SAKARYA ÜNİVERSİTESİ

Discrete Mathematics
LECTURE 1
Class Overview

Assistant Professor Gülüzar ÇİT

Outline

- Class Information & Materials
- Academic Honesty
- Requirements of the Class
- Objectives of the Class
- Contents of the Class
- Recommended Resources

Class Information & Materials

- **Lecturer**
  - Assistant Professor Gülüzar ÇİT
- **Assistant**
  - Research Assistant Nagihan Çekiç
- **Syllabus**
  - Monday
    - 13.00-16.00
    - teorical information
    - exercises

Class Information & Materials…

- **Lecture Evaluation**
  - Midterm – **60%**
    - Quizzes
    - Midterm Exam
  - Final Exam – **40%**

Class Information & Materials…

- **Lecture Evaluation…**
  - **Quizzes**
    - 4 quizzes
    - each one is %10 of midterm evaluation
    - will be (un)announced
  - **Midterm Exam**
    - 60% of midterm evaluation
    - most probably at 8th week of the semester
    - face-to-face
  - **Final Exam**
    - between January 9 and 22
    - face-to-face
  - **no "make-up exam"**

Objectives of the Class

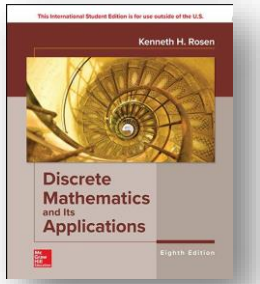
- Discrete mathematics is the mathematics underlying almost all of computer science.
- provides the mathematical background needed for many computer science courses
  - Computer network
    - designing high-speed networks and message routing paths,
  - Optimization
    - finding good algorithms for matching
  - Data Structures
    - searchig in trees
  - Cryptology
    - designing cryptographic protocols, etc.
- teach some basics of mathematics
- analyse basic algorithms
- develop algorithmic thinking skills

Contents of the Class

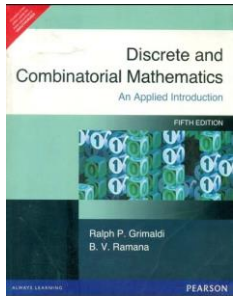
- Logic
- Sets
- Functions
- Sequences & Sums
- Proofs
- Induction & Recursion
- Counting
- Relation
- Graphs
- Trees
- Matching
- Cryptology

Recommended Resources

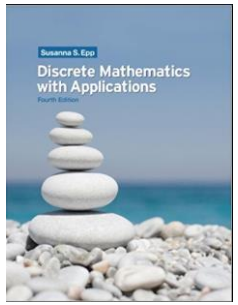
- K.H. Rosen, Discrete Mathematics and Its Applications, Seventh Edition, Mc Graw Hill, 2012.



- R.P. Grimaldi, B.V. Ramana, Discrete and Combinatorial Mathematcics - An Applied Introduction, Fifth Edition, Pearson, 2003.



- S.S. Epp, Discrete Mathemtics with Applications, Fourth Edition, 2010.



Discrete Mathematics

- field of mathematics
- study of **discrete objects** of mathematics
  - integers
  - process steps executed by a computer program
  - detecting different ways to get from A to B on a map
- deals with the solution of a problem with finite possible states.

- Why we study discrete mathematics in computer science?
  - directly help us write programs
  - it is the mathematics underlying almost all of computer science
    - designing high-speed networks and message routing paths
    - finding good algorithms for sorting
    - performing web searches
    - analysing algorithms for correctness and efficiency
    - formalizing security requirements
    - designing cryptographic protocols

Discrete Mathematics…

- sample questions that can be solved with discrete mathematics
  - calculating the number of many ways that a password be selected according to predefined rules?
  - calculating the number of valid Internet addresses?
  - calculating the probability of winning the lottery with three full tickets?
  - determining whether there is a connection between two specific computers on a network, or not?
  - encrypting/decrypting a message
  - constructing a circuit that adds two integers?
  - finding the shortest path between two cities using a transportation system?
  - finding the shortest path from a group of cities that visits each one only once and finishes the tour in the starting city?
  - proving of a prime number is a positivite integer number that is only divided by one and itself?
  - sorting a list of words alphabetically?

Discrete Mathematics…

- deals with the solution of a **problem** with finite possible states.
  - Existence problem
    - the question of whether a solution to a given problem exists.
  - Counting problem
    - we know that there is a solution, but we want to know how many
  - Optimization problem
    - The situation where the best solution is desired

Discrete Mathematics…

- Four married couples play mixed and double tennis matches on two courts every Sunday evening. They change their partners and opponents every half hour within two hours of playing time. Is there a fixture where each man plays with and against each woman at least once and plays at least once against each other man?

Existence Problem

- A six-person investment club wants to change their chairman and accountant positions on a rotating basis every year. How many years must pass before the same people come to the same positions? The problem here can be thought of as the counting problem.

Counting Problem

Discrete Mathematics…

- Three employees at a workplace, Azra, Beril and Cenk, receive 10 million, 12 million and 15 million hourly wages, respectively. The boss has 3 separate jobs to give these people. The table shows how long it will take each person to complete these tasks. What job should the boss assign to each of them so that they pay the least overall?

Optimization Problem

	Azra	Beril	Cenk
Work 1	7,5	6	6,5
Work 2	8	8,5	7
Work 3	5	6,5	5,5

References

- K.H. Rosen, Discrete Mathematics and Its Applications, Seventh Edition, Mc Graw Hill, 2012.
- R.P. Grimaldi, Discrete and Combinatorial Mathematcics, An Applied Introduction, Fifth Edition, Pearson, 2003.
- S.S. Epp, Discrete Mathemtics with Applications, Fouth Edition, 2010.
- N. Yurtay, "Ayrık İşlemsel Yapılar" Lecture Notes, Sakarya University.