What is “discrete structures”? 

- Often called “discrete math”
- The mathematical tools that underlie computer science
- Discrete Math : Computer Science :: Calculus : Physics
What is “discrete structures”?

- Formal logic
- Basic probability and statistics
- Sets, functions, relations
- Automata
- Number theory
- Graphs
What is “discrete structures”?

- Formal logic
  - Software construction
  - Algorithm design and analysis
  - Security
- Basic probability and statistics
- Sets, functions, relations
- Automata
- Number theory
- Graphs
What is “discrete structures”?

- Formal logic
- Basic probability and statistics
  - “Big data”
  - Machine learning
  - Information theory
- Sets, functions, relations
- Automata
- Number theory
- Graphs
What is “discrete structures”?

- Formal logic
- Basic probability and statistics
- Sets, functions, relations
  - Databases
  - Functional programming
- Automata
- Number theory
- Graphs
What is “discrete structures”?

- Formal logic
- Basic probability and statistics
- Sets, functions, relations
- Automata
  - Compilers
  - Network protocols
  - Games and animations
  - Nature of the universe
- Number theory
- Graphs
What is “discrete structures”?

- Formal logic
- Basic probability and statistics
- Sets, functions, relations
- Automata
- Number theory
  - Cryptography
  - Geometry
- Graphs
What is “discrete structures”?

- Formal logic
- Basic probability and statistics
- Sets, functions, relations
- Automata
- Number theory
- Graphs
  - Social networks
  - AI, planning
  - Networking
What is “discrete structures”?

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- Sets, functions, relations
- Automata
- Number theory
- Graphs

Important foundations for computer science
What is this course really about?

Math = Computation?
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Math = Computation?

Formal, step by step reasoning (proofs)
  ▶ Distinguishing good arguments from bad
  ▶ Clearly stating definitions
    ▶ ... and sticking to them!
  ▶ Tools for avoiding being wrong
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Math = Computation?

Formal, step by step reasoning (proofs)

▶ Distinguishing good arguments from bad
▶ Clearly stating definitions
  ▶ ... and sticking to them!
▶ Tools for avoiding being wrong

Reasoning abstractly

▶ Ignore the details of the objects you’re considering; work only with their properties
  ▶ Example: I can add two integers, two real numbers, two strings, two paths on the surface of a donut.
  ▶ Example: I can find shortest paths in a social network, a physical network, the flow of data in a program
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Math = Computation?

Formal, step by step reasoning (proofs)

- Distinguishing good arguments from bad
- Clearly stating definitions
  - ... and sticking to them!
- **Tools for avoiding being wrong**

Reasoning abstractly

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  - Example: I can add two integers, two real numbers, two strings, two paths on the surface of a donut.
  - Example: I can find shortest paths in a social network, a physical network, the flow of data in a program
- Avoids getting bogged down in details
- Lets you reuse work
Course logistics

- Lecture
  - Designed to be useful
  - Some from Prof. George, some from Prof. Chaudhuri
  - **Please no laptops.**
Course logistics

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- Weekly problem sets (≈40%)
  - Released Monday, due Monday at noon
  - Judged on **clarity** and **correctness**
  - Usual rubric:
    - 3: correct and clearly explained
    - 2: important error
    - 1: misunderstanding of key concept
    - 0: blank
Course logistics

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- **Exams**
  - Two (in class) prelims (≈15% each), on final (≈25%)
Course logistics

- No textbook
  - But see Rosen or Pass and Tseng (links on website)
  - Lecture notes and additional readings will be posted

- Website, CMS, Piazza
  - http://www.cs.cornell.edu/Courses/cs2800
  - Please use Piazza for all communication with course staff
  - CMS not populated yet

- Lots of office hours!
  - Starting next week.
  - Schedule posted on Piazza

- Study sessions highly encouraged
Collaboration

Expectations:
▶ You are encouraged to work together, but
▶ ... All submitted work **must** be your own

Encouraged:
▶ “Let’s work together on problem 3”

Disallowed:
▶ “What did you write for problem 3?”

Rule of thumb:
▶ You should be able to reproduce the paper you turned in without consulting your notes