

MATH 7233: Graph Theory

Northeastern University, Fall 2018

- **Instructor:** Gábor Lippner (email: g.lippner@northeastern.edu)
- **Time and place:** Mondays/Wednesdays 3:30-5:00pm in Ryder 435.
- **Office hours:** Tuesday 10-11am and Thursday 10 - 12am, 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 useful.
- **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)
- **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.
- **Grading:** There will be graded homework (for 60%), four 20 minute long quizzes (5% each), and one 90 minute test (for 20%) in this course. No finals.
- **Dates:**
 - Quiz dates: Sept 19, Oct 10, Oct 31, Nov 28.
 - Test date: Nov 14.
- **The final grade:** will be determined according to the following scale: A from 90.0% , A- from 80.0%, B+ from 70.0%, B from 60.0%, B- from 50.0%, C+ from 40.0%, and so on...
- **Homework, quizzes, test:** Homework will be assigned and scored throughout the semester. There will be two types of homework, each type contributing 30% to your final grade.
 - Writing up solutions to problems (mostly ones that were discussed in class, but occasionally you will be expected to find solutions by yourself). There will be 15 such problems in total, each contributing 2%.
 - Two larger computer assignments consisting of 3 parts each (so 5% per part) 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.

Partial credit **will not** be given for either kind of homework, but you will have a 2nd attempt to improve solution after feedback if the first attempt didn't pass.

Quizzes will be checking your understanding of basic concepts. You may have to give examples of a certain type of object, or decide whether a given object possesses a certain property.

The test will be similar to homework in that you will have to write down solutions to problems previously encountered in class. However, you will not be able to use your notes, and will have to finish within 90 minutes.

- **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