

**Math 180:  
Graph Theory  
(Fall 2020)**

This document is subject to minor changes until October 1st, 2020.

**Instructor:** Adam Moreno

- **Email:** [moreno@math.ucla.edu](mailto:moreno@math.ucla.edu)
- **Lecture:** Monday, Wednesday, Friday 9:00-9:50am (via Zoom)
  - Meeting ID: 950 6193 6516
  - Password: Trogdor
- **Office Hours:** Monday, Wednesday, Friday 10:00-11:00am (via Zoom)
  - Meeting ID: 940 0048 8609
  - Password: Babel
- **Course Website:** <https://ccle.ucla.edu/course/view/20F-MATH180-1>
- **Campuswire page:** <https://campuswire.com/p/G160D9FB6>
  - Join Code: 6978

**Teaching Assistants:**

David Soukup (email: [soukup@math.ucla.edu](mailto:soukup@math.ucla.edu))

Discussion Section 1A: Tuesday 9:00-9:50am (via Zoom)

**Materials:**

J. Matousek and J. Nešetřil, Invitation to Discrete Mathematics, 2nd Ed., Oxford

**Meeting via Zoom:** Please note that **lectures will be recorded**. What will be recorded is my face, and the notebook/board on which I am writing. I will stop often to address questions in the chat window of Zoom. Occasionally, you may have a question that is easier to speak than type. In this case, you will need to unmute yourself and speak aloud. *Be aware that your face, screenname, and chat questions will not be in the recording, but your voice will be.* If this makes you uncomfortable, please reach out to me and accommodations can be discussed.

Office hours will also be offered via Zoom. **I will not record office hours**. However, I would like to write your questions in a OneNote file, along with my answers (as if writing on a board). With your permission, I will add these to an "Office Hours" section of the class notebook. I will not include any names, and the writing may only make sense to those present that day. However, many people may have similar questions and may benefit from the additional resource.

**Grading:** Your final course grade will be based on the following scheme:

15 % Homework, 5% Participation, 25% Midterms (each), 30% Final

Final course grades are determined by straight points subject to the following scale:

Range	Grade	Range	Grade
[93, 100]	A	[77, 80)	C+
[90, 93)	A-	[70, 77)	C
[87, 90)	B+	[67, 70)	D+
[83, 87)	B	[63, 67)	D
[80, 83)	B-	[50, 63)	D-
		[0, 50)	F

In particular, your grade does not depend upon your rank in the class (i.e., there is no “curve”). Note also that there are no A+ or C- grades. The former is because this grade is too difficult to gauge in the remote format; the latter is to avoid ‘grade grubbing’ at the end of the course. Your grade will not be ‘bumped’, please do not ask. Any change to this grading scale will only benefit students (e.g, the lower bound of “A” range may be decreased).

**Homework:** There will be 7 homework assignments, to be turned in via Gradescope on Sundays by at 11:59pm Pacific time. No late homework will be accepted and no make-up homework will be given.

Each student is required to turn in their own homework. Moreover, you should write your name in the upper left corner of each page and submit each problem to Gradescope **on a separate piece of paper**. Finally, each problem should be clearly labeled (e.g. 7.2 #2 or 7.2.2)

Each assignment will be uploaded to the course website on CCLE. You should complete the required problems on separate pieces of paper, with your name in the upper left corner of each. Also, each problem should be clearly labeled (e.g. 7.2 #2 or 7.2.2).

You will submit your completed assignments via Gradescope. To get to Gradescope, visit the course CCLE page and use the left navigation bar to find “Gradescope” under Course Apps. This will take you to where you will submit your assignment. Your assignment will need to be in pdf format. There are several apps that allow you to do this, but CamScanner (free on Apple App Store and Google Play Store) seems to be a favorite. Of course, if you can do your homework directly on a device, there is no reason to download any additional software; pdfs can be directly uploaded from your device to Gradescope.

**Exams:** There will be two midterm exams, scheduled for **Friday, October 30th** and **Friday, November 20th**. You may use any resources with the exception of human resources (e.g. Chegg, Math Stack Exchange) and technical calculators (e.g. Wolfram Alpha). **The use of any such materials constitutes academic dishonesty.** The midterm will become available on Gradescope at 7:00am (Pacific time) on the scheduled day and you will have 24 hours to submit it via Gradescope. The final exam will be the same format (though 2-3 hours long), given on **Monday, December 14th**. There will be **no make-up exams**.

**Attendance and Participation:** There is no grade given strictly for attendance, though

attendance is very important for your success. You are expected to attend each class, and if you must miss, watch the recorded lecture.

The participation portion of your grade will be made up from a combination of to what extend you

- Attend office hours
- Participate in class (asking questions either aloud or in the chat)
- Participate on Campuswire (see below)

Obviously with timezone differences, some students will not be able to participate in class. All that matters is that you have *some* presence in the class. The easiest way to participate is via Campuswire (see below). I will post announcements, polls, and quick conceptual checks throughout the course. I encourage you all to ask and answer questions of your fellow classmates here.

**Campuswire:** We will use Campuswire as a forum to communicate about the class and participate in discussion. *You are not required to register for Campuswire, but be aware that this is the easiest way to earn your participation grade.* If you choose not to register, your participation will be determined by to what extent you attend office hours, participate during lectures, etc.

Campuswire has a built in reputation system based on points. The points offered and your participation grade are given by:

Action	Point Value	Total Points	Participation
Ask a question	2	200	5%
Like a question	2	150	4%
Answer a question	5	100	3%
Upvotes for your answer	10	50	2%
		25	1%
		< 25	0%

I will often ask conceptual style questions that require an explanation. As you can see, giving quality answers is the quickest way to earn your participation grade. You are highly encouraged to answer these questions (you can do this anonymously and still receive your points). Obviously, once a solid answer is provided, there may be no better answer. In that case, you are encouraged to upvote the quality answers. **Once you reach 200 points, I ask that you sit back and upvote your classmates so that they may participate as well.**

**Collaboration Policy:** For the homework assignments, you are allowed (encouraged even) to work with up to 4 other people (these can be different from your group for the meetings). However, each group member is required to turn in their own separate solutions. You should write the names of your other group members on your assignment. **For the exams, no collaboration is allowed.**

**Academic Dishonesty:** The shift to remote instruction presents a challenge in maintaining academic honesty. As covered above, collaborating or using expressly forbidden materials on

exams constitutes academic dishonesty. For homework, collaboration is allowed, but as usual, looking up solutions is considered dishonest.

**Getting Help:** You are strongly encouraged to attend your TA's or my office hours to discuss any mathematical concerns. This is typically the way to handle confusion, but of course, you may also email us.

**Tentative Schedule:** It is highly recommended that you read the sections we will cover before class. I will not assume you have, but this way, you will be better prepared to ask questions. We will attempt to stick to the following schedule:

Week	Date	Lecture #	Section	Topic
0	10/2	1	1.3, 3.1, 3.2	Induction, Functions, Permutations
1	10/5	2	4.1, 4.2	Graphs & Subgraphs
	10/7	3	4.2, 4.3	Adjacency Matrix & Graph Score
	10/9	4	4.3	Graph Score
2	10/11	<b>HW 1</b>		<b>Homework 1 due by 11:59pm (PST)</b>
	10/12	5	4.4, 4.5	Eulerian Graphs
	10/14	6	4.6	2-connectivity
	10/16	7	4.7	Triangle-free Graphs
3	10/18	<b>HW 2</b>		<b>Homework 2 due by 11:59pm (PST)</b>
	10/19	8	6.1, 6.2	Planar Drawings & Cycles
	10/21	9	6.3	Euler's Formula
	10/23	10	6.4	Colorings
4	10/25	<b>HW 3</b>		<b>Homework 3 due by 11:59pm (PST)</b>
	10/26	11	6.4	Colorings
	10/28	12	7.1	Parity Arguments
	10/30	<b>Midterm 1</b>		Cumulative through 6.4
5	11/2	13	7.1, 7.2	Parity Arguments & Sperner's Theorem
	11/4	14	7.3	Forbidden 4-cycles
	11/6	15	5.1	Trees
6	11/9	16	8.1, 8.2	Number of Spanning Trees & Proof via Score
	11/11	Holiday		Veteran's Day
	11/13	17	8.3	A Proof with Vertebrates
7	11/15	<b>HW 4</b>		<b>Homework 4 due by 11:59pm (PST)</b>
	11/16	18	8.4	A Proof using the Prüfer Code
	11/18	19	8.4	Prüfer code and Catch-up
	11/20	<b>Midterm 2</b>		Covering 7.1 through 8.4
8	11/22	<b>HW 5</b>		<b>Homework 5 due by 11:59pm (PST)</b>
	11/23	20	10.2, 10.3	Probabilistic Counting & Applications
	11/25	21	10.2, 10.3	Probabilistic Counting & Applications
	11/27	Holiday		Thanksgiving Break
9	11/30	22	11.1, 11.2	Ramsey's Theorem
	12/2	23	11.3	Lower Bound for Ramsey Numbers
	12/4	24	13.1	Block Designs
10	12/6	<b>HW 6</b>		<b>Homework 6 due by 11:59pm (PST)</b>
	12/7	26	13.2	Fischer's Inequality
	12/9	27	13.3	Covering by Complete Bipartite Graphs
	12/11	Review		Exam Review
	12/13	<b>HW 7</b>		<b>Homework 7 due by 11:59pm (PST)</b>
	12/14	<b>Final Exam</b>		Cumulative, with focus on 10.2-13.3