Discrete Mathematics (MATH 204)
Sabancı University, Autumn 2021

Lecturer: Michel Lavrauw
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Office: FENS 1015
Lectures: Tue 14:40-15:30; Thu 10:40-12:30
Office Hours: Tue 15:40-16:30 (inform the lecturer by email if you want to meet via Zoom)

Course Information

1. **Course Content**: Introduction to combinatorial problems and techniques. Sets, relations and functions. Graphs, trees. Counting techniques. Recurrence relations and generating functions. Also part of the "core course" pools for the CS, MS, and TE degree programs.

2. **Objectives**: This course aims to introduce basic ideas of discrete mathematics such as formal mathematical reasoning techniques, basic counting techniques, relations, graphs and trees. The course gives students training to develop their mathematical skills, analytical and critical thinking abilities, their ability to apply these capabilities to practical problems, and to communicate their knowledge of these areas.

3. **Recommended or required reading**:
   (a) Textbook:

   - Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw-Hill

   (b) Readings:

   - Ronald L. Graham, Donald E. Knuth, Oren Patashnik, Concrete Mathematics, Addison-Wesley;
   - Alan Tucker, Applied Combinatorics, John Wiley Sons.

4. **Course Outline**:

   - Week 1: Foundations and basic structures (Ch 1, Ch 2)
   - Week 2: Algorithms, Growth of Functions (Ch 3)
   - Week 3-4: Number Theory and Cryptography (Ch 4)
   - Week 5-6: Sequences, Summation, Induction, Recursion (Ch 5)
   - Week 7-9: Counting, solving recurrence relations (Ch 6, Ch 8)
   - Week 10-13: Relations, Graphs and Trees (Ch 9, Ch 10, Ch 11)
   - Week 14: Applications

5. **Learning Outcomes**: On completion of this course the student is expected to:

   - understand the notion of mathematical thinking, mathematical proofs, algorithmic thinking, and able to apply them in problem solving;
   - be able to present simple proofs in a precise and formally correct way;
   - be able to apply various methods of proof like mathematical induction, direct, indirect proofs, proof by contradiction, etc.;
   - understand the basic concept of an algorithm and apply appropriate algorithms to solve problems in combinatorial mathematics;
   - understand asymptotic notation, its significance, and be able to use it to analyze asymptotic performance for some basic algorithmic examples;
   - know the basic definitions from elementary number theory, and be able to apply those to solve problems and prove statements in elementary number theory;

- understand the principle of recursion and be able to apply recursion to the study of sequences and sets;

- be able to solve recurrence relations;

- know the basic properties of relations, graphs and trees;

- understand and apply the principles of counting.

Exam Policy

1. There will be one midterm during the semester (week 7 or 8) and one final exam. Both exams will be in the form of a written exam, in-person, and on campus. Further details will be announced during the lectures and on SUCourse. The total grade will consist of **30% from the midterm and 70% from the final exam**.

2. Exams are closed book. This means that during the exams, the use of books, notes, electronic devices (including cell phones, smart watches, calculators, computers etc.), or any other kind of supporting learning material is **NOT** allowed. A student violating this rule will receive 0 points for that exam. All personal belongings, except necessary writing utensils and student ID, need to be placed at the designated area in the classroom or auditorium. Students who keep their personal belongings within reach (for example, on the chair next to them) will be expelled from the exam room.

Course Policies

1. **Lectures**: Students are responsible for announcements made during the lectures.

2. **SuCourse**: Students are responsible for announcements made on SUCourse.

3. **Homework**: Homework problems will be assigned on a regular basis.

4. **Recitations**: Students must attend the recitation classes to which they are registered.