21-484 Graph Theory

Spring 2025 MWF 12:00-1:00 Wean 8220

Professor Bohman

Graph theory is a central area of discrete mathematics that features both fascinating problems and powerful techniques. There are many nontrivial applications of graph theory in operations research, computer science and other disciplines. It is one of the very few mathematical areas where one is always close to interesting unsolved problems. Topics include graphs and subgraphs, trees, connectivity, matchings, graph colorings, planar graphs, network flows, counting arguments, and extremal problems.

- **Suggested texts:**
  - *Graph Theory*, Diestel.
  - *Introduction to Graph Theory*, West.
- **Prerequisites:** *Discrete Mathematics* (21-228 or 15-251) and *Matrices and Linear Transformations* (21-241 or 21-242).
- **Office hours:**
  - Professor Bohman: Wednesday 3:00-5:00 or by arrangement.
    - office: Wean 8208
    - email: `tbohman@math.cmu.edu`
- **Homeworks:** Eight homework assignments will be given during the semester. These will be due at the beginning of lecture on Fridays. Since genuine mathematical understanding is best achieved through the personal exploration of the material that comes with working problems, homeworks are regarded as important. Discussion of the homeworks with other students is permitted, but collaboration on the writing of the assignments is not (i.e. you are NOT permitted to see the actual pages another student is handing in). Homeworks will be submitted through Gradescope.
- **Tests:** There will be tests on 2/14, 3/21 and 4/18 and a comprehensive final exam.

  If circumstances such as illness prevent you from taking a test or exam at the scheduled time, please discuss the problem with me *before* the quiz or exam if possible.

  Planning for any alternate final exam time will be completed by April 18. No requests for alternate final exam times will be entertained after this date.
- **Grades:** The final exam will account for 30% of the course grade. Homework and class participation will give 15% of the grade. The remaining 55% of the course grade will be given by the average of your best two test scores. The lowest test grade will be dropped.
- **Web Page:** `http://www.math.cmu.edu/~tbohman/21-484/graphs.html`

  Homeworks, review sheets, and other course materials will be posted on both the course web page and on Canvas. Announcements will be posted on Canvas.

- **Homework Policy.** Homework is due at the beginning of class on the due date. Late homeworks will be accepted at the following lecture and will receive half credit.
- **Accomodations for students with disabilities.** If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at access@andrew.cmu.edu.
- **Wellness.** As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. CMU services are available, and treatment does work. You can learn more about confidential mental health services available on campus at: http://www.cmu.edu/counseling/. Support is always available (24/7) from Counseling and Psychological Services: 412-268-2922.
- **Learning Objectives.** Students should further develop their understanding of rigorous mathematical arguments and strengthen their ability to both read and write mathematical proofs. Students should gain an understanding of various concepts and theorems from graph theory, including Hall's Theorem, Menger's Theorem, max-flow/min-cut and the Szemerédi Regularity Lemma.