Welcome!

CSC 320 – Spring 2024

Lecture 0 - Introduction

Today

Why are we here?

Logistics

Algorithms!

Why?

- The design and analysis of algorithms is **fundamental** to every branch of computer science

- Algorithms play a key role in modern technological innovation

- Applications
- Designing software
- Understanding the universe
- Challenging (i.e. good for the brain!) and *FUN!*

Driving Innovation

See "Progress in Algorithms Beats Moore's Law" excerpt (Github).

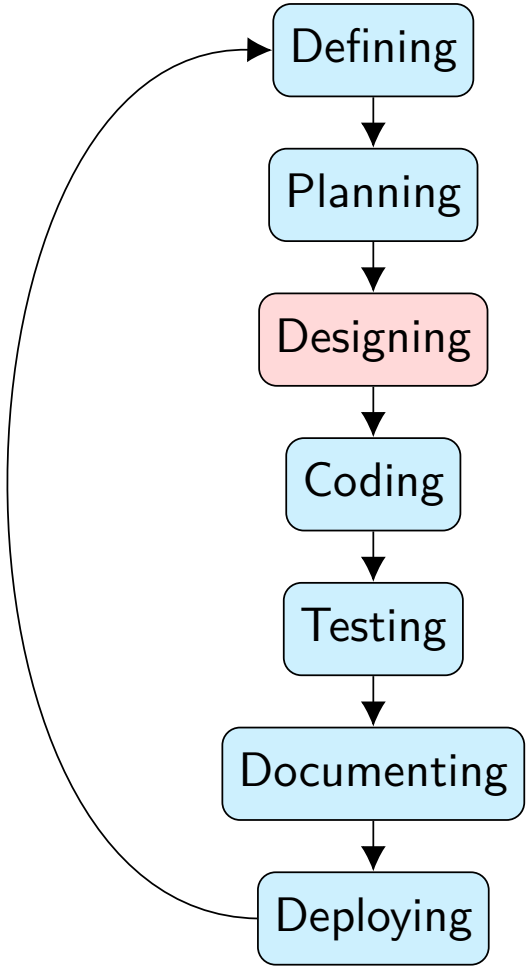
… Even more remarkable – and even less widely understood – is that in many areas, performance gains due to improvements in algorithms have vastly exceeded even the dramatic performance gains due to increased processor speed…

… The design and analysis of algorithms, and the study of the inherent computational complexity of problems, are fundamental subfields of computer science.

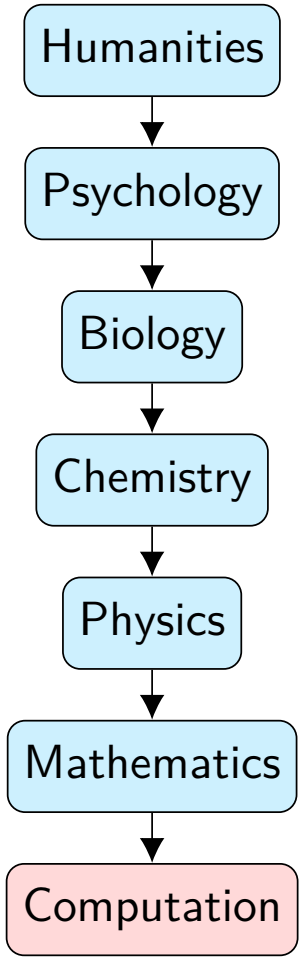
Applications

Field/application	Algorithms
Google Search	Ranking/relevance algorithms
Internet routing/Google Maps	Shortest path algorithms
Secure emails/ecommerce	Cryptographic algorithms
Pharmaceuticals	Computational biology algorithms
Movie graphics	Geometric algorithms
Stock market prediction	Machine learning algorithms
Image processing	Computer vision algorithms
Amazon/Netflix/Facebook	Recommendation algorithms
IBM Watson	Artificial intelligence algorithms
Companies/banks/hospitals	Database algorithms
Physics/chemistry/biology	Simulation algorithms
Compilers	Automata algorithms
Evolution	Evolutionary algorithms
Cooking	Cooking algorithms (recipes)

Designing Software



Understanding the Universe



Providing a novel “lens” on processes outside of CS/technology

- quantum mechanics, economic markets, biological processes

What is this course?

Themes:

- "Design Techniques" – not just "here's an algorithm" but "*here's a way of thinking about a class of algorithms*"

- "Modeling" – In the real world, no one will say "I need you to run Prim's algorithm on this graph" they will say "I need you to choose where to build electrical wires so every town is connected to the power plant as cheaply as possible"

- "Set realistic expectations" – there are some things we (think/know) computers can't do efficiently. How do you recognize these problems?

- "Reductions" – if you've already solved a problem, don't solve it again (reuse ideas) and if you know you can't solve a problem, what else can't you solve.

Logistics

Syllabus

Let’s go!

Activity Worksheet