CS2800
Discrete Structures

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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

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- Formal logic
- Basic probability and statistics
- Sets, functions, relations
- Automata
- Number theory
  - Cryptography
  - Geometry
- Graphs

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- Sets, functions, relations
- Automata
- Number theory
- Graphs
  - Social networks
  - AI, planning
  - Networking

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Important foundations for computer science

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Math = Computation?

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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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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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- 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
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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
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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