CSE 1107
Discrete Mathematics

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What is Discrete Mathematics?

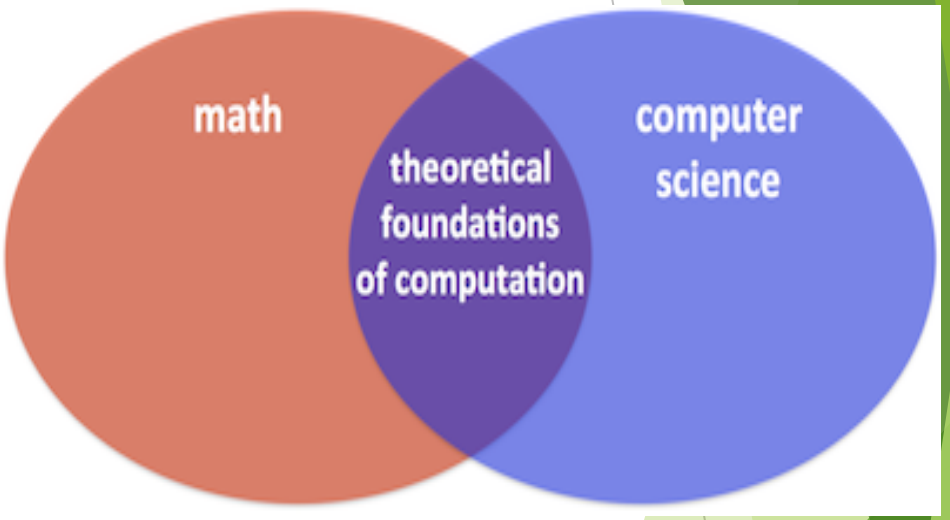
Computer Science: use computer technology to solve problems.

Many courses in our curriculum will talk about computer technology.

This course will ***provide the mathematical foundation to solve problems***,

e.g. to design a security system, to design a fast searching algorithm,

to analyze algorithms rigorously (e.g. pagerank and linear algebra), etc.



What does Discrete Mathematics tell about?

Continuous vs. Discrete Math

Why is it in computer science?

Mathematical techniques for DM

Discrete vs. Continuous Mathematics

Continuous Mathematics

It considers objects that vary **continuously;**

Example: **analog wristwatch** (separate hour, minute, and second hands).

From an analog watch perspective, between 1 :25 p.m. and 1 :26 p.m.

there are infinitely many possible different times as the second hand moves around the watch face.

Real-number system --- core of continuous mathematics;

Continuous mathematics --- models and tools for analyzing real-world phenomena that change smoothly over time. (Differential equations etc.)

Discrete vs. Continuous Mathematics

Discrete Mathematics

It considers objects that vary in a **discrete** way.

Example: **digital wristwatch.**

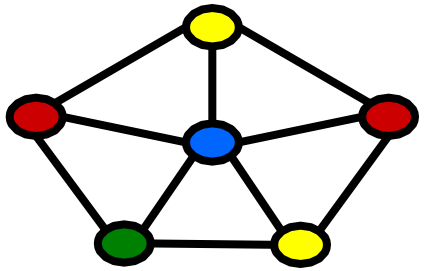
On a digital watch, there are only finitely many possible different times between 1 :25 P.M. and 1:27 P.M. A digital watch does not show split seconds: - no time between 1 :25:03 and 1 :25:04. The watch moves from one time to the next.

Integers --- *core of discrete mathematics*

Discrete mathematics --- models and tools for analyzing real-world phenomena that change discretely over time and therefore ideal for studying

computer science – computers are digital! (numbers as finite bit strings; data structures, all discrete! Historical aside: earliest computers were analogue.)

Discrete Mathematics vs. Continuous Mathematics



discrete mathematics	continuous mathematics
integers	real numbers
graphs	geometric space
induction	calculus
logic	

These two areas are not disjoint, e.g. calculus can be used to solve discrete problems (generating functions).

Why is it in computer science?

- The conceptual center of computer science is the **ALGORITHM**.
- Discrete Math helps provide…

  …the machinery necessary for creating sophisticated algorithms

  …the tools for analyzing their efficiency

  …the means of proving their validity

Why is it in computer science?

- In computer science we usually deal with finite, discrete objects.
  - For example, we cannot store a real number (infinite precision) in a computer but can only store bits (finite precisions).
  - We often model a computer network as a graph, and use the knowledge and techniques in dealing with graphs to solve problems in networks.
  - The problems and the techniques are often different (e.g. induction, recursion).

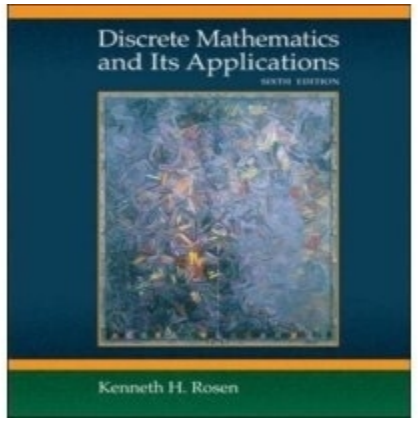
Why is it in computer science?

- Although the point of CSE-1107 is to provide the tools for creating and analyzing sophisticated algorithms, we won't focus on the algorithmic aspect, rather we will focus on the tools or discrete structures.
- This course covers elementary discrete mathematics for computer science and engineering.

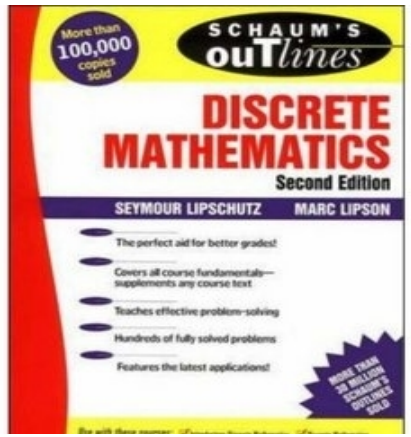
Mathematical techniques for DM

- Review of functions, sets cardinality connectives
- Prepositional calculus and predicate calculus
- Proofs techniques
- Mathematical Reasonic: Induction, Contradiction and recursion
- Elementary Number Theory
- Counting and Combinatorics
- Graph and trees
- Group : Basic algebra in groups ,cyclic group

Textbook



Discrete Mathematics and Its Application
By Seymour Kenneth H. Rosen



Discrete Mathematics
By Seymour Lipschutz and Marc Lipson

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Any Question


Thank
You