

Programming for Informatics (CS2110)

Spring 2021

Professor: James Cremer

TA: Jonathan Rusert

ANNOUNCEMENTS

- No formal discussion sections tomorrow but your TA will be available on Zoom during his scheduled section times (see section, not lecture, ICON page for section Zoom links) to help with Python installation/execution questions
- First homework will be assigned tomorrow, due Monday, Feb. 1, 11am. Usually, homework assignments will be due on Mondays.
- Office Hour Zoom links for both me and TA are on the lecture ICON page. Times are posted on the main course information page (outside of ICON)

IMPORTANT THINGS TO DO THIS WEEK

- Read the textbook, Ch 1 and Ch2
- Install Python on your computer, and practice basic expressions
- Make sure you can access Piazza (discussion forum) through the lecture ICON
- Email questions to me (or post questions on ICON). If you email the TA, **always** include (cc) me as well. Do not hesitate to send me email!

THINGS TO BE COVERED TODAY

- Background – welcome to CS2110, and recent developments in computer science
- Goals of this course
- About me
- The syllabus, including details about the work required and grading criteria

Welcome to CS2110!

- This is an exciting time to be a computer scientist! Computing and *computational thinking* is becoming part of all aspects of life:
 - Healthcare, Biology, Pharmacy, Biomedical Engineering
 - Economics, Finance
 - Sociology, Psychology
 - Physics, Astronomy
 - Music, Film
 - Humanities (e.g. Digital Humanities Initiative at UI)

Core Computer Science areas are full of exciting developments and activity

- Machine learning, deep learning, AI
 - Image recognition (e.g. Yelp uses machine learning to classify user-submitted restaurant pictures), facial recognition (lots of articles about various governments using/proposing using facial recognition systems... privacy concerns, etc.)
 - Voice recognition (Alexa, Siri, ...)
 - companies want expertise in machine learning to enable “mining” of customer and other data
- Data science (new UI major) and visualization
- Computer graphics, animation, virtual reality (e.g. Oculus Rift, Microsoft Hololens, Google Glass, Magic Leap, ...)
- Human-computer interaction (HCI)
- Networks and distributed computing
- Natural language processing
- Computer vision
- Robotics
- Algorithms

Search Engines

- Exemplify amazing computer science contributions
- Advances in algorithms, networking, distributed computing, machine learning all combine to support
 - *millions of simultaneous searches of*
 - *billions of web pages, with*
 - *responses in milliseconds*
 - *[“The Friendship that Made Google Huge](#). Coding together at the same computer, Jeff Dean and Sanjay Ghemawat changed the course of the company—and the Internet.”*

Just a few other recent developments

- [IBM's Watson defeated the best human Jeopardy players in 2010](#) – substantial progress in natural language understanding
- In 1997, IBM's Deep Blue became first computer to beat reigning world chess champion.
- In 2016, [AlphaGo surprised many experts](#) by becoming first computer program to defeat a top professional Go player (Lee Sedol, ranked #2 in international titles). [Movie](#)
- But then, in 2017 [AlphaGO Zero](#) and [AlphaZero](#) easily defeated AlphaGO as well as the chess and shogi programs.
- Dec, 2018: [AlphaZero paper in top journal Science](#). “One program to rule them all”
- 2019: [AlphaStar](#), grandmaster level for StarCraft II real-time strategy video game
- Microsoft Kinect sensor – add-on for Xbox gaming console. Very impressive technology for \$149. Distance and color sensors plus algorithms enabling detailed tracking of 20+ joints of 6 humans at once
- [autonomous vehicles](#) Major advances in AI (deep learning), sensing (don't hit people, animals, stuff!), etc.
- [Blockchain](#) and cryptocurrency: Bitcoin, Ethereum, Litecoin, and many more. Blockchain – essentially a secure distributed ledger – is expected to be used for many things beyond just currency
- Machine learning/deep learning is everywhere: facial recognition systems, Siri/Alexa/OK Google, traffic prediction, social media personalization, product recommendations, credit card fraud detection, medical diagnoses, machine translation, automatic new article creation, ...

This Course

- This course has one primary goal - to provide a core of computer science programming concepts and skills, and enough practice using them, that students will develop confidence in their ability to think computationally and to solve problems via programming.
- Beyond basic programming concepts, the course provides an introduction to object-oriented programming, algorithmic design and analysis, web programming, and graphical user interfaces.
- CS is much more than programming but this is a skills oriented programming course rather than a broad overview of CS. It teaches programming principles necessary for more advanced work in the Computer Science. CS1020 and CS1110 provide broader introductions to the overall field of Computer Science.

Me

- 28 years at Iowa. PhD from Cornell University, 1989. Lived many places before that - 13 in 17 years, all over US and also in Europe.
- Teaching: data structures, computer graphics, virtual reality, algorithms. Most recently have regularly taught iOS/iPhone/iPad App Development class (incl joint class with Vietnam), and CS 1: Fundamentals (a lot like this course).
 - Two semesters teaching in Hanoi
- Research: previously, the [Hank VR research group](#). Now, the [Computational Epidemiology group](#). E.g. [“Gamifying Accelerometer Use Increases Physical Activity Levels of Sedentary Office Workers”](#), [“More than Just a Game? A Randomized Controlled Trial of Pokèmon Go on Physical Activity Habits”](#), [“Using Computer Vision and Depth Sensing to Measure Healthcare Worker-Patient Contacts and Personal Protective Equipment Adherence Within Hospital Rooms”](#)
- Outside of work: when not hanging out at home, I’m somewhere in the world riding an [ElliptiGO](#)







ICON/the syllabus/course website

- ICON: used for four things
 - Providing links to Zoom lectures and lecture recordings
 - Submitting homework
 - Posting/reading questions about assignments/lectures (Piazza link in ICON)
 - Posting all scores/grades
- Syllabus and all course announcements, homework assignments, and lectures notes will be posted on external course website: <http://homepage.cs.uiowa.edu/~cremer/courses/cs2110/>

The rest of today's lecture discusses the information on the course website.

- Many people find this course difficult. I believe that if you work at it steadily, not just last-minute, you can do well without suffering.
- The course can be very rewarding – from (for some of you) no programming skill to real confidence and ability to make computer do cool stuff for you.
- Come to class, do your own work, read and think (very valuable before sitting keyboard programming), work hard on the homeworks. If you do the homeworks well, the exams will take care of themselves.

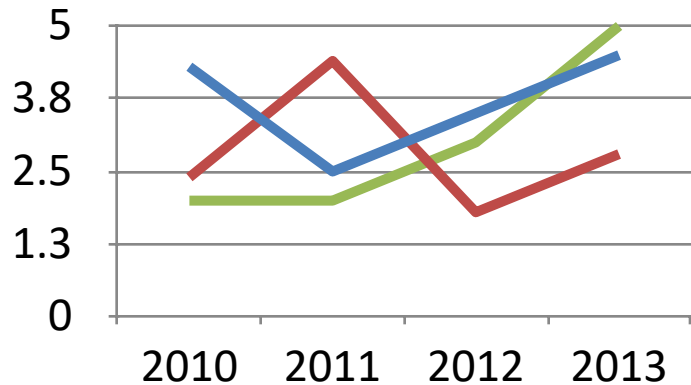
Before next time:

- Read/do: Chapter 1 of the text. It is short and easy.
- Do: Install Python on your machine. Evaluate some Python code in the interpreter. Ask for help during discussion sections tomorrow (via Zoom)

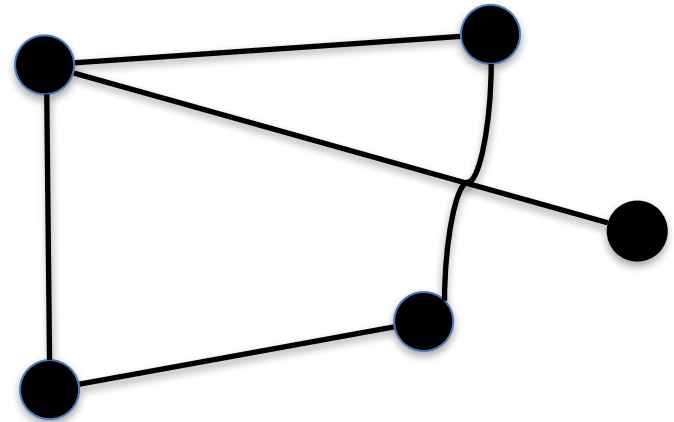
Next time: beginning Python, some interesting problems

To think about: *examples of computational complexity*

- Euler vs Hamiltonian circuits and [TSP](#). *Graphs* in computer science: different notion than the graphical plots taught in high school



vs.



- Can you find a path that traverses every edge (connection) exactly once?
- Can you find a path that visits every node (vertex) exactly once?
- If the edges are assigned “weights” (representing distance/cost to traverse), can you find path of minimum cost that visits every node exactly once?
- If the edges are assigned weights, can you find minimum cost path between two particular nodes?

Are these similarly computationally hard or easy?