Discrete Structures

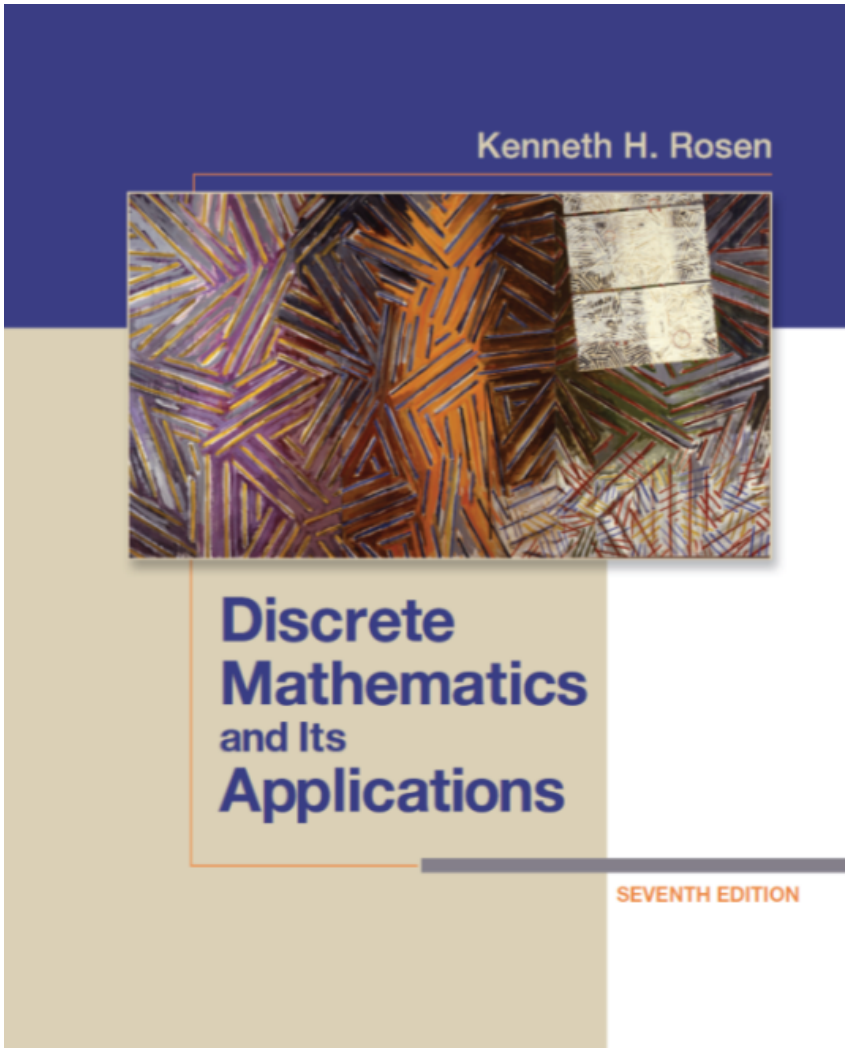
Heather M. Michaud

Textbook

Kenneth H. Rosen

Discrete Mathematics and Its Applications,

7th edition, McGraw-Hill



Also available as PDF

Course Requirements

Attendance	5%	
Quizzes	20%	
Homework	20%	
Midterm Exam	25%	Wednesday, March 2nd 9:15-10:30am
Extra Credit Problems	2-5%	TBD
Final Exam	30%	Wednesday, May 11th 10:15-12:30pm

Course Requirements

Exams

- Closed book, closed notes

Homework:

- ~10 assignments
- will be announced in class and posted on the course website

Office Hours

- Monday and Wednesday, 11am-12pm
  - or by appointment
- Room 352 Math and Science Building

Course Site & Contact

- Course site
  - web.cs.kent.edu/~hmichaud/discrete
  - slides
  - homework
  - important dates
- Contact
  - hmichaud@kent.edu
  - put “Discrete Structures” somewhere in the subject

Tips

Homework… Do it!

- Do it by yourself.
- If you do it in groups… do it it small groups.
  - Try it on your own first.
  - Discuss approaches, not solutions.
  - Do not copy.
- Explain your answers.

General

- Come to class
- Do the odd numbered problems at the end of each section
  - The solutions are in the end of the book
- Ask questions

Discrete Mathematics

What is Discrete Mathematics?

Discrete mathematics is the study of mathematical structures that are fundamentally discrete rather than continuous.

Discrete

- given any two numbers, there isn't an infinite set in between them
- finite set, countable

Examples

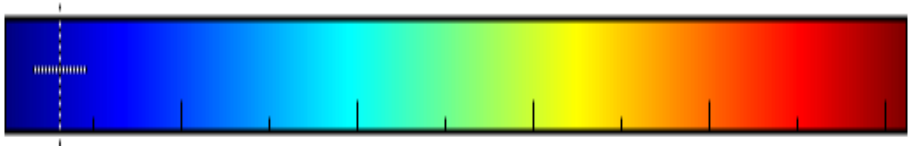
- number of students
- number of languages you speak

Continous

- given any two numbers, can always find numbers in between
- infinite set, measurable

Examples

- height of a person
- speed of a car



Why Discrete Math?

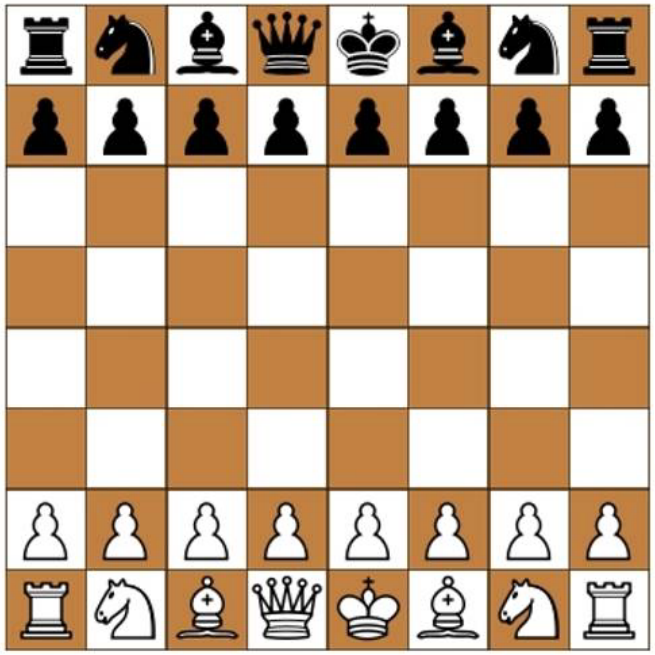
- Design efficient computer systems.

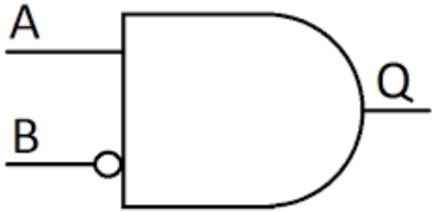
Topics in Discrete Math

- Logic - artificial intelligence (AI), circuit design, puzzles
- Counting - probability, analysis of algorithm
- Graph theory - computer network, data structures, path finding
- Number theory - cryptography

Topic 1. Logic & Proofs

- Logic: propositional logic, first order logic
- Proof: induction, contradiction
- Artificial intelligence, database, circuit, algorithms





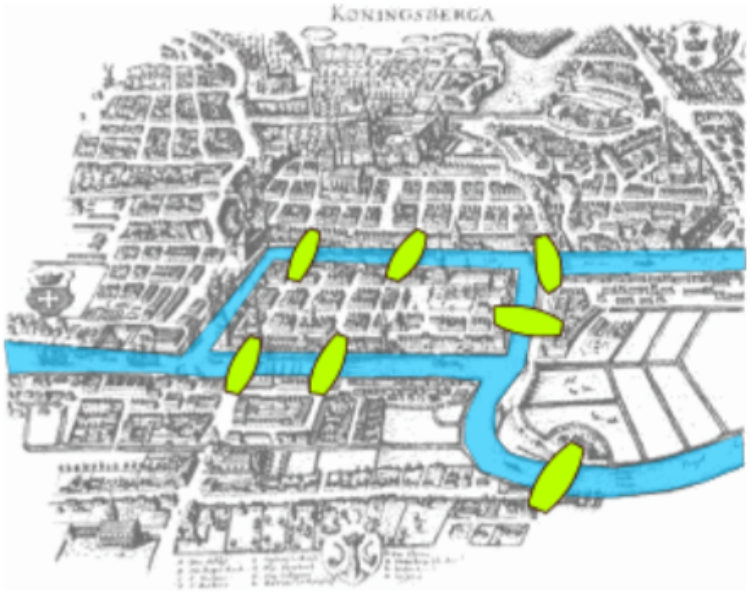
5	3			7				
6			1	9	5			
	9	8					6	
8				6				3
4			8		3			1
7				2				6
	6					2	8	
			4	1	9			5
				8			7	9

Topic 2. Counting

- How many combinations/permutations exist?
- How many steps are needed to sort *n* numbers?
- Sets
- Combinations, Permutations, Binomial theorem
- Functions
- Counting by mapping, pigeonhole principle
- Recursions, generating functions
- Probability, algorithms, data structures

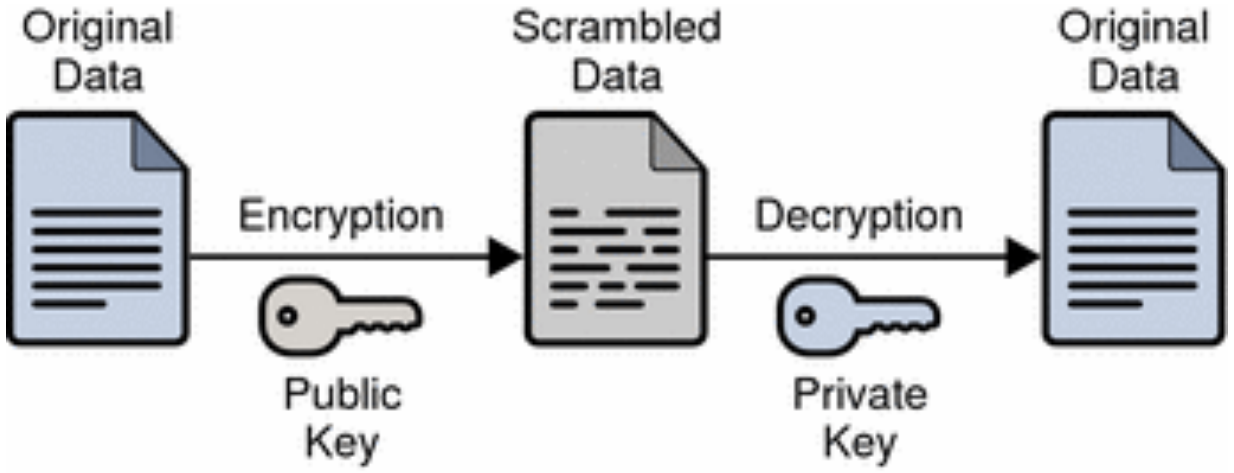
Topic 3. Graph Theory

- What's the best path?
- Relations, graphs, trees
- Degree sequence, isomorphism, Eulerian graphs
- Computer networks, circuit design, data structures

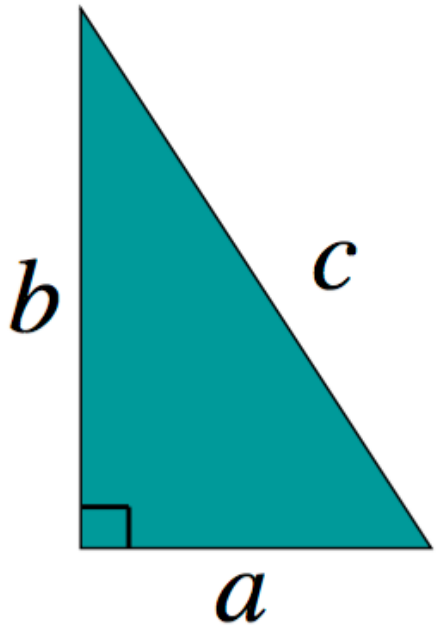


Topic 4. Number Theory

- Number sequence
- Euclidean algorithm
- Prime number
- Modular arithmetic
- Cryptography, coding theory, data structures



Pythagorean Theorem



- Familiar?
- Obvious?

$$a^2 + b^2 = c^2$$

http://www.cut-the-knot.org/pythagoras/index.shtml