Can Computers Think?
an introduction to computer science, programming
and artificial intelligence

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• small, residential liberal arts college in upstate New York
• ca. 2100 students
• old engineering program (since 1845)
• ca. 12% major in engineering (electrical, computer, mechanical)
• CS graduates 7 last year, 8 this year, 12 next year
• 8 CS faculty members
(New) Introductory Courses

- Can Computers Think? (artificial intelligence)
- Robots Rule! (robotics)
- Creative Computing (image and sound processing)
- Snappy Name Needed (computer games)
- Snappy Name Needed (computational science)
Goals

Messages to students:

• CS is interdisciplinary.

• CS has to do with something you are interested in.

• CS can be interesting, fun, and useful to you.

• You don’t have to be a computer geek to study CS.

• You don’t have to be a CS major to study CS.

⇒ increase number of students in computing: CS majors, minors, interdepartmental majors
(New) Introductory Courses

- Can Computers Think? (artificial intelligence)
- Robots Rule! (robotics)
- Creative Computing (image and sound processing)
- Snappy Name Needed (computer games)
- Snappy Name Needed (computational science)

- All courses have a common set of CS/programming related objectives adapted from the 2001 ACM Computer Science Curriculum Guidelines.
After the Introductory Courses

Senior Project

- bioinformatics
- AI
- computer graphics
- databases
- parallel computing
- robotics
- user interfaces
- programming languages
- compilers
- theory of computing
- operating systems
- algorithms
- software development
- computer organization
- web programming
- natural language processing
- CS of computer games

intro courses

- Discrete Math
- Data Structures
Target Audience of the AI Course

- (prospective) computer science majors
  - satisfies a requirement for the major
- neuroscience majors
  - satisfies a requirement for the major
- other students interested in artificial intelligence and/or computer science
  - satisfies a distribution requirement
Course Objectives

• introduction to fundamental CS concepts
  – esp. algorithmic problem solving

• familiarize students with a programming language (Python)

• CS is more than programming

• introduction to the field of AI
Part 1 (3 weeks)

• **AI**
  - What is intelligence?
  - When would we call a machine intelligent?
  - Are machines intelligent? Will they ever be?
  - What is (the goal of) artificial intelligence?

• **CS**
  - What is computing/computer science?
  - algorithms; basic concepts: variables, data types, control structures, functions
  - overview of computer architecture, encoding information in binary representation

• **Programming**
  - Python interpreter and IDLE
  - small programs involving
    • numbers and strings
    • assignments, print statements, input statements, function calls, if-then-else statements, while loops, function definitions
Part 1: ELIZA as Common Thread

- Is Eliza intelligent? Why/why not? What’s missing?
- How does Eliza work? What’s the *algorithm*?
- Decomposing Eliza into functions.

⇒ Build your own Eliza.
Part 2

Unit 1: • lists
  • rational agents; stimulus-response agent

Unit 2: • documenting, testing, debugging
  • artificial life

Unit 3: • recursion
  • searching and sorting lists
  • search

Unit 4: • dictionaries
  • reading from files
  • machine learning; n-gram models for natural language modelling

Unit 5: • modules
  • artificial neural nets
Part 2 – Unit 1

- lists
- rational agents; stimulus-response agent

**project**: simulation of a stimulus-response agent in a grid world

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- simulate world
- simulate agent (sensing, acting/moving)
- behaviors:
  - wall-following
  - eating cookies
  - avoiding fire/searching warmth
Part 2 – Unit 2

• documenting, testing, debugging

• artificial life

project: game of life
Part 2 – Unit 3

• recursion

• searching and sorting lists

project: drawing spirals and a Koch snowflake using Python’s turtle drawing library
Part 2 – Unit 4

- reading from files
- dictionaries
- machine learning: n-gram models for natural language

**project**: authorship determination

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**Texts by Author A**

Emma Woodhouse, handsome, clever, and rich, with a comfortable home and happy disposition, seemed to unite some of the best blessings of existence; and had lived nearly twenty-one years in the world with very little to distress or vex her. …

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**Texts by Author B**

The flying ship of Professor Lucifer sang through the skies like a silver arrow; the bleak white steel of it, gleaming in the bleak blue emptiness of the evening. That it was far above the earth was no expression for it; to the two men in it, it seemed to be far above the stars. …

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**Who wrote the following passage? A or B?**

The suburb of Saffron Park lay on the sunset side of London, as red and ragged as a cloud of sunset. It was built of a bright brick throughout; its sky-line was fantastic, and even its ground plan was wild.
Part 2 – Unit 5

• modules

• artificial neural networks

project: classification of handwritten digits using bpnn.py
Challenges

- Finding appropriate reading material.
- Programming: What should I give them? What should I hide from them?
- open-endedness of projects
Winter 2008: Students

1 psychology
1 math
1 neuroscience
1 computer science
4 engineering undecided

8
If this class wasn’t offered, would you have taken another introductory computer science class? That is, one without the artificial intelligence theme?

2 – yes
2 – probably
1 – yes, but I prefer the AI theme
1 – no

Why are you taking this class? What do you hope to learn?

4 – need the class for major/minor
2 – learn about CS
4 – learn programming
1 – understand how computers work
2 – learn about AI
Are you planning on taking more CS classes?

5 – yes
1 – no
1 – maybe

Has having taken this class influenced your answer to the previous question?

7 – No. I already knew that I would/wouldn’t take more CS classes.
Winter 2008: Motivation to pursue AI

Do you want to learn more about AI?
7 – yes

Has having taken this class influenced your answer to the previous question?
2 – No. I already knew that AI is an area that I find interesting.
5 – Yes. I was not interested in AI before, but now I would like to learn more.
Winter 2008: What did they learn?

What is the most interesting thing you learned in this class?

5 – AI related answers
2 – programming related answers
Conclusion

• Course has worked well to get students who were (mostly) already interested in CS interested in AI.

• Will it work the other way round?
  – next offering: fall 2008
  – will be in catalogue
  – will be required for incoming neuroscience majors

http://antipasto.union.edu/~striegnk/courses/cancomputersthink/