

Intro CS @ Union

Majors, Minors, and “Butts in Chairs”

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Union College

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- Liberal arts college with engineering (4 engineering degrees)
- ~2100 students
- trimester calendar, 36 course total required (40 for engineers)
- Major and ID major options
- CS Department:
 - 6 FTE, 6 course load (but at most 30 per year offered)
 - CS intro is “expensive” to offer
 - dedicated teaching lab, shared additional teaching lab
 - combination HCI & robotics lab
 - major role in Collaborative Design Studio (3D printing, very interdisciplinary)

CS Major Requirements

6 Core Courses:

- Intro
-adding a new course
- Data Structures
- Algorithms
- Large Scale Software Development
- Computer Organization

5 Electives:

- Theory elective
- Systems elective
- Two 300-level electives
- One additional elective

Other:

- Capstone project

CS ID Major Requirements

5 Core Courses:

- Intro
- adding a new course
- Data Structures
- Algorithms
- Large Scale Software Development

4 Electives:

- One 300-level elective
- Three additional electives
- Eight req. courses for other field

Other:

- Capstone project
(combines both fields)

Enrollment Snapshot

2013-2016 overall enrollments:

- average 560/year
- no longer have a CS0 course
- highest enrollments since before 2000-2001

Enrollment Snapshot

2013-2016 overall enrollments:

- average 560/year
- no longer have a CS0 course
- highest enrollments since before 2000-2001
- 30% increase over 2000-2001

Union College's Campus-Wide Computation Initiative

Contextualized computing taken to the extreme.

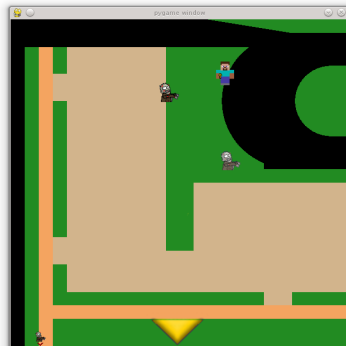
Three areas of change:

- 1 Introductory Computer Science Course(s)
- 2 Intermediate Computer Science Courses
- 3 Courses in Non-CS Disciplines

Introductory Computer Science

Six theme-based introductory courses:

- Taming Big Data
- Robots Rule!
- Game Development
- Can Computers Think?
- Creative Computing
- Programming for Engineers



Taming Big Data

- Retirement Planning
- GDP and Unemployment Rate
- Breast Cancer Classifier
- Longitudinal Temperature Analysis

Robots Rule!

- Light chasing
- Follow the leader
- Dance choreography
- Follow a pre-planned route
- Braitenberg vehicles

Can Computers Think?

- Guessing game
 - Pig Latin
 - Mad Libs
 - Morse Code
 - Palindromes
- Tic-Tac-Toe
 - Analysis of presidential speeches
 - Reading and discussion of Turing, Searle, and current articles related to robotics, learning, brains vs computers

Creative Computing

- Change color image to grey scale, to red scale
- Posterize an image
- Shrink, expand, copy, crop an image
- Make mirror image
- Image collage, sound collage
- Increase volume, add echo to sounds
- Design custom sound effects

Programming for Engineers

- Solving parameterized statics problems
- Newton's method
- Structs for physical properties
- Matrix fractals
- Encryption / decryption
- DNA string analysis
- Image edge detection
- Agent-based motion planning

The Students

- 75% no prior programming experience
- 15% took high school CS
- 10% learned to program elsewhere

```
Welcome traveler! You are about to embark on what is known as a text-adventure.
What is a text-adventure you ask? Well a text-adventure is an interactive story.
You will be displayed text and it is up to you to try and figure out, based on
the clues given to you, what to do. Type in the word bananas after you are done
reading the rules. You can interact with objects by picking them up. If you want
to know what items you're carrying or you're that bad and need help, just type
inventory or help respectively. Can you solve they mystery and get to the end?
```

```
Input Command: bananas
```

```
You wake up and and stand in a dark room. You have a huge headache and a
stinging pain in your side.
```

```
Input Command: turn on light
```

```
Invalid input.
```

```
Input Command: turn lightswitch
```

```
You've done the only thing you can possibly do with a lightswitch. It turns on.
The light from the bulb hanging down from the ceiling flickers momentarily.
After a few seconds, blinding light fills the room. Your headache worsens from
the brightness. As your eyes readjust, you realize a myriad of options have
suddenly appeared for you. To the north you have a wall, to the west there's a
bookcase, and to the east there's a desk.
```

```
Input Command: go south
```

```
As you start walking, you suddenly feel pain. Perhaps you should reorganize
your priorities next time and check something . . .
```

```
Input Command: check pain
```

```
Invalid input.
```

```
Input Command: check side
```

```
You check out the pain in your side. You discover three large claw marks.
Perhaps a wolverine got to you while you were unconscious? They are pretty
deadly. The hypothetical wolverine, I mean.
```

```
Input Command:
```

Change in Enrollments - Introductory Courses

Year	Sections	Students	# Disc.	% Total Seats
2004-2005	3	29	8	9%
2011-2012				
2012-2013				
2013-2014				
2014-2015				
2015-2016				

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2013-2014	11	205	25	39%
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Impact of increased size of upper level courses, staffing oscillations.

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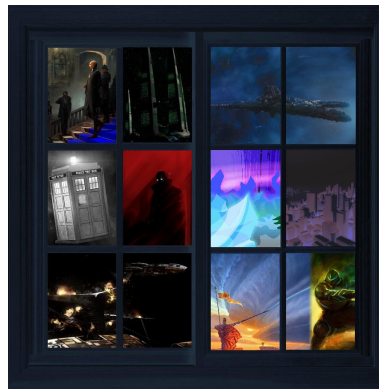
Now: 32% - 45% depending on the year and specific offerings

A Look at CS Majors, Minors

Year	Total	Women	%-age
2014	13	2	15%
2015	19	1	5%
2016	21	6	29%
2017	18	3	17%
2018	25	7	28%
2019	15	5	33%
Minors	16	7	44%

The Students – After the Intro

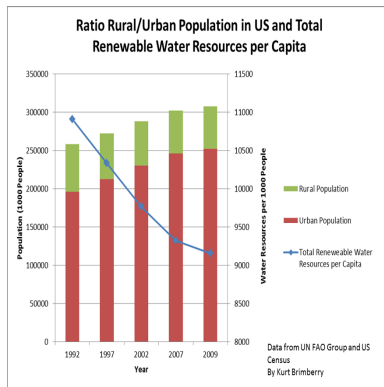
- Interested in CS or applications of computing?
 - 57%
- Expect to take additional CS courses?
 - 58% say “yes” or “maybe”



What's Next? Intermediate Computer Science

Available to majors and non-majors alike....

- Natural Language Processing
- Data Visualization
- Modeling & Simulation
- Web Programming
- The Computer Science of Computer Games
- Intro to Bioinformatics
- plus the usual route into the major



Beyond CS: Disciplinary Thinking, Computational Doing

- 4 colleges
- 28 faculty, faculty-student teams (mostly not CS students)
- computational components added to more than 24 courses



CPATH EAE: Campus Wide Computation Initiative - A New Model for Computing Education 0722203

The Disciplines

- Astronomy
- Biology
- Chemistry
- Economics
- Electrical Engineering
- English
- Egypt mini-term /
Engineering
- Experimental Humanities
- Film Studies
- Geology
- History
- Mechanical Engineering
- Music
- Physics
- Political Science
- Psychology/Neuroscience

This is what success looks like

```
while True:  
    print "We do not have enough faculty"
```

Links to more information

- Union's [introductory CS courses](#)
- The set of [concepts and skills](#) covered in the intro courses
- Information on Union's [campus-wide computing project](#)