Objectives

- Computer Science is Complexity Science

Review

- What are common constructs in programming languages?
- What are some differences between programming languages?

A human must turn information into intelligence or knowledge.
We've tended to forget that
no computer will ever ask a new question.
-- Grace Hopper

Computers are incredibly fast, accurate, and stupid.
Human beings are incredibly slow, inaccurate, and brilliant.
Together they are powerful beyond imagination.
-- Albert Einstein

COMPLEXITY SCIENCE

CS == Complexity Science

- How can it be done?
  - Based on **information**
  - Managing, manipulating data
  - Possible algorithms
- How well can it be done?
  - Most **efficient** algorithm in terms of time and/or space
- Can it be done at all?
  - Often, proof is a program--an implementation of the above

Computer Science != Programming

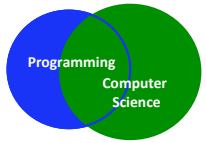
programming : CS ::

machining : engineering

grammar : literature

equations : mathematics

walking : W&L



a vehicle, not a destination

Computer Science Fields

Systems
- Architecture
- Operating systems
- Networks
- Distributed and parallel systems
- Databases
- Security
- …

Software
- Compilers
- Graphics
- Software engineering
- Software testing and verification
- …

Theory
- Algorithms
- Theory of computation
- …

Other
- Artificial intelligence
- Robotics
- Natural language processing
- Bioinformatics
- Visualization
- Numerical analysis
- …

- Often research involves combinations of these fields
- Not just programming!
  - But programming is a tool to do much, much more!

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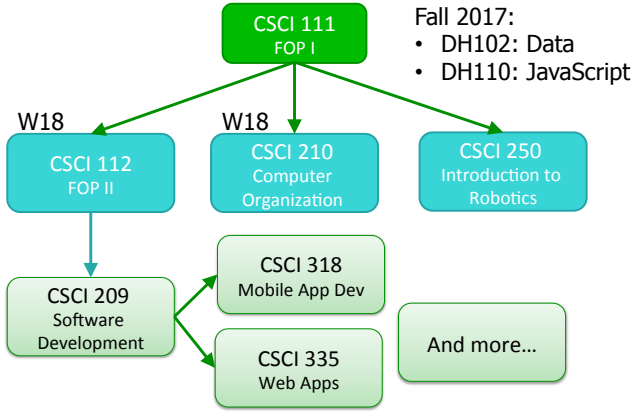
* = field we discussed or did a problem in
  - Some are a stretch :)

Where Can You Go from Here?



Conclusions

- See impact of computer science on your life
  - Think differently about issues
- Understand some of the computing issues better
  - Taking out some of the mystery
  - Testing, debugging, efficiency
- Algorithms are everywhere
  - Process for solving problems, **efficiently**
  - Mapping human intuition to systematic/automatic process

Final Exam Take Home Questions

- 2 essay questions about the Broader Issues
- **Due before end of exam period**
  - Noon Friday
- Each essay should be about 1/2 a page, single-spaced
- Goal: answer the question clearly, precisely, and convincingly
  - Not too wordy
  - Evidence/examples to support your argument
  - Correct spelling, grammar, punctuation

Final Exam

- Finals are taken in the lab classroom (Parmly 405)
  - No computers
  - If need to change your time, sheet outside the CS department office
- Evaluations due Saturday at midnight on Sakai
- Take-home essay due Friday at noon.
  - End of exam period
- All lab work and extra credit articles must be submitted by **Wed**
- Office hours:
  - Saturday: 2:15– 5 p.m.
  - Monday: (working on these; have to schedule a meeting)
  - Appointments preferable during that time
  - Other times by appointment

Final Exam Review

- Focus on object-oriented programming
- New content: search techniques, lists (1D and 2D), complexity science
- Cumulative:
  - Functions, data types, common methods & operations
  - How to model data

Your questions?

Final Exam Review

- What do you need to do to be able to use methods from a class?
- What are the different ways to iterate through a list?
- How can you iterate through a dictionary?

Animal Shelter Software

- We want to keep track of animals at an animal shelter

What is our process for developing a class?

Process

- Determine data, functionality
- Create class
  - Create __init__, __str__ methods
- Test
- Create additional methods, testing

Class: Pet

- Data:
  - Name
  - Species of animal (dog, cat, chinchilla)
  - Status (in holding, in adoption room, adopted)
- Functionality
  - Getters for this information
  - Mark animal as adopted or in holding!

Exam 2: Analysis of Code

```
def helper1(word, letter):
    for i in range(len(word)):
        if word[i] == letter:
            return i
    return -1
```

```
def helper2(word, letter):
    total = 0
    for ch in word:
        if ch == letter:
            total += 1
    return total
```


Broader Issue Groups

John Josette Mike Mira Robert	Austin Collin Molly Sarah Zander	Ashley Burke Jae Lexi Tony	Charlotte George Leslie Win	Alex Anna Kate Buddy Victor

Facebook's News Feed

- How does Facebook's news feed work?
- How did the algorithms use match (or not) your experience with Facebook?
  - What was the most surprising part of the algorithm? Least surprising? Most interesting?
- What does Facebook still need to work on?
  - What doesn't it get right?
- How could you implement some of the aspects of the Facebook news feed in FaceSpace?

Course Evaluations

- On Sakai, due Saturday
- Incentive
  - If 60% of students complete evaluation, 1% Extra Credit on lab grades
  - For each additional 10% of students who complete evaluation, 1% EC on lab grades
  - Total possible EC: 5%

Counter Class Specification

- Implement, Test
- Example use: Caesar cipher

- A class that represents a counter that wraps around from a high value back to its low value
- Functionality:
  - Constructor – takes as parameters the low value and the high value; default – counter starts at low value
  - A string representation of the Counter
  - Increment the counter by a given amount (a positive amount), wrapping around to low again, if necessary. Returns number of times had to wrap around.
  - Decrement the counter by a given amount (a positive number), wrapping around to high again, if necessary. Returns number of times had to wrap around.
  - Sets the counter's value, only if low <= value <= high. Otherwise, prints an error message.
  - Getters: low, high, current value