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

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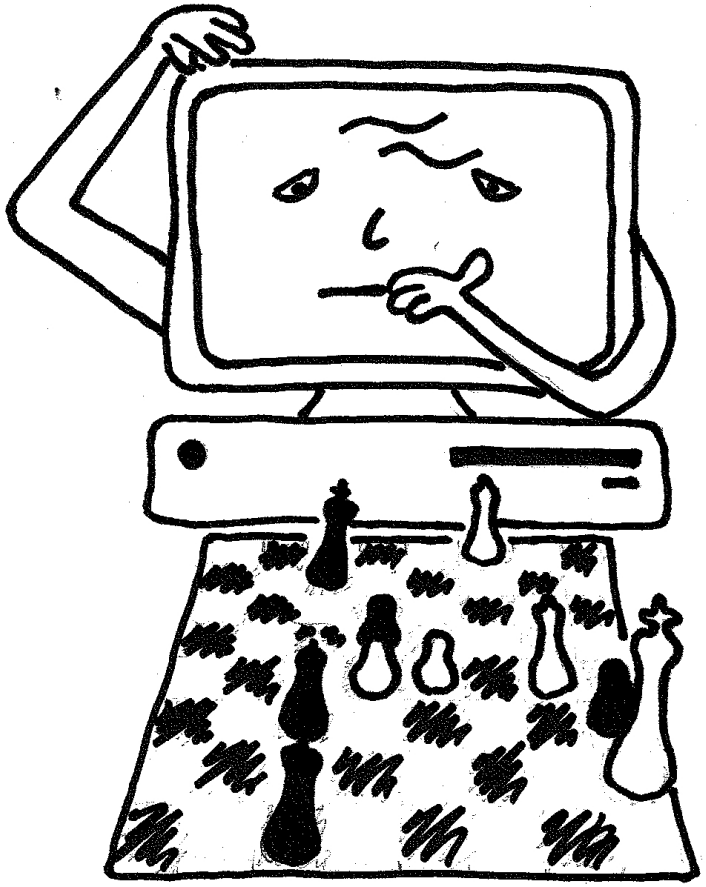

UNION COLLEGE

CS@Union College

- 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

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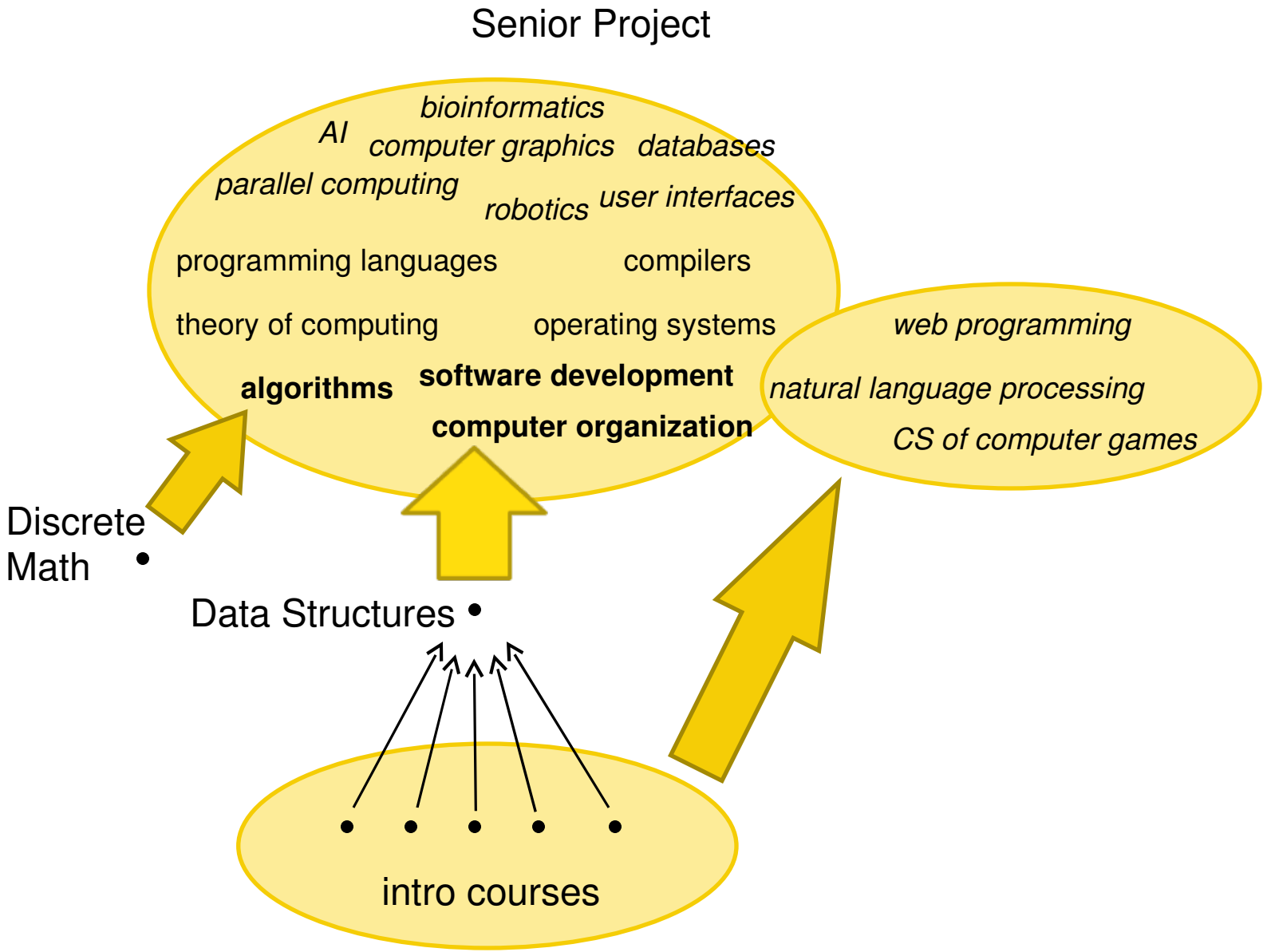
- Snappy Name Needed (computer games)
- Snappy Name Needed (computational science)

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

After the Introductory Courses



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

```
wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww
w                        ww        w
w                        ww        w
w      wwwwwwwwwwwww     ww        w
w      wwww      wwww          R   w
w      wwww      wwww              w
w                                  wwwwww
w                                  wwwwww
wwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwwww
```

- 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

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.
…

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.
…

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

Winter 2008: Motivation for taking the course

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

Winter 2008: Motivation to pursue CS

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/