SYLLABUS MATH 280
GRAPH THEORY
FALL 2022

"In 1736, during his first stay in St. Petersburg, Euler tackled the now famous problem of the seven bridges of Königsberg. His contribution to this problem is often cited as the birth of graph theory and topology." David Richeson

1. General information

- **Professor**:
  Ivan Contreras
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  - Website: `https://www.amherst.edu/people/facstaff/icontreraspalacios`
  - Office: SMUD 502
  - Phone: (413) 542-5749
  - Office hours:
    - Monday: 11:00–12:00 M, 2:00-3:00 PM
    - Wednesday: 11:00–12:00 M, 2:00–4:00 PM
    - Friday: 11:00–12:00 M
- **Course information:**
  - Lecture Times: MWF 9:00–9:50 AM
  - Room: TBA
  - Course website: `https://moodle.amherst.edu/course/view.php?id=24237`.
  - Textbook: John Harris, Jeffry Hirst, Michael Mossinghoff, *Combinatorics and Graph Theory*, Second Edition, Springer, 2008. Free to download from the Amherst network at SpringerLink `https://link.springer.com/book/10.1007/978-0-387-79711-3`
- **Math 280 Fellows (TAs):**
  - Molly Gans
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  - Will Henshon
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2. What is MATH 280 about?

2.1. **Content.** Welcome to MATH 280! In this course we will have an introduction to the basic tools in graph theory. A graph is the mathematical abstraction of a network,i.e. a collection of nodes and edges, therefore its study brings together different areas such as network theory, information theory, computer science, etc.
The goals of the course are:

- Understand, read and write proofs that involve the main concepts in graph theory.
- Apply various notions and constructions of graph theory to different sciences, as well as other areas of mathematics.
- Compare and implement different algorithms in graph theory.

2.2. **During the lectures.** I encourage you to stop me during the lectures and ask questions. Active participation is quite important in the learning process, and specially with mathematical reasoning. If you are feeling lost, I am almost certain that there is someone else sharing the same feeling. I like to stop from time to time and ask around questions about the material, please do not feel intimidated, it is a way to encourage discussion. I will take roll occasionally. Although attendance is not going to be graded, I expect you to come to each lecture.

3. List of topics

A preliminary list of topics that will be covered includes:

- Notation and terminology in graph theory.
- Distance in graphs.
- Trees.
- Graph connectivity.
- Walks and cycles.
- Traversability.
- Planar graphs
- Vertex colorings.
- Edge coloring and Ramsey theory.
- Matching and factoring.
- Spectral graph theory.

4. Prerequisites and Target Audience

Either MATH 271 or MATH 272. Otherwise you need permission from the instructor.

5. Homework and Exams

5.1. **Homework.**

- One weekly homework assignment that will be posted on Moodle.
- The assignment will be collected each **Thursday** no later than 11:59 PM (EST) via Gradescope.
- Maybe you have heard this many times, but it is a very good idea to do the assignments! And it is not just to get a good grade. This is the only way that you know if you are really getting the material covered in the lecture, doing mathematics is not sitting down and listening to someone else, it is done in paper or blackboard.
- Homework after the due date will not be accepted (see the Special Arrangement section for exceptions).If you know beforehand that you will need an extension to submit an assignment, please let me know asap.
- Working in groups is always a good idea, and you may find a big profit by sharing your ideas and questions to others. However, writing down the solutions is an individual process, so be sure that you write the solutions to the assignment in your own words. If you happen to work in an assignment with a partner (s) and you all come up with the same solution , please write the name (s) of the students involved.
- Please label the problems in the same order as listed in the assignment.

5.2. **Slack and Course Diary.** We will use a Slack channel as a Q/A forum. We will also use a course diary in Overleaf:
(https://www.overleaf.com/2586293525gdqhpjkjkgkf)
in which you will have the opportunity to engage in asynchronous discussions and activities with your peers, your TAs and your instructor.

5.3. **Exams.** There will be two take-home midterm exams, to be completed by the following Thursday.

- Midterm 1 will be handed out on Wednesday **October 12**, and collected no later than **October 19**.
- Midterm 2 will be handed out on Wednesday **November 9**, and collected no later than **November 16**.

5.4. **Final Project/Final Exam.** You can choose either one of the following:

- To take a final take-home exam (that will be handed out on Friday **December 9**, to be completed no later than Friday **December 16**.
- To work on a final group project (3–4 students per group). This will consist on two parts: an in class oral presentation during the last three lectures (Wednesday **December 5**–Friday **December 9**) and a written report, due the finals week (Friday **December 16**).

6. Grading

The final grade for the course will be based on the following distribution:

- Participation (10%), this will be computed in terms of participation (both synchronously and asynchronously) and attendance. Asking and answering questions, making comments in Slack and the Course Diary are ways in which you earn participation points. [1]
- Homework (15%, the lowest Homework grade will be dropped).
- Midterms (45%, the highest grade is worth 25%, the lowest grade is worth 20%, so a bad midterm won't cause too much trouble!)
- Final project/ Final exam (30%).

The final course grade will be curved.

7. Support

We offer several options to support you in case you are struggling with the course. Please do not hesitate to do either one of the following:

- Discuss with your classmates and work in groups.
- Attend office hours, I am glad to help!
- Ask Molly and Will (your Math Fellows).
- Find a peer-tutor: you could ask me or ask at the QCenter.

8. Special arrangements

8.1. **Extensions.** If for reason X or Y you cannot hand in your homework in time, you can request up to TWO extensions during the term. You must contact me no later than the day before the due date to let me know.

8.2. **Extra Office Hours.** If you attend class regulary, as well as the scheduled office hours, but you feel you need more time to discuss the content of the course, please contact me. We can set up occasional extra office hours.

8.3. **Accommodations.** At Amherst we want to make sure our courses are as welcoming and accessible to all students as possible. If you consider that you may need a particular accommodation for MATH 280, please do not hesitate to contact me or the Accessibility Services (accessibility@amherst.edu).

[1] If the average of your midterms is higher than your participation grade, I will use the average of your midterms as the 10%.

9. The Amherst College Honor Code

The Amherst College Honor Code applies to this course, in particular regarding the remote nature of the midterms and assignments.

- The take-home exams are individual. The tests are closed-internet. You should not communicate with other students about specific questions on the exams. Doing so is a violation of the honor code.
- As stated in the Homework rules, working in groups is highly encouraged. You should ask me or your Math Fellows for guidance in case you feel lost with the assignments. However, you MUST write down your homework in your own words. Copying word-by-word the work of others is a violation of the Amherst College honor code.

10. Antiracism, Diversity, Equity and Inclusion

The Mathematics and Statistics Department fully endorses Amherst College's Anti-Racism Plan, which can be found here:
`https://www.amherst.edu/amherst-story/president/past_presidents/biddy-martin/statements/node/775925`
We are also fully committed towards diversity, equity and inclusion in the mathematical sciences and the Amherst College community in general:
`https://www.amherst.edu/academiclife/departments/mathematics-statistics/about-the-department/diversity-equity-and-inclusion`
We all strive to respect and care for each other, and it is the responsibility of all members of our community to maintain an environment based on respect and openness to growth.