CSE 142 vs CSE 143

CSE 142 / AP CS A
- You learned how to write programs and decompose large problems with:
  - Print statements
  - Methods
  - Control Structures
    - loops, if/else
  - File I/O
  - Arrays
  - Objects

CSE 143
- Return of the objects
- You learned to solve more complex tasks efficiently
  - Data structures to organize and model data
  - Algorithms for solving common tasks
  - More advanced language features
- Abstractions are important!
Road Map

CS Concepts
- Client/Implemener
- Efficiency
- Recursion
- Regular Expressions
- Grammars
- Searching / Sorting
- Backtracking
- Hashing
- Huffman Compression

Java Language
- Exceptions
- Interfaces
- References
- Comparable
- Generics
- Inheritance / Polymorphism
- Abstract Classes

Data Structures
- Lists
- Stacks
- Queues
- Sets
- Maps
- Priority Queues

Java Collections
- Arrays
- ArrayList
- LinkedList
- Stack
- TreeSet / TreeMap
- HashSet / HashMap
- PriorityQueue
Major themes

- **Abstraction**
  - Leverage existing components without understanding details
  - Create components that can be used as black boxes

- **Problem solving**
  - Decomposing a large problem into smaller ones

- **Design tradeoffs**
  - Algorithm analysis - scalability and growth
  - Keeping code easy to read for maintainability

- **Recursion**
  - Reason about problems in terms of self-similarity
  - Write very short code to achieve complex behaviors
What project?

- Add a GUI to the random sentence generator
- Automate chemistry, physics, calculus problems, etc
  - Maybe even automate writing code with good style?
- Find quotes by keyword in books
- What are you currently doing that a computer could do?
- List of some project ideas
What language?

- Expanding your Java knowledge with a project is valuable

- Pick a project, see what language is most appropriate
  - iOS: Swift
  - Android: Java, Kotlin
  - Client-side web: Javascript (many frameworks to choose from)
  - Beautiful visuals: Processing
  - Data Processing + Machine Learning: Python
  - Data Management: SQL
  - Embedded systems: C / C++

- Learn a new programming paradigm
  - Functional languages: Racket, Haskell, Scala, (now, Java 8!)
Leveraging existing code

- Processing language

- Building games
  - [http://lwjgl.org/](http://lwjgl.org/)
  - [http://jbox2d.org/](http://jbox2d.org/) (with physics!)

- Processing biological data
  - [http://biojava.org/wiki/Main_Page](http://biojava.org/wiki/Main_Page)

- Accessing Facebook data
  - [http://restfb.com/](http://restfb.com/)

- Making music
  - [http://www.jfugue.org/](http://www.jfugue.org/)
Courses?

• CSE non-majors
  • CSE 154: Web Programming
  • CSE 163: Intermediate Data Programming (Python)
  • CSE 373: Data Structures and Algorithms
  • CSE 374: Programming Concepts and Tools (C/C++, Linux, ...)
  • CSE/STAT 416: Machine learning (requires STAT 311 or 390)
  • CSE 131: Digital Photography
  • CSE 460: Animation Capstone (open to all majors)
  • And more!

• CSE majors
  • CSE 311: (Mathematical) Foundations of Computing
  • CSE 332: Data Abstractions (Data Structures and Algorithms)
  • CSE 331: Software Design and Implementation
  • CSE 341: Programming Languages
  • CSE 344: Intro to Data Management (and databases)
  • CSE 351: Hardware/Software Interface
  • And more!

• INFO, AMATH, HCDE, DXARTS, ...
Beyond programming

- Mind-controlled robots
  - [http://www.youtube.com/watch?v=TQ7EOpPNQyw](http://www.youtube.com/watch?v=TQ7EOpPNQyw)

- Muscle-controlled interfaces
  - [http://www.youtube.com/watch?v=pktVSTwC8qo](http://www.youtube.com/watch?v=pktVSTwC8qo)

- 3D models from pictures
  - [http://www.youtube.com/watch?v=25Yifq70eIY](http://www.youtube.com/watch?v=25Yifq70eIY)

- Face aging
  - [http://www.youtube.com/watch?v=fLQtssJDMMc](http://www.youtube.com/watch?v=fLQtssJDMMc)

- Animation
  - [http://www.youtube.com/watch?v=b4kkPILdMvI](http://www.youtube.com/watch?v=b4kkPILdMvI)

- Security
Weekly meetings

- Change – technologies for low-income regions
  - [http://change.washington.edu/](http://change.washington.edu/)

- Dub – human-computer interaction and design
  - [http://dub.washington.edu/](http://dub.washington.edu/)
Computer Science Books

The Hidden Language of Computer Hardware and Software

Charles Petzold

Code

100011 1001111 1000100 1000101

9 Algorithms That Changed the Future

The Ingenious Ideas That Drive Today's Computers

John MacCormick

Dear Data

Giorgia Lupi

Stefanie Posavec

Forward by Maria Popova
Computing & Jobs


- Computer occupations (15-1100)
- Engineers (17-2000)
- Life scientists (19-1000)
- Physical scientists (19-2000)
- Social scientists and related workers (19-3000)
- Mathematical science occupations (15-2000)

Data from the spreadsheet at http://www.bls.gov/emp/ind-occ-matrix/occupation.xlsx
Internships

- Various career fairs around campus.

- Start looking early!

- Cast a broad net and interview lots of places. Don’t be afraid of getting rejected!

- For those just starting out
  - Microsoft Explorer Program
  - Google Engineering Practicum
Roles in Industry

- **Software Developer/Software Engineer**
  - Builds and designs software
  - Includes designing and engineering architecture of a software system as well as programming

- **Product Manager (PM)**
  - Designs and makes decisions regarding the overall product
  - Works with people across disciplines at the company
  - Role can be different at different companies

- **Test/QA**
  - Write and design tests of the product

- **Site Reliability Engineer (SRE)**
  - Responsible for ensuring that systems and services are available and responsive
Small vs Big Company?

- **Small Company**
  - Lots of autonomy and impact within the company
  - Often move quickly
  - Breadth – get to work on many projects and with many types of people

- **Large company**
  - Large data sets, impact many users
  - Lots of support and infrastructure to do your job well
  - Depth – get to focus on specific areas of a project
What Do I Do?

• I’m lecturer in the Paul G. Allen Center of Computer Science & Engineering. My job is to teach and get you all excited about computing!

• Topics in CS that interest me:
  • Data Science
    • Machine Learning and Data Visualization
  • Theoretical Computer Science
    • Approximations and randomized algorithms
  • Computer Science Education
    • Introductory programming and introductory data science
    • Scaling classes to handle increased enrollments
Where Have I worked?

- **Redfin**
  - Job: Full-stack engineer (worked on frontend and backend)
  - Languages: Java + Javascript

- **Socrata** *(Seattle City Data)*
  - Job: Mostly data science, a little of backend work on search
  - Machine Learning: Python
  - Search Backend: Scala + ElasticSearch

- **Sift Science**
  - Job: Machine learning infrastructure
  - Language: Java + Python
  - Libraries: Spark
AMA
(ask me anything)