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”?

- Probability and Statistics
- Sets, Functions, Relations
- Formal Logic
- Automata
- Number Theory
- Graphs
What is “Discrete Structures”?

- Probability and Statistics
  - “Big data”/machine learning
  - Information theory
  - …
- Sets, Functions, Relations
- Formal Logic
- Automata
- Number Theory
- Graphs
What is “Discrete Structures”?

- Probability and Statistics
- Sets, Functions, Relations
  - Databases
  - Functional programming
  - …
- Formal Logic
- Automata
- Number Theory
- Graphs
What is “Discrete Structures”? 

- Probability and Statistics
- Sets, Functions, Relations
- Formal Logic
  - Logical circuits
  - Formal program verification
- Automata
- Number Theory
- Graphs
What is “Discrete Structures”?

- Probability and Statistics
- Sets, Functions, Relations
- Formal Logic
- Automata
  - Games
  - Network protocols
  - Compilers
  - Nature of the universe
  - ...
- Number Theory
- Graphs
What is “Discrete Structures”? 

- Probability and Statistics 
- Sets, Functions, Relations 
- Formal Logic 
- Automata 
- Number Theory 
  - Cryptography 
  - Geometry 
  - ... 
- Graphs
What is “Discrete Structures”?

- Probability and Statistics
- Sets, Functions, Relations
- Formal Logic
- Automata
- Number Theory
- Graphs
  - Social networks
  - AI, planning
  - Routing
  - ...
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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?

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▶ 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
What is this course really about?
Math = Computation?

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- Distinguishing good arguments from bad
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  - and sticking to them!
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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 your work
Course Logistics

- Lecture
  - Designed to be useful
  - Some from Prof. George, some from Prof. Chaudhuri
  - Please no laptops.
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- Problem Sets (weekly)
  - released Friday, due Friday (5:00 PM), graded Monday
  - judged on clarity and correctness
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▶ Problem Sets (weekly)
  ▶ released Friday, due Friday (5:00 PM), graded Monday
  ▶ judged on clarity and correctness

▶ Exams
  ▶ Two prelims (in class), one final

▶ Textbook
  ▶ No textbook
  ▶ May wish to consult “Discrete Mathematics and its Applications” by Rosen

▶ Website, CMS, Piazza
  ▶ http://www.cs.cornell.edu/Courses/cs2800/2014fa
Academic Integrity

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

Encouraged:
- Let’s work on problem 3 together

Disallowed:
- How did you do problem 3?

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