CSC110 Lecture 32: Wrapping Up and Looking Ahead

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*Navigation tip for web slides: press **?** to see keyboard navigation controls.*

Announcements and Today's Plan

Announcements

- Please complete the PythonTA Survey 2
  - Due December 8
- Final exam info has been posted
  - Regular office hours end after today
  - Additional office hours will begin on Friday
- Please complete our Course Evaluation to help make CSC110 better next year!


JOIN US FOR
DCS Exam De-Stress Event
COME FOR SOME HOT COCOA, GINGERBREAD DECORATING, AND GAMES!
WEDNESDAY, DECEMBER 7, 2022
BA3200
2 - 4 PM

Today's objectives

1. Review information about the final exam
2. Share some study strategies and test-taking strategies
3. Review some big takeaways from CSC110
4. Look ahead to CSC111

Final Exam Info

Final Exam Info Page (Quercus link)

Location and time: see Faculty of Arts & Science webpage

Cover page and **reference sheets** have been posted!

Additional Office Hour Schedule has been posted!

Test content

- Covers Chapters 1 to 11—the entire course!
- Lecture 31 (yesterday) is not covered
- Questions will target all parts of the course
- Slight focus on Chapters 9-11; Weeks 8-11

Test format

Very similar to term tests:

- **eight** questions total
- mixture of short answer, programming, proof, and running-time analysis questions
- vary in difficulty, but overall a bit more challenging than the term test questions—assessing a higher level of mastery of course material

Advice: Studying for the final exam

1. When **reviewing material**, be active!
    - Take notes, summarize, write down questions, make connections to other concepts
2. When **doing practice questions**:
    - If you get stuck, write down the progress you've made and what you're stuck at, and ask for help
    - If you finish a question, practice checking your work
    - Try to identify patterns and structure in questions—and then create your own
3. Practice completing questions in a test-like environment
    - Practice writing code on paper
    - Use a watch and keep track of time

Advice: Taking the final exam

1. Get a good night's sleep, and eat well before the exam.
2. Treat the test paper as a priority queue, not a queue.
    - Skim the entire test and identify the questions you feel most confident in, and do those first
3. Bring a non-smart watch and keep track of time during the test.
    - Be careful not to spend too much time on any one question!
4. If you get stuck, don't be afraid to move onto the next question.
    - You can still get partial credit for an incomplete solution.

Big Takeaways from CSC110

The four “layers” of a computer program

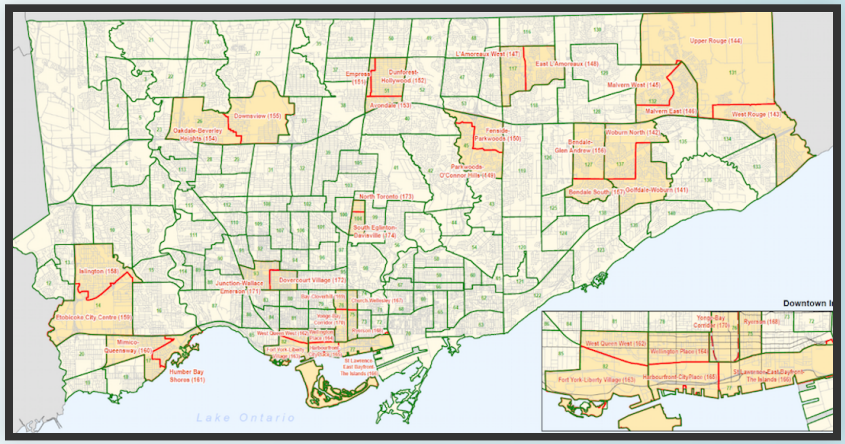
Data

Algorithms

User interface

Social impact

Computing with data (what we've done)



Computing with data (what's to come)

Data is everywhere!

At U of T:

- STA130 and the Data Science Specialist program
- Look for computational positions at research labs across U of T

Online:

- Look for "X" datasets or "X" API (Application Programming Interface)
- Shout out: Data is Plural weekly newsletter

Developing technical skills:

- Data science Python libraries: numpy, pandas, SciPy, plotly

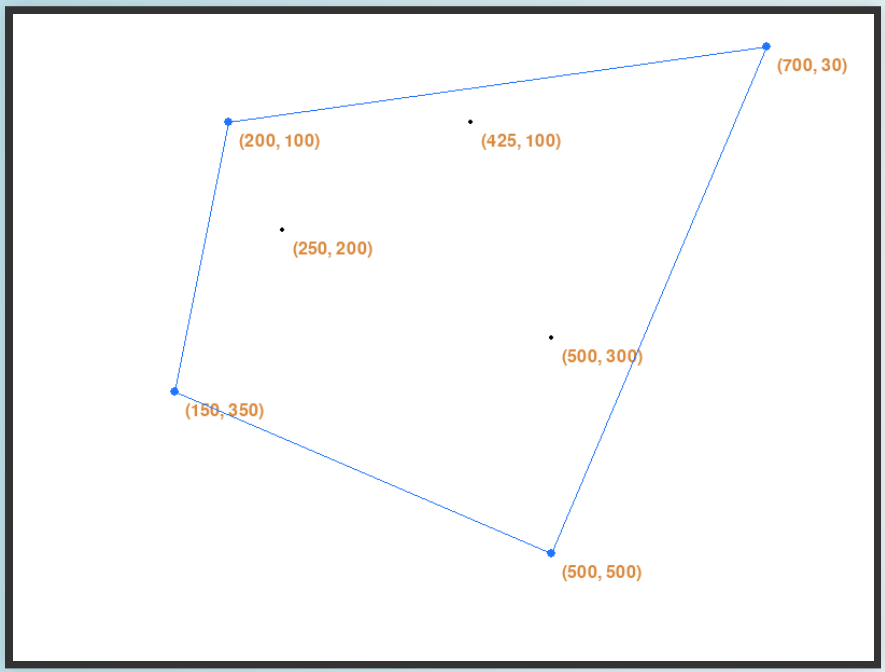
Processing Data: Algorithms (what we've done)

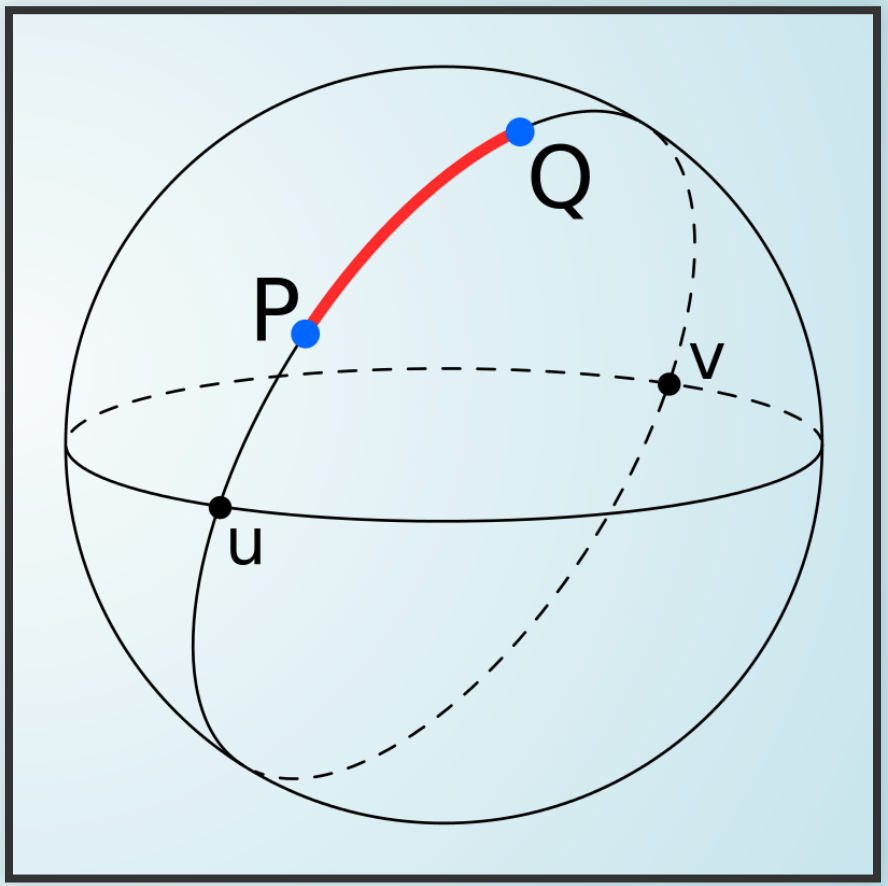
Iteration	x	y
0	124124124	110
1	110	14
2	14	12
3	12	2
4	2	0

1. g, p
2. a; $A = g^a \% p$
3. b; $B = g^b \% p$
4. $k_A = B^a \% p$; $k_B = A^b \% p$

1. (n, e), (p, q, d)
2. $c = m^e \% n$
3. $m' = c^d \% pq$

Processing Data: Algorithms (what we've done)





Processing Data: Algorithms (what's to come)

Every area of computer science requires complex algorithms:

- Artificial intelligence and machine learning
- Computer graphics
- Scientific computing and numerical modeling
- Any time you want to store and analyze data efficiently

Many future courses will explore these domains!

Programming in Python

Data: data types, literals, operators, comprehensions, data classes; object mutation

Functions: built-in functions and methods; defining functions

Control flow: if statements, for loops, while loops; raising exceptions

Modules: import statements; `math`, `datetime`, `random`; `doctest`, `pytest`, `hypothesis`, `python_ta`

Class design: defining an initializer and other methods; inheritance

But writing professional software isn't just about knowing how to write code...

From programming to software engineering

"Software engineering" encompasses not just the act of writing code, but all of the tools and processes an organization uses to build and maintain that code over time. What practices can a software organization introduce that will best keep its code valuable over the long term? How can engineers make a codebase more sustainable and the software engineering discipline itself more rigorous?

–Software Engineering at Google: Lessons Learned from Programming Over Time (Titus Winters, Tom Manshreck, Hyrum Wright)

Software Engineering (what we've done)

You've gotten practice with many stages of the software development process:

1. Designing data types and functions for a program.
    - Creating logical specifications for data types and functions (preconditions, representation invariants)
    - Breaking down a problem domain into various classes and functions (food delivery)
2. Implementing these data types and functions in Python.
    - Using programming building blocks
    - Learning some libraries

Software Engineering (what we've done)

3. Debugging and testing your code.
    - Using the PyCharm debugger
    - Using `doctest`, `pytest`, and `hypothesis`
4. Analysing your code...
    - for efficiency (running-time analysis)
    - for good code design and style (`python_ta`)

Software Engineering (what's to come)

Upper-year CS courses will go deeper into:

- software design and specification (e.g., CSC207, CSC301, CSC410)
- programming techniques, patterns, and programming language design (e.g., CSC324, CSC367)

Many of these courses are project-based, so you'll get experience with general software engineering skills:

- communication!
- breaking down a project into tasks and milestones
- using version control to track changes and collaborate with teammates on shared code

Mathematical logic and proof

Mathematics gave us tools for precisely representing data and reasoning about code:

- Preconditions and representation invariants
- Loop invariants and assert statements
- Big-O/Omega/Theta notation, running-time analysis

Mathematical theory and proofs formed the basis of several algorithms:

- Formulas like Euclidean distance
- Prime number checking
- The Euclidean Algorithm
- Cryptosystems

Looking Ahead to CSC111

CSC111 at a glance

CSC111 is a direct continuation of CSC110.

- A regular half-course: 3 lecture hours and 2 tutorial hours per week
- Less work, but topics are more advanced
- Same overall structure and themes as CSC110
- Builds on material from CSC110

Topics include:

- Designing and implementing new data structures (linked lists, trees, graphs)
- New algorithms and algorithm analysis (including sorting!)
- Induction (the proof technique) and recursion (the programming technique)
- Digging deeper into the Python programming language

Questions? Comments?


CSC110
is ending
We'll see
each other
again in
CSC111!
imgflip.com

Thank you for being a great class! Good luck with the final exam, and see you in CSC111!