CS 2800: Discrete structures

Today:
- introductions
- key skills: definitions, proofs, abstraction
- discrete structures:
  - sets, functions, relations
  - number theory
  - automata
- course logistics

- [http://courses.cs.cornell.edu/7cs2800/wiki/](http://courses.cs.cornell.edu/7cs2800/wiki/)
- Professor Michael Georgiadis
  - combinatorics
  - probability
  - metalogic
What is CS2800?

- How to be right about stuff (think)
- How to convince others that you’re right.

Key Skills:

- Writing/use definitions
- Writing proofs
  - Proof is an argument
  - Start with what’s agreed on/obvious
  - Small step-by-step arguments
  - End with desired non-obvious fact
- Building abstractions so we can write short elegant lemmas & proofs
Prof. George

- 10th semester of 2800

- Also taught:
  - 2110: Object Oriented Prog.
  - 3110: Functional Prog.
  - 4220: Algorithms
  - 44110: Operating systems

- Grad. research:
  - Programming languages
  - Security

{ USE 2800 skills in all of these. }
Discrete Structures

- **Discrete**

  - Discrete means 'separated': No notion of "infintesimally close" or "limit"  
    - Exs: programs, networks, integers, lists, people, ...

- Sets, Functions (fn), relations (rel)
  - basic tools
  - how many are there, how big is infinity?
- Number theory
  - different representations of integers, introduce "modular"?
  - applications in encoding, digital logic, encryption.
  - we'll cover cryptography.
- Automata theory
  - model computers (programs)
  - applications in computability theory, networks,
  - we'll cover regular expressions.

- Combinatorics
  - how big is a set?
  - applications in algorithm analysis
- Probability
  - estimating likelihood of events
  - applications in machine learning, algorithm development, many others...
  - we'll build up to hashing: key algorithm in many systems
- Metalogic
  - use logical tools to analyze logic
  - applications in programming languages
Logistics

Lecture etiquette:
- No screens in lecture.
- No whispering.
- Ask questions!
- Give feedback.

Homework:
- Plan 1/2 hour per lecture for review.
- Weekly HW, due Monday @ 5PM.

Grading:
- Grade on A/B/C scale per problem.
- Don't translate directly to A/B/C course grades.
- I'll release course grade estimates after each prelim.

2802 (Honors version)
- Assumes some familiarity with proof techniques.
- Covers more material, assumes you'll glean things from reading, etc.

Academic integrity:
- You MUST write your own solutions, without reference to discussion notes.
- You MUST NOT consult solutions to these or similar problems from any source.
- You are ENCOURAGED to discuss the problems with classmates, but throw out your notes before writing your solution, and never share your solution.