

An abstract graphic on the left side of the slide, featuring a sphere-like shape composed of a dense grid of intersecting red, green, and blue lines. The lines are curved and follow the contour of the sphere, creating a complex, woven pattern. The sphere is set against a dark gray background.

# 15-181 Demystifying AI

## Overview & Intelligence

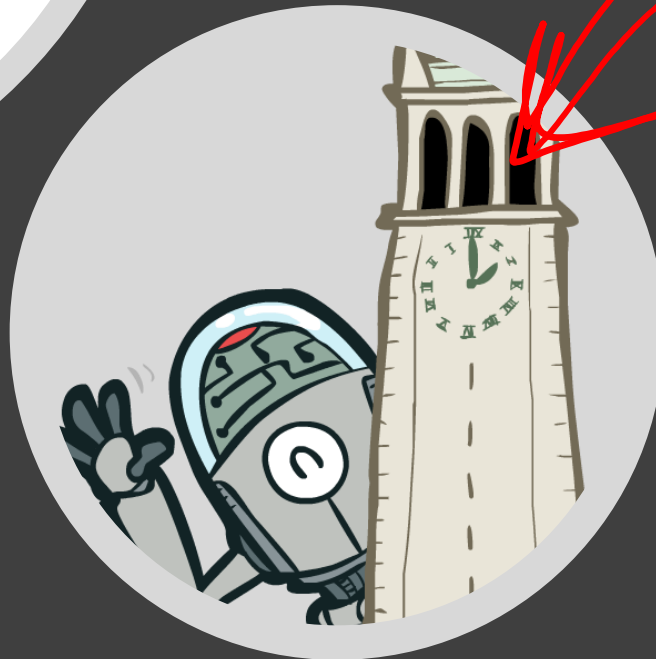
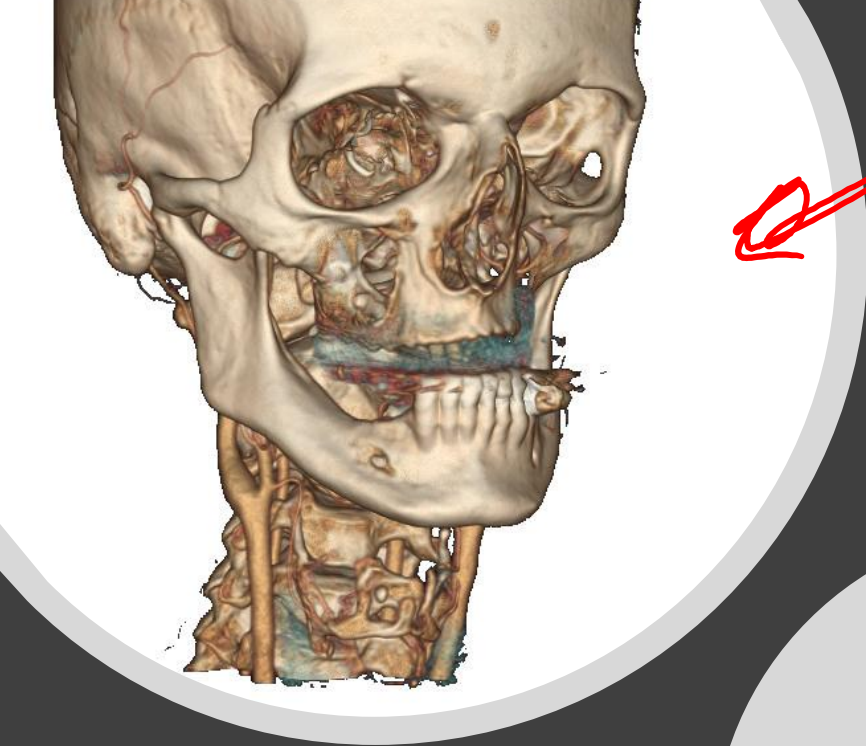
Instructor: Pat Virtue

# Warm-up as we get started

Candy Grab game!

## Shared Drive Folder/Lec1

[https://drive.google.com/drive/folders/1JXonj8iPWRXngauDaR6vRUYbjm79aYo ?usp=sharing](https://drive.google.com/drive/folders/1JXonj8iPWRXngauDaR6vRUYbjm79aYo?usp=sharing)



Instructor  
Pat Virtue

CS and ML Departments  
Teaching Professor

# Plan

Course Info (part 1)

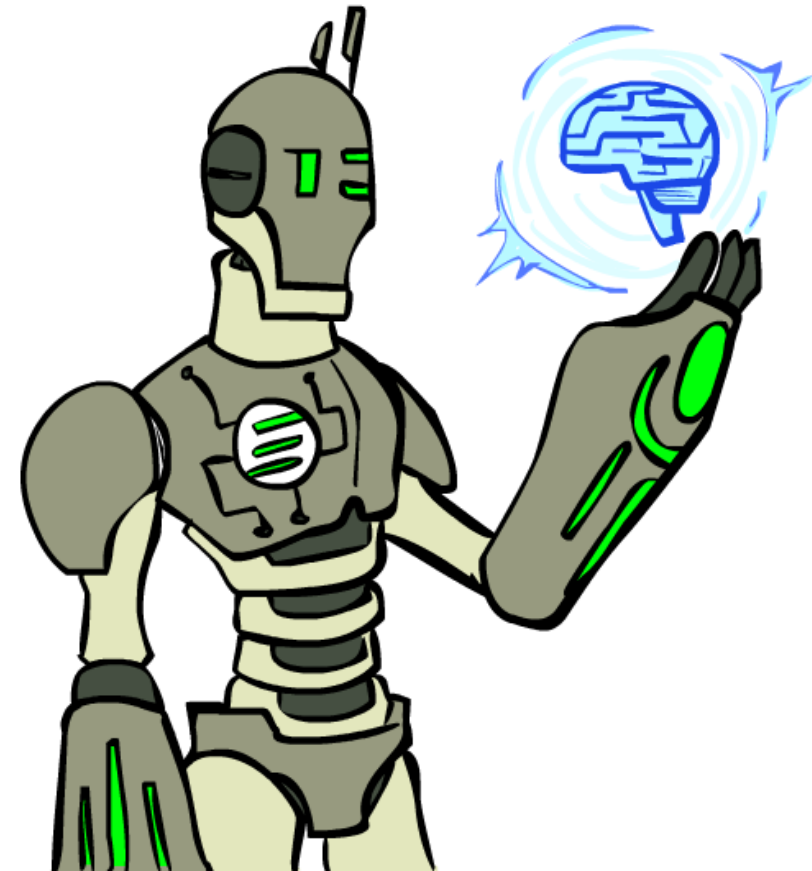
Candy Grab 

Discussion on Intelligence

AI focus in this course

- Weak AI
- “Scholarly” AI
- Agents that act rationally

Course Info (part 2)



# Demystifying AI

## Pilot Course!

### Explaining AI

- What it is
- What it can do
- How to use it
- How it works
- What can go wrong

### Prereqs

- 15-110
- (High school algebra)

# Quick Logistics

Slides will be available

## Asking questions in main room

- Use the hand-raise icon
- Prof. can't really see the chat

## Asking questions in breakout room

- Press request help button
- Pop back into main room

# Quick Logistics

## Breakout rooms

- Cameras on
- Unmuted
- Introduce yourself if you haven't met
  - At least just a quick, "Hi, I'm Pat"
- One person share screen



# Warm-up as we get started

Candy Grab game!

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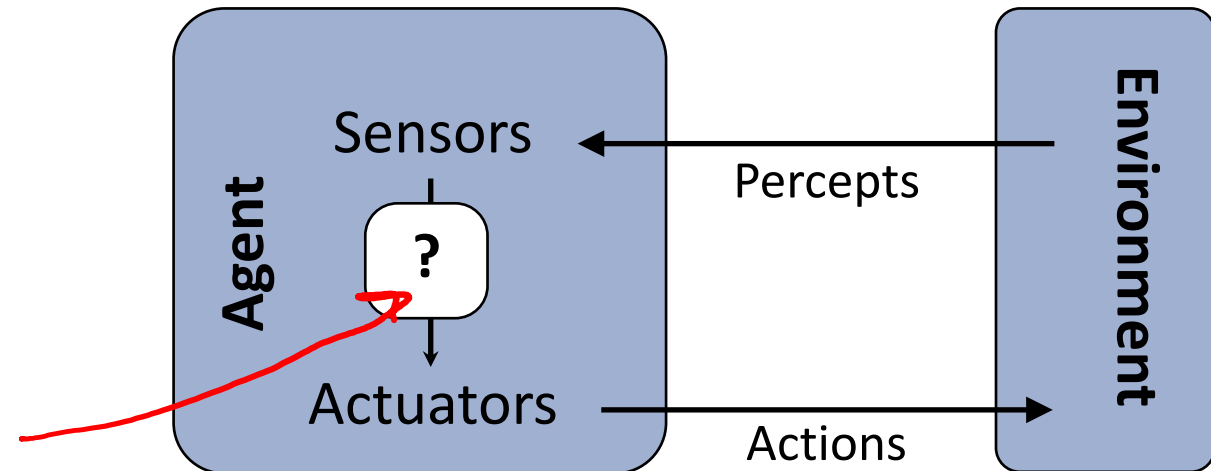
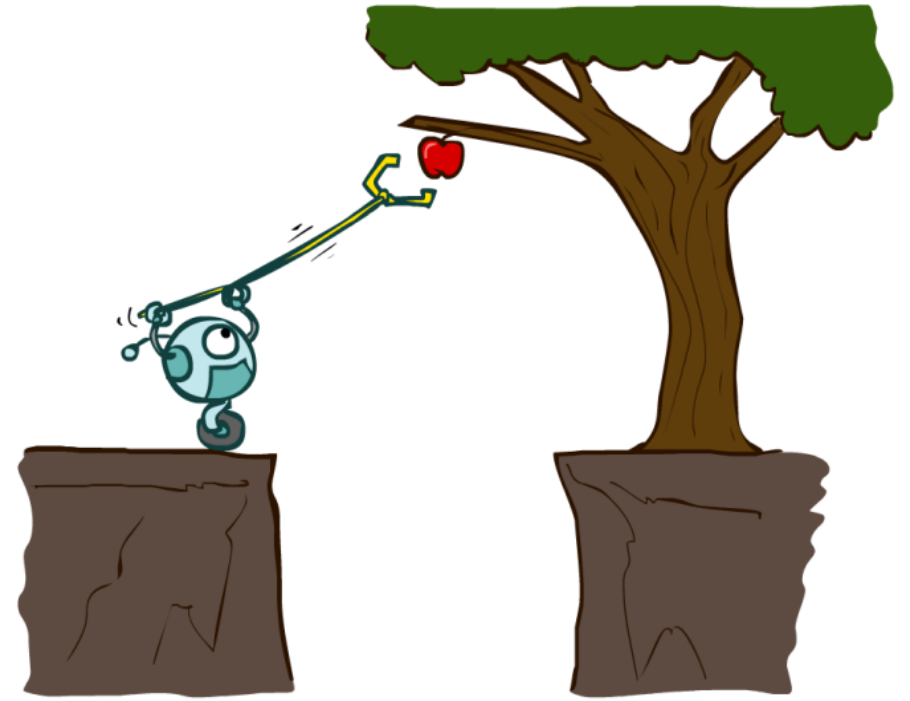


# Designing Agents

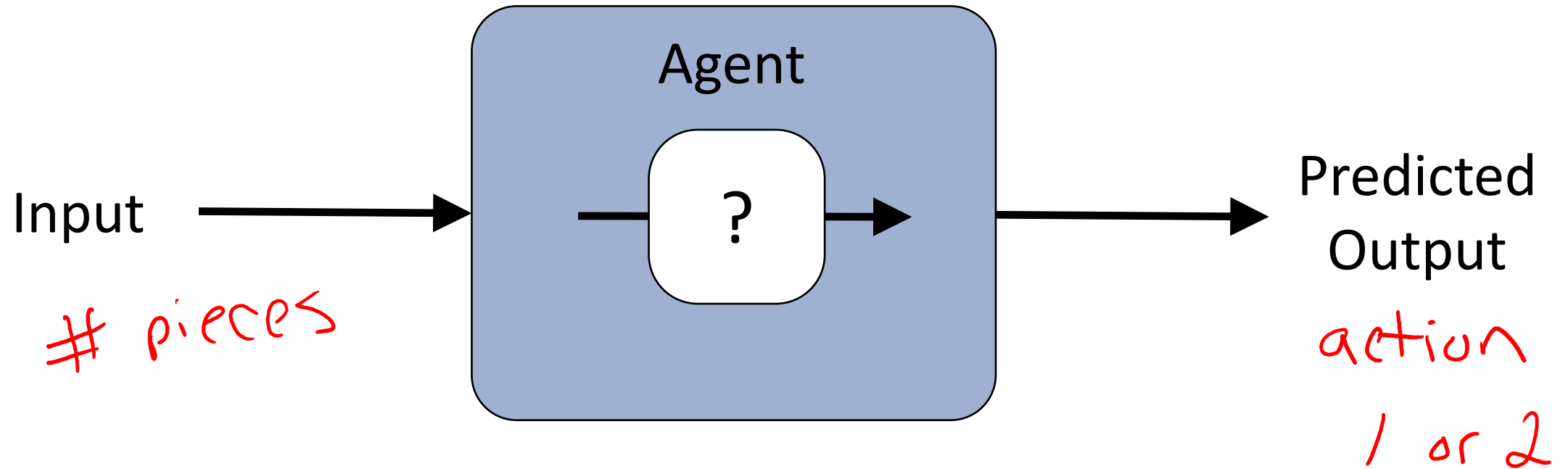
An **agent** is an entity that *perceives* and *acts*.

Actions can have an effect on the *environment*.

The specific *sensors* and *actuators* affect what the agent is capable of *perceiving* and what *actions* it is capable of taking



# Agent Model: Simple Input/Output Version

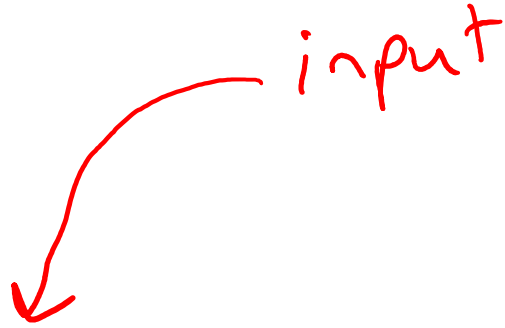


# Nim Agent

```
class Agent
```

```
    function getAction(state)
```

```
        return action
```



# Nim Agent

Agent 001 – Always choose 1

```
function getAction(  
      
    return 1
```

# Nim Agent

## Agent 002 – Always choose 2

```
function getAction( numPiecesAvailable )  
  
    return 2
```

# Nim Agent

Agent 004 – Choose the opposite of opponent



```
function getAction( numPiecesAvailable )  
  
    return ?
```

# Nim Agent

Agent 007 – Whatever you think is best

```
function getAction( numPiecesAvailable )  
  
    return ?
```



# Nim Agent

Agent 007 – Whatever you think is best

$num / 3$   
→ rem

```
function getAction( numPiecesAvailable )  
  
    remainder = numPiecesAvailable % 3  
    if remainder == 2  
        return 2  
    else  
        return 1
```

## Poll 1

### Games – Three “Intelligent” Agents

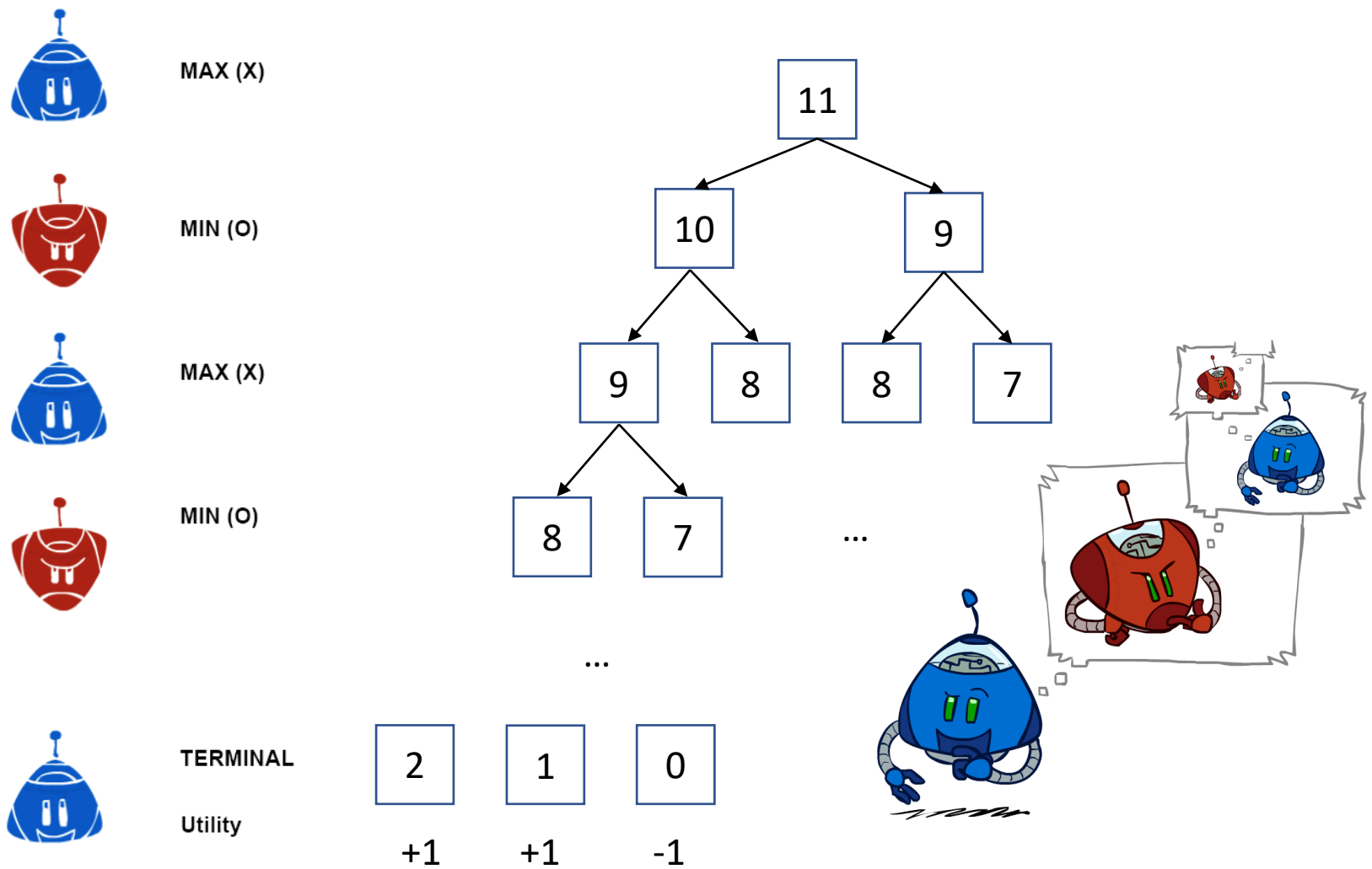
Which agent code is the most “intelligent”?

# Games – Three “Intelligent” Agents

A: Search / Recursion

# Games – Three “Intelligent” Agents

## A: Search / Recursion



# Games – Three “Intelligent” Agents

## B: Encode the pattern

```
function getAction( numPiecesAvailable )  
  
    if numPiecesAvailable % 3 == 2  
        return 2  
    else  
        return 1
```

10's	value:Win
9's	value:Lose
8's	value:Win
7's	value:Win
6's	value:Lose
5's	value:Win
4's	value:Win
3's	value:Lose
2's	value:Win
1's	value:Win
0's	value:Lose

# Games – Three “Intelligent” Agents

C: Record statistics of winning positions

Pieces Available	Take 1	Take 2
2	0%	<b>100%</b>
3	2%	0%
4	<b>75%</b>	2%
5	4%	<b>68%</b>
6	5%	6%
7	<b>60%</b>	5%

## Poll 1

### Games – Three “Intelligent” Agents

Which agent code is the most “intelligent”?

- A. Search / Recursion
- B. Encode multiple of 3 pattern
- C. Keep stats on winning positions



# Games – Three “Intelligent” Agents

C: Record statistics of winning positions

Pieces Available	Take 1	Take 2
2	0%	<b>100%</b>
3	2%	0%
4	<b>75%</b>	2%
5	4%	<b>68%</b>
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7	<b>60%</b>	5%

# Plan

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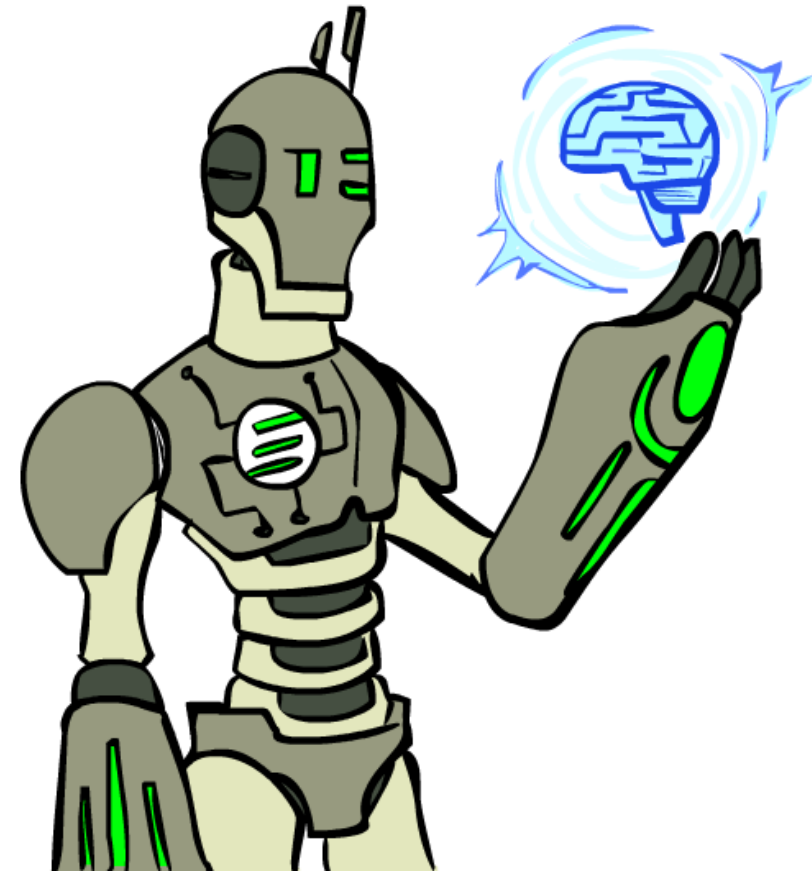
Candy Grab

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- Agents that act rationally

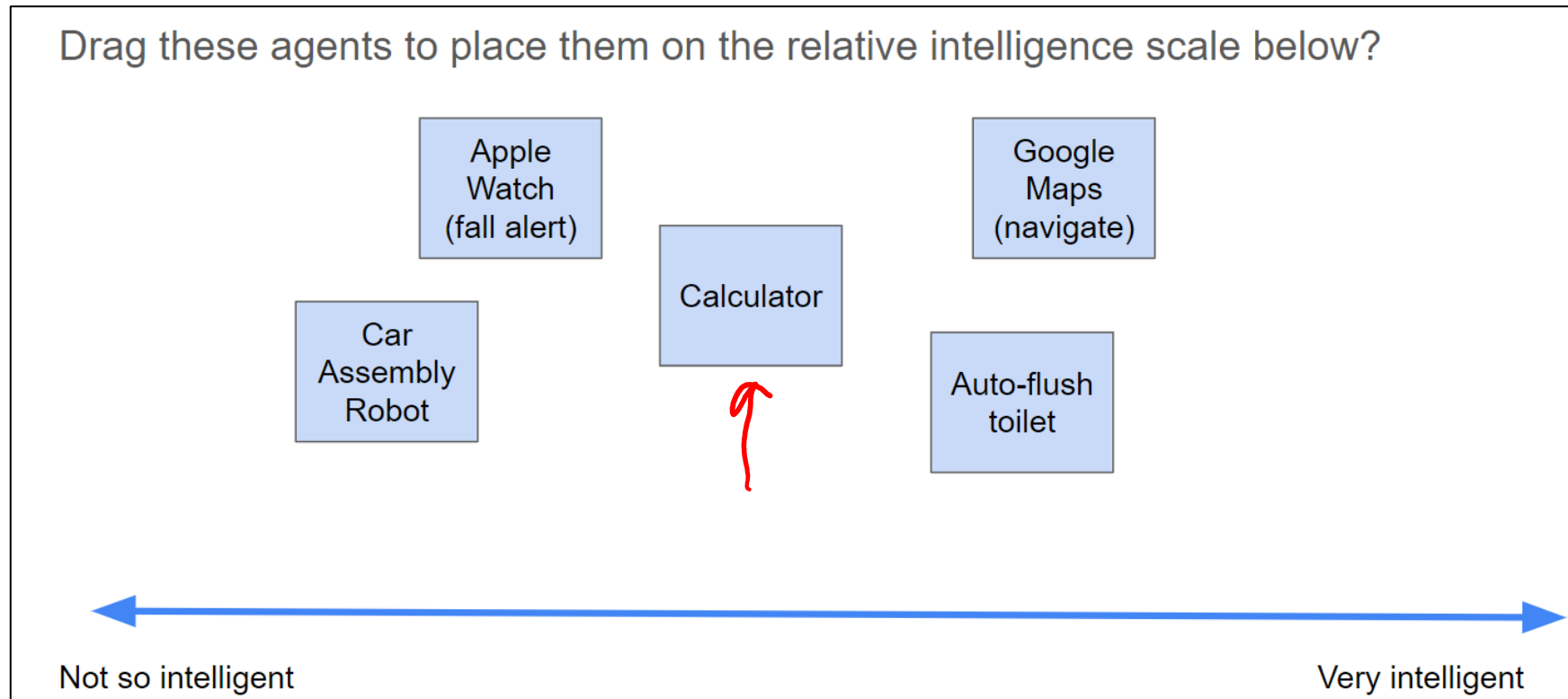
Course Info (part 2)



# How intelligent are these agents?

Shared Drive Folder/Lec1

<https://drive.google.com/drive/folders/1JXonj8iPWRXngauDaR6vRUYbjm79aYo?usp=sharing>



# Attributes of Intelligence

- Adaptability
- Decision making
- Predicting patterns
- Creativity
- Perceive env.
- ~ Actuators

# Intelligence and Uncertainty

Another way to think about intelligence is to consider how much **uncertainty** is involved

Uncertainty comes into play whenever it is not feasible to determine exact information

Uncertainty requires decisions to be made

# Intelligence and Uncertainty

Consider the uncertainty present in the following

- Typing a product ID number into a website  
(book ISBN number into amazon.com)
- Barcode reader scanning a book in a  
well-lit library
- Barcode reader scanning a bag of carrots  
in a grocery store

ISBN 978-0-307-95090-1



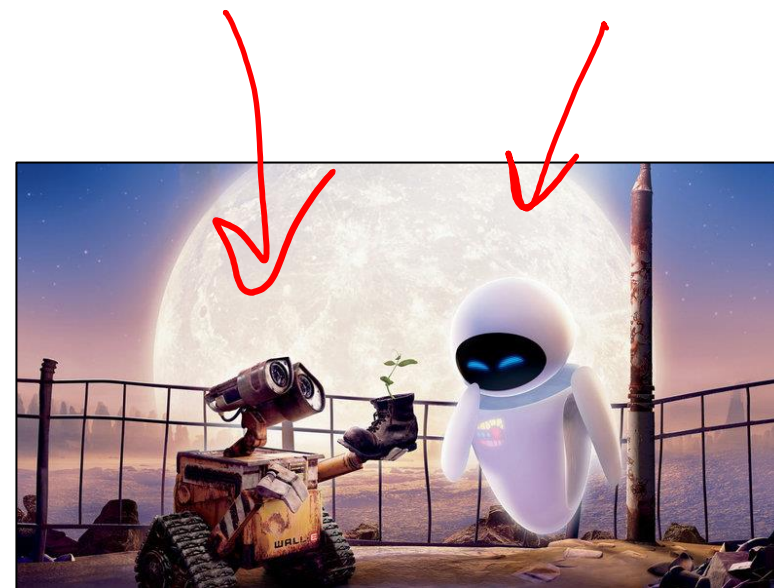
# Intelligence and Uncertainty

Uncertainty can have lots of sources, including anything we attribute to random chance

- Hidden information
  - Cards in another player's hand
- Noise
  - Sensor noise
- Way too complicated to model
  - Leaves blowing in the wind
- Infinite number of possible configurations ←
- More possibilities than any computer can compute in a reasonable time
  - Tic-tac-toe → Checkers → Chess



# Sci-Fi AI?



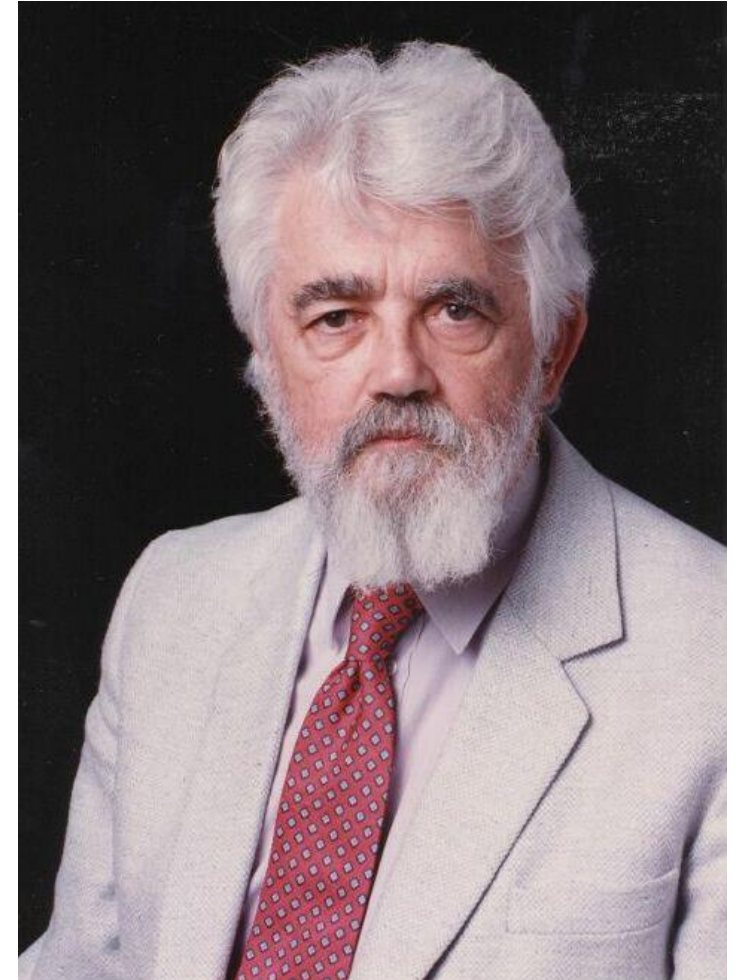
# AI Definition by John McCarthy

## What is artificial intelligence

- It is the science and engineering of making intelligent machines, especially intelligent computer programs

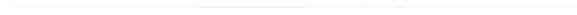
## What is intelligence

- Intelligence is the computational part of the ability to achieve goals in the world



# What is AI?

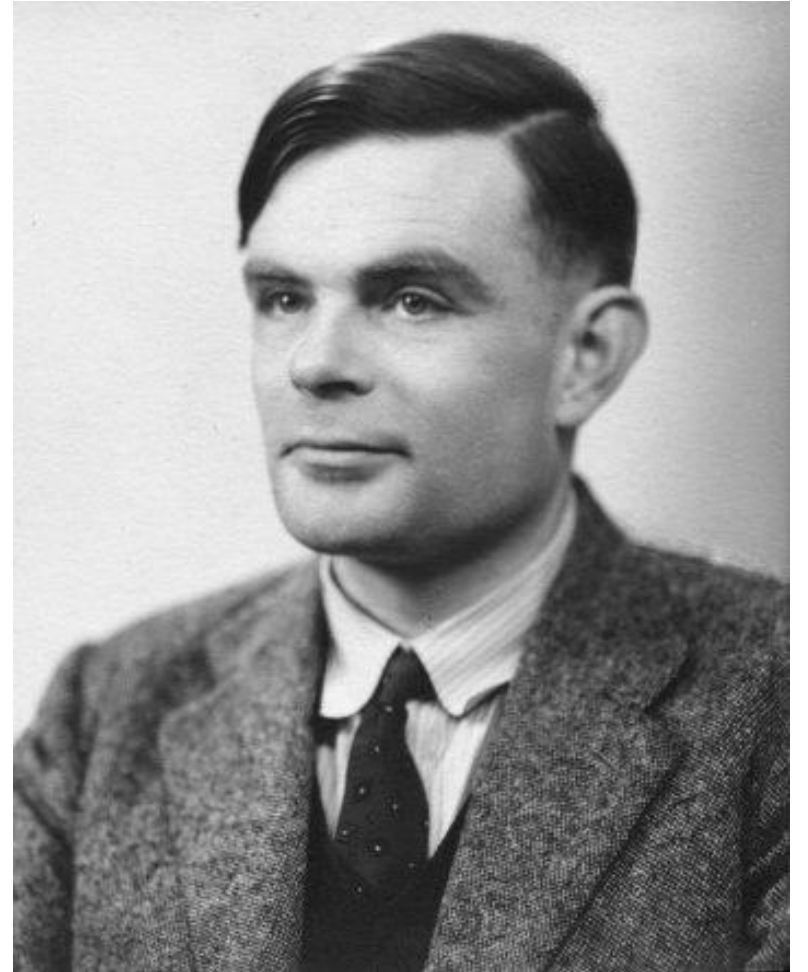
The science of making machines that:



# Turing Test

In 1950, Turing defined a test of whether a machine could “think”

“A human judge engages in a natural language conversation with one human and one machine, each of which tries to appear human. If judge can’t tell, machine passes the Turing test”

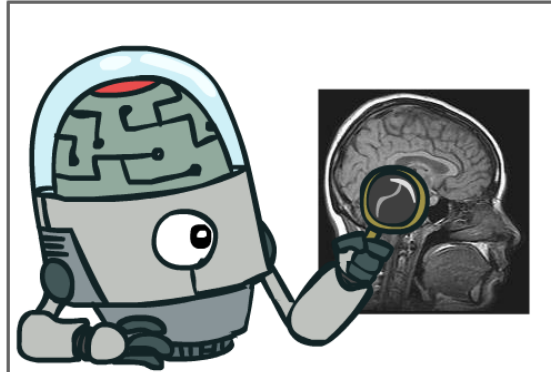


[en.wikipedia.org/wiki/Turing\\_test](https://en.wikipedia.org/wiki/Turing_test)

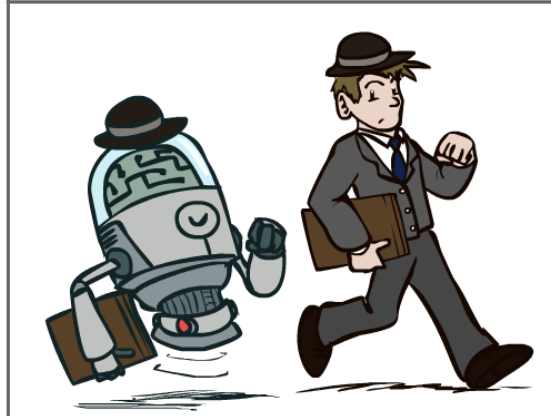
# What is AI?

The science of making machines that:

Think like people



Act like people



performance  
measure

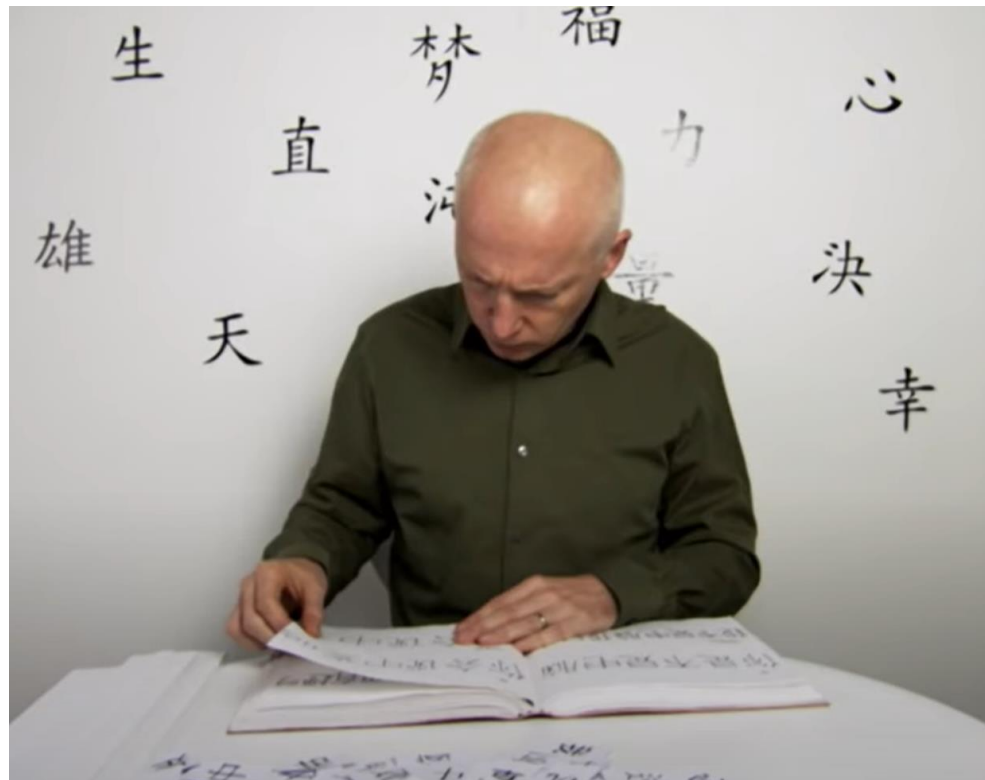


# What is Intelligence?

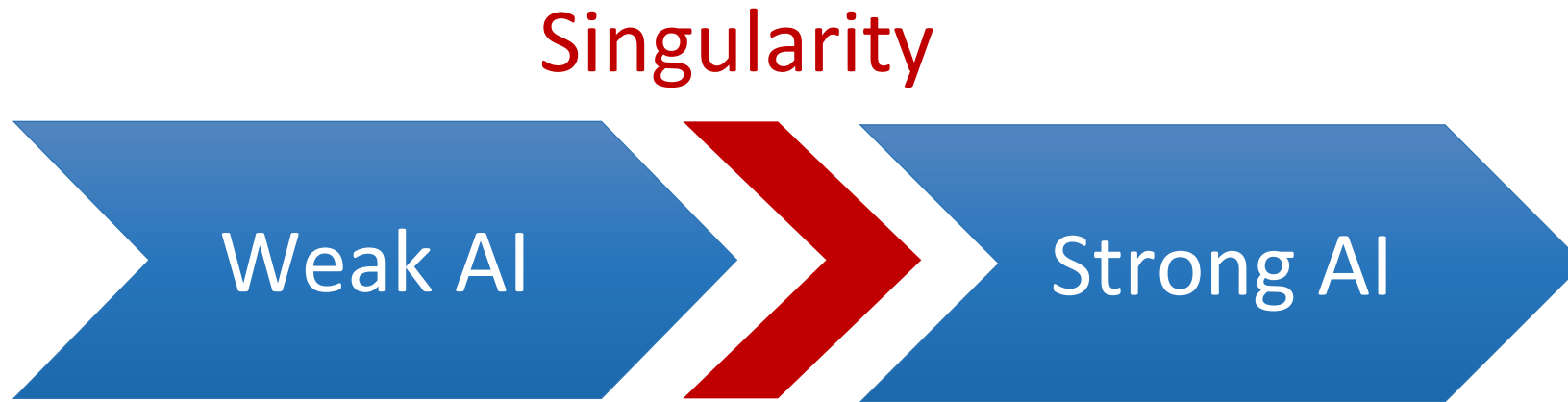
Chinese room experiment

John Searle

<https://www.youtube.com/watch?v=D0MD4sRHj1M>



# Weak AI vs AGI



- Narrow AI
- Limited number of applications

- Artificial General Intelligence (AGI)
- Recursive self-improvement
- Beyond human control



# AI in the News

electrek



Fred Lambert - Jan. 19th 2022 5:20 am

Elon Musk: Tesla could play a role in Artificial General Intelligence, decentralize Tesla Bot to avoid Terminator scenario



<https://electrek.co/2022/01/19/elon-musk-tesla-artificial-general-intelligence-decentralize-tesla-bot-avoid-terminator-scenario/amp/>  
<https://twitter.com/elonmusk/status/1483728729545363457>

# “Athletic” vs “Scholarly” AI

Boston Dynamics Founder and Chairman Marc Raibert



<https://venturebeat.com/2019/11/12/boston-dynamics-ceo-on-the-companys-top-3-robots-ai-and-viral-videos/>  
<https://www.youtube.com/watch?v=tF4DML7FIWk>

# “Athletic” vs “Scholarly” AI

Boston Dynamics Founder and Chairman Marc Raibert

## “Athletic AI”

*[Being] smart about controlling our bodies,  
managing the energy use of our bodies,  
receiving the world that’s right around us  
and maneuvering in real time with respect to either obstacles or  
competitors*

## “Scholarly AI”

*Make plans and then you execute on the plans. That’s the bulk of AI  
now — working at a high level where you’ve abstracted the world.  
You’re not interacting in real time with the physical world, you’ve  
abstracted the world*

<https://venturebeat.com/2019/11/12/boston-dynamics-ceo-on-the-companys-top-3-robots-ai-and-viral-videos/>

# Intelligence and Uncertainty

## Uncertainty in “athletic AI”

- Robot that assemble cars in factory
- Robot that fold clothes



<https://www.youtube.com/watch?v=pxLpsSkEtuY>

<https://www.youtube.com/watch?v=gy5g33S0Gzo>



# CMU Spotlight

CMU Biorobotics Laboratory

<http://biorobotics.ri.cmu.edu/>



Matthew Travers



Howie Choset



# Intelligence

In this course we'll focus on

Rational agents

- Agents that choose actions that maximize their expected performance measure

Weak AI (rather than AGI)

“Scholarly” AI (rather than “athletic” AI)

# Plan

Course Info (part 1)

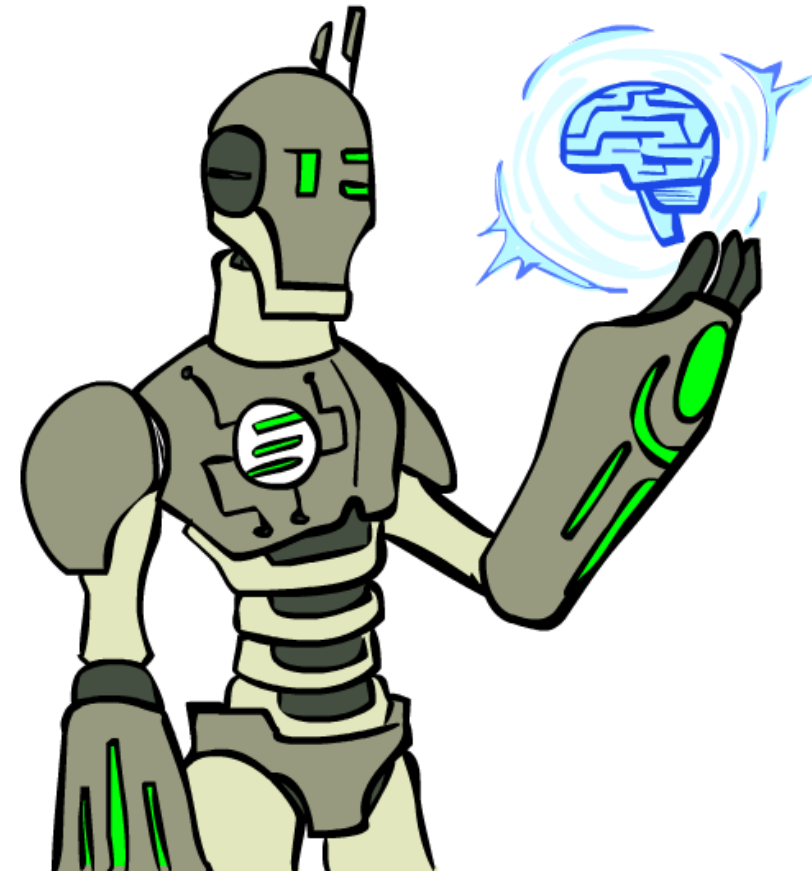
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Course Info (part 2)



# Course Information

Website: <https://www.cs.cmu.edu/~15181>

Canvas: [canvas.cmu.edu](https://canvas.cmu.edu) ✓



Gradescope: [gradescope.com](https://gradescope.com) ✓



Communication:

[piazza.com](https://piazza.com) ←



E-mail (only if piazza doesn't work):

[pvirtue@andrew.cmu.edu](mailto:pvirtue@andrew.cmu.edu)



# Course Information

## Lectures

- Lectures are recorded
  - Shared with our course and CMU teaching staff only
- Slides will be posted

## Participation

- Participation points earned by answering Piazza polls in lecture
  - One point for each “take” so make sure to answer all of them
- Credit for participating in lecture activities
- Participating  $\geq 80\%$  will earn full participation score

# Course Information

## Assignments

- Online homeworks
  - Quick exercises to help practice topics
  - Online in Gradescope
- Projects
  - Hand-on experience with AI
  - Python
  - Data
  - Report

# Course Information

## Quizzes

- Quizzes will in lecture, announced two days ahead of time

## Final exam

- Schedule TBD

# Course Information

## Office Hours

- OH calendar on course website
- OH-by-appointment requests are certainly welcome

## Mental Health

Don't struggle alone

Find at least one person and let them know how you're feeling

- Friend, family, roommate, advisor
- <https://www.cmu.edu/student-affairs/resources/index.html#liaisons>
- CMU CaPS <https://www.cmu.edu/counseling/>
- And, of course, you can always talk to me