Computer Science Principles

CSE 120 Winter 2017

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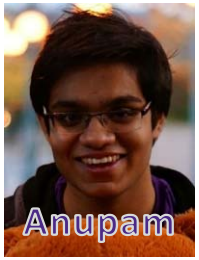
Teaching Assistants: Anupam Gupta, Braydon Hall, Eugene Oh, Savanna Yee

Who: Course Staff

- Your Instructor: just call me Justin
  - From California (UC Berkeley and the Bay Area)
  - I like: teaching, the outdoors, board games, and ultimate
  - Excited to be teaching CSP for the 1st time at UW!
- 4 TAs:



  - Available during lab, in office hours, and on Piazza
  - An invaluable source of information and help
- Get to know us
  - We are here to help you succeed
  - And to make the course better – with your help

Who: You!

- 52 students registered
  - Undergrads from *many* different majors
- This class is intended for students without significant previous experience with computing/programming
- Get to know each other and help each other out!
  - Learning is much more fun with friends
  - Working well with others is a valuable life skill
  - Diversity of perspectives expands your horizons
- Submit Introduction Survey so we can find out more

Why Study Computer Science?

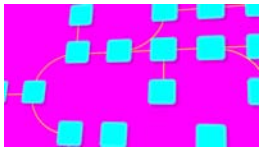
- Increasingly useful for *all* fields of study and areas of employment
  - Art – computer-aided design, animation
  - Drama – lighting, sound, ticket sales, advertising
  - Lumberjacking – mapping, tracking size & # of forests

- Massive impact on our lives and society as a whole


Commercial Drones


Intelligent Apps


Virtual Assistants

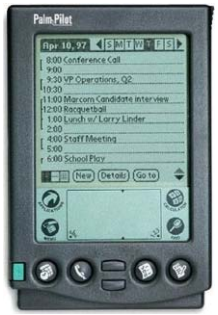

Blockchain (currency transfers)

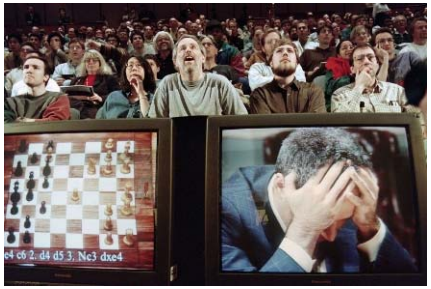

Autonomous Vehicles


VR / AR

The Hottest Tech 20 Years Ago (1997)

- Sharp MiniDisc Player
- Sony PlayStation
- Grand Theft Auto
- WebTV
- Palm Pilot 1000
- DVD Players





- Al Gore: “Atari Democrat”
- Deep Blue
- Sony Mavica MVC-FD5
- Motorola StarTAC
- Windows 95
- MP3s

https://www.cnet.com/pictures/this-was-the-hottest-tech-20-years-ago-in-1997/

Computing in Your Future

- Computing and its data are inescapable
  - You generate "digital footprints" all the time
- Computing is a regular part of *every* job
  - Use computers and computational tools
  - Generate and process data
  - Dealing with IT people
  - Understanding the computation portion of projects
- Our goal is to help you make sense of the "Digital Age" that we now all live in

What This Course Is

- This course is split into two major themes:

1) Computational Thinking
   - How can you use computers to solve problems
   - Using programming as a tool

2) Computational Principles
   - The "big ideas of computing" that we think everyone should know
   - *e.g.* bits can represent anything and everything, what a computer can and can't compute, how do websites and the Internet work, social implications of computing

What This Course Is NOT

- Preparation for CSE142: Computer Programming I
  - This is not just a programming course
  - But great if you feel motivated to continue afterward!
- Trivial
  - Supposed to be material you haven't seen before
  - A technical class that asks you to read and write and be creative
- Boring or back-breaking
  - Assignments intended to be fun, interesting, and reasonable

About Programming

- programming ≠ computational thinking
  - *Computational thinking* is knowing how to break down and solve a problem in a way that a computer can do it
  - *Programming* is the tool you use to execute your solution
  - We use programming in this course as a way of teaching computational thinking

- Can be learned, just like any other skill
  - It's not black magic; there's no such thing as a "coding gene"
  - Yes, at first it may be challenging and mind-bending – just like learning your first non-native language
  - My hope is that you will think differently after this course

Programming in CSE120

- Use a language called Processing
  - Text-based language that is good for visuals and interaction
  - We will use Java syntax
  - At the end of the day, the language you use doesn't matter as long as you develop computational thinking skills

- Examples:
  - Jumping robot
  - Ripples
  - Constellations

Big Ideas of Computing

- Exposure to a broad range of topics in computer science
  - Not going to dive into the details
  - These are the motivations & the applications for programming (the tool)
  - Focus on what to be aware of to navigate the digital world

- **Goal:** become "literate" in computing
  - As new innovations arise, can you read about it, understand its consequences, and form your own opinion?
  - This course will ask you to *read*, *discuss*, and *write* about computing

Lecture Outline

- Course Introduction
- **Course Policies**
  - http://courses.cs.washington.edu/courses/cse120/17sp/policies.php
- Abstraction

Communication

- Website: http://cs.uw.edu/120
  - Calendar, schedule, policies, labs, links, assignments, etc.
  - Grade book and assignment submissions via Canvas
- Discussion: http://piazza.com/washington/spring2017/cse120
  - Ask and answer questions – staff will monitor and contribute
  - *ALL* questions on course material should go here
- Office Hours: spread throughout the week
  - Can also email to make individual appointments
- Anonymous feedback form

Weekly Schedule

- Lectures are Mon, Wed, Fri (3 hr)
  - Friday lectures will generally be reserved for "Big Ideas"
- Weekly reading is due before lab on Thursday
  - All readings online, complete "reading check" to prep
- Labs on Tue, Thu (2 hr)
  - Work time for labs & assignments w/help from TAs
  - 15-20 minutes at start of Thu lab will be spent discussing the weekly reading
- Can be a demanding schedule, but should be fun!

Monday	Tuesday	Wednesday	Thursday	Friday	Weekends
Lecture	Lab	Lecture	Lab (Reading)	Lecture	Assignments

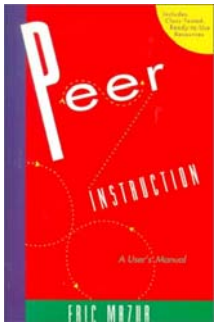
Course Components and Grading

- **Programming Assignments** (40% total)
  - Labs and Assignments (mostly Processing)
  - Website portfolio
  - Mid-course "Creativity Assignment" (2 mini-projects)
- **Final Project** (20%)
  - Use your newfound skills to make a project *of your choosing!*
- **Written Assignments** (15% total)
  - Reading Checks
  - Living Computer Museum Report ($)
  - Innovation Blog
- **Exams:** Midterm (10%) and Final (10%)
  - Double-check understanding of concepts and big ideas
- **EPA:** Effort, Participation, and Altruism (5%)

EPA

- Encourage class-wide learning!
- Effort
  - Attending labs and office hours, completing all assignments
  - Keeping up with Piazza activity
- Participation
  - Making the class more interactive by asking questions in lecture, office hours, and on Piazza
  - Peer instruction voting
- Altruism
  - Helping others in lab, during office hours, and on Piazza

Peer Instruction



- Increase real-time learning in lecture, test your understanding, increase student interactions
  - Lots of research supports its effectiveness
- Multiple choice question at end of lecture "segment"
  - 1 minute to decide on your own
  - 2 minutes in pairs to reach consensus
  - Learn through discussion

- Vote using Poll Everywhere
  - Use website (https://www.polleverywhere.com) or app
  - Linked to your UWNetID

Peer Instruction Question

- Which of the following statements is FALSE?
  - Vote at http://PollEv.com/justinh

A. **The weekly readings are intended to prepare you for the "big ideas" lecture on Friday**

B. **Your participation both in person and online count towards your class grade**

C. **Effective communication is an important skill for this class**

D. **The two major themes for this class are programming and computational principles**

How to Get an A (I Promise!)

- Attend class everyday
- Complete your assignments on time
- Reach out to us if you ever feel stuck or overwhelmed
- If you miss ANY deadline, don't ignore it—come talk to us and tell us what is going on
- **Persistence is important**: a lot of things will seem new and confusing at first, but you can figure them out – stick with it and don't give up!
  - You learn best from your mistakes

Make a good-faith effort to *try everything* and *think* about what you do!

What to Expect From Us

- We will put forth a good faith effort to present the material in the clearest possible way
- We will teach topics that are interesting and enjoyable – if it's not working for you, let us know
- We will be respectful, cooperative, and understanding
- We will provide help whenever you ask, both online and 1-on-1

What We Expect From You

- Come to every class ready to learn
- Make a sincere effort to understand the material
- Do a little bit of work for this class each day
- Turn in work on time, and communicate with us if you have special circumstances that require extensions
- Submit your own work… please don't cheat ☹

- Be respectful to us and other students
  - Everyone has different past experiences and learns at their own pace

Hooked on Gadgets

- Gadgets reduce focus and learning
  - Bursts of info (*e.g.* emails, IMs, etc.) are *addictive*
  - Heavy multitaskers have more trouble focusing and shutting out irrelevant information
    - http://www.npr.org/2016/04/17/474525392/attention-students-put-your-laptops-away
  - This applies to all aspects of life, not just lecture
- NO audio allowed (mute phones & computers)
- Non-disruptive use okay
  - Stick to side and back seats
  - Stop/move if asked by fellow student

To-Do List

- Explore website thoroughly: http://cs.uw.edu/120
  - Read through the full course policies!!!
- Check that you are registered on Piazza, Canvas, and Poll Everywhere
- Upcoming assignments:
  - Introduction Survey (3/28)
  - Personal Values (4/2)
  - Website setup (3/31)
  - Exploring Lightbot (3/29)

Lecture Outline

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- **Abstraction**

Complexity and Abstraction

- Programming is straightforward, as long as your programs are small
  - *Complexity* is our enemy
  - *Abstraction* is the key to conquering complexity
- Abstraction allows us to build general-purpose artifacts
  - **Detail Removal:** Hide unnecessary details from users and designers
  - **Generalization:** Avoid unnecessary repetitive work
- Learning to reason using the most appropriate abstraction is a key goal of computational thinking

Abstraction: Detail Removal

- "The act or process of leaving out of consideration one or more properties of a complex object so as to attend to others."

Henri Matisse *"Naked Blue IV"*

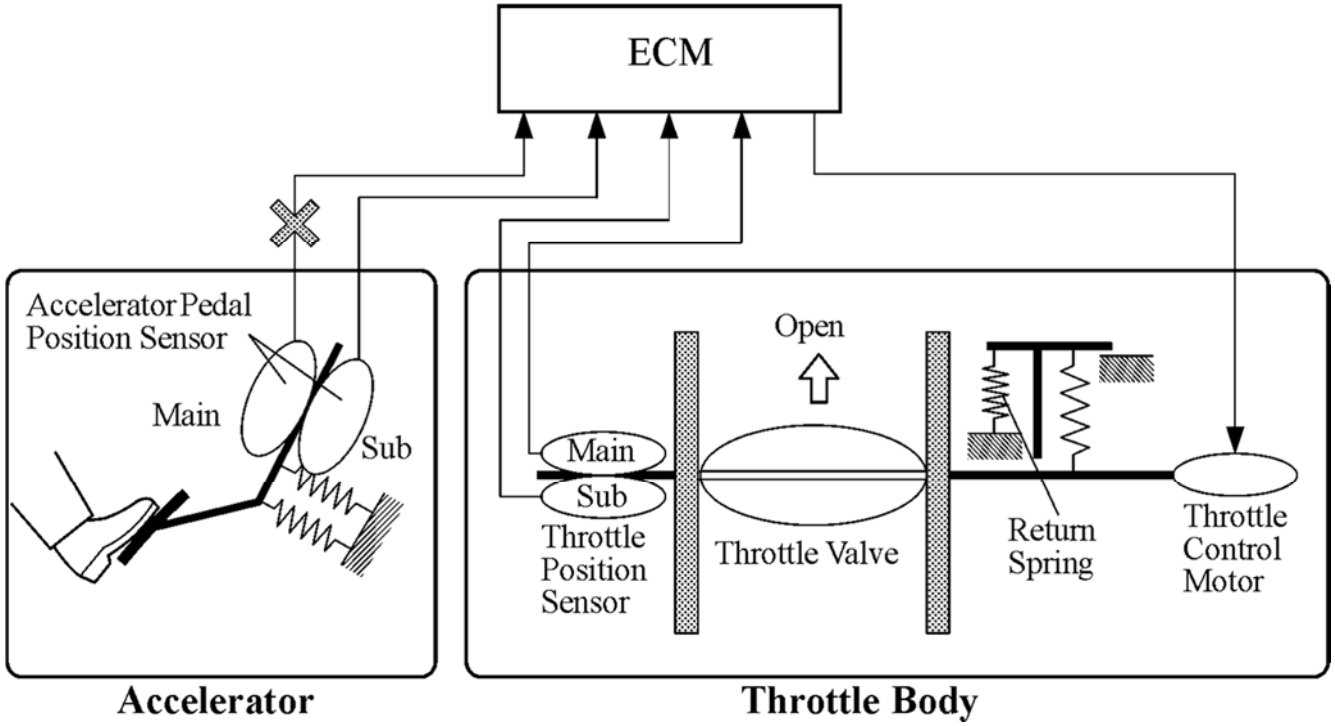
Maps for directions

Abstraction: Detail Removal

- Detail removal example:
  - Modern user interface: Right pedal is “accelerate”, left is “decelerate”
  - Even as underlying technology has changed, this abstraction has not!
    - Computer controlled fuel injection
    - Anti-lock brakes (ABS)

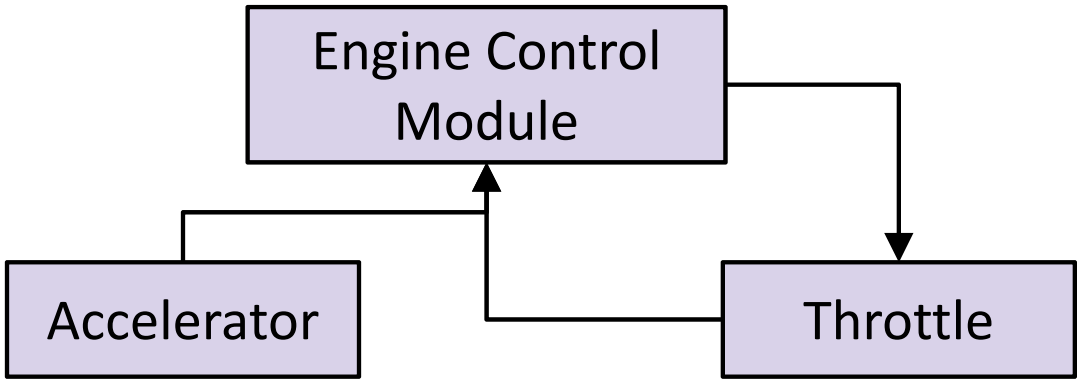
Abstraction: Detail Removal

- Detail removal example:
  - Hide unnecessary details from other designers
    - *e.g.* Engine Control Module (ECM) designer doesn't care about the return spring inside the Throttle!



Abstraction: Detail Removal

- Detail removal example:
  - Hide unnecessary details from other designers
    - *e.g.* Engine Control Module (ECM) designer doesn't care about the return spring inside the Throttle!
  - Nice to be able to think of a system as a hierarchy of well defined "chunks" with precise functionality
    - In CS, we say that we have a **separation of concerns**



Abstraction: Generalization

- "The process of formulating general concepts by abstracting common properties of instances."

- Extensible shower rods
- Adjustable hats
- Single recipe for <fruit> cheesecake
- Feeding animals on a farm
  - To feed <animal>, put <animal> food in <animal> dish

Summary

- Abstraction is one of the most important challenges in computer science
  - How do you identify the right abstraction you need (block to build) to solve your problem?

- Think about computers:
  - How many of you actually know how a computer works?
  - How many of you can use a computer?
    - Thanks to abstraction!!!