“Cheat Sheet” here
What Else Do We Automate?
What is Machine Learning?
The art & science of developing intelligent agents.
The art & science of developing intelligent agents.

Better than chance
The art & science of developing intelligent agents.

Better than chance

And better than humans
The art & science of developing intelligent agents.
Milestones & Applications


Artificial Intelligence

Machine Learning

Deep Learning
Artificial Intelligence

Machine Learning

Deep Learning
Techniques which enable computers to mimic human behavior

→ Deep Blue chess computer
Artificial Intelligence

Machine Learning

Deep Learning

Techniques which enable computers to mimic human behavior
→ Deep Blue chess computer

Subset of AI techniques which uses statistical methods to enable machines to learn with experience
→ Email spam filter
Artificial Intelligence

- Techniques which enable computers to mimic human behavior
  → Deep Blue chess computer

Machine Learning

- Subset of AI techniques which uses statistical methods to enable machines to learn with experience
  → Email spam filter

Deep Learning

- Subset of ML that uses deep neural networks that learn from large amounts of data
  → Alpha Go
Why Not ML and AI ALL the Time?

Sounds good to me... <3
Why Not ML and AI ALL the Time?

Google Photos, y'all up. My friend's not a gorilla.

Skyscrapers  Airplanes  Cars
Bikes  Gorillas  Graduation

Oh... :((
Amazon scraps secret AI recruiting tool that showed bias against women

SAN FRANCISCO (Reuters) - Amazon.com Inc’s (AMZN.O) machine-learning specialists uncovered a big problem: their new recruiting engine did not like women.
Man is to Computer Programmer as Woman is to Homemaker? Debiasing Word Embeddings

Microsoft is deleting its AI chatbot's incredibly racist tweets
What does this mean?
What does this mean?

These are great tools, but “with great power comes great responsibility”.

It’s important to be able to think critically about these technologies, especially if you’re developing them!
**Natural Language Processing** (NLP) is a large branch of Artificial Intelligence.

Helps computers understand, interpret, and manipulate human language.
NLP

Recommendation Systems  Question Answering  Translation

Text Generation  Sentiment Analysis  Digital Assistants
Chatbot Demo
import java.util.Scanner;
import java.util.regex.*;

public class TalkToMe{
    public static void main(String[] args) {
        // String to be scanned to find the pattern.
        String nameString = "[Mm]y name is ([a-zA-Z]+).?";
        Scanner console = new Scanner(System.in);

        System.out.println("Talk to me!");
        String line = console.nextLine();
        while(!line.equals("")) {

            // Create a Pattern object
            Pattern namePattern = Pattern.compile(nameString);

            // Now create matcher object to detect matches
            Matcher nameMatches = namePattern.matcher(line);
            if (nameMatches.find()) {
                // .group(1) gives you the found name
                String name = nameMatches.group(1);
                System.out.println("Hello " + name);
            } else {
                System.out.println("Hmmm... okay.");
            }

            System.out.println("Talk to me!");
            line = console.nextLine();
        }

        console.close();
    }
}
Want to Learn More about Regexs?

Here's a website with lessons and challenges to create more complex regular expressions!

RegexOne: Challenges and Lessons
A Fun Machine Learning Example

Teachable Machine

Can we use Machine Learning to teach a computer the moves in Rock Paper Scissors?

https://teachablemachine.withgoogle.com/
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See you next week for the Review Lectures!