

MATH 7233: Graph Theory

Northeastern University, Fall 2016

- **Instructor:** Gábor Lippner (email: g.lippner@neu.edu)
- **Time and place:** Mondays/Wednesdays 4:10-5:40pm in (TBA).
- **Office hours:** Mondays 2-3, Wednesdays 1-3, or by appointment; in 547LA, phone ext: 5651.
- **Prerequisites:** No explicit requirements, but knowledge of some linear algebra (eigenvalues, eigenvectors) and basic probability theory will be assumed.
- **Texts:**
 - Handouts (problems sets and solution sheets) during the semester
 - Online lecture notes by Dan Spielman available at <http://www.cs.yale.edu/homes/spielman/561/>
 - *Graph Theory*, R. Diestel. Available freely online at <http://diestel-graph-theory.com/basic.html> (for reference only)
- **Grade:** Based on homework, and occasionally on class participation.

Course description The first half of the semester will be a brief introduction to various classical topics in graph theory. In the second half we will look at linear algebraic methods in more detail. There will be a strong emphasis on problem solving, and learning to give clear explanations both in writing and at the board. A typical lesson will consist of roughly equal parts of a) on-the-spot problem solving in groups, b) discussion of solutions, and c) lecture.

Homework and grading Homework will be assigned and scored throughout the semester. Your grade will largely depend on your homework score. There will be two types of homework, each type contributing 50% to your final score.

- writing up solutions to problems (mostly ones that were discussed in class, but occasionally you will be expected to find solutions by yourself)
- computer assignments in MatLab (e.g. implement an algorithm or method that you learned about, and run it on some kind of data). I will be happy to help with MatLab basics in case you haven't used it before.

The final grade will be determined according to the following scale: A from 85.0% , A- from 80.0%, B+ from 75.0%, B from 70.0%, B- from 65.0%, C+ from 60.0%, and so on...

Topics

- Classical concepts:
 1. Paths, cycles, trees.
 2. Bipartite graphs and matchings.
 3. Planar graphs.

4. Random graphs.
- Linear algebra methods:
 1. Random walks and electric networks
 2. Adjacency and Laplace matrices
 3. Eigenvalues, spectral gap, expander graphs
 4. Graph partitioning