

# CS 2800

## Discrete Structures

Professor George    Professor Chaudhuri

Fall 2014

# 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

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- ▶ 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

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- ▶ Probability and Statistics
- ▶ Sets, Functions, Relations
- ▶ Formal Logic
- ▶ Automata
- ▶ Number Theory
  - ▶ Cryptography
  - ▶ Geometry
  - ▶ ...
- ▶ Graphs



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- ▶ Sets, Functions, Relations
- ▶ Formal Logic
- ▶ Automata
- ▶ Number Theory
- ▶ Graphs
  - ▶ Social networks
  - ▶ AI, planning
  - ▶ Routing
  - ▶ ...

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Formal, step by step reasoning (proofs)

- ▶ Distinguishing good arguments from bad
- ▶ Clearly stating definitions
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- ▶ **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 your work

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- ▶ 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.