

MAS477 Introduction to Graph Theory
2020 Fall, KAIST

This course is an introduction to some of the major topics of graph theory. They include graph connectivity, matchings, planar graphs, graph coloring, and nowhere-zero flows.

Basic notions and theorems covered in Discrete Mathematics (MAS275 or CS204) will be assumed; but we will review them in the first week. Usually it is recommended to take MAS275 before taking this course unless you are familiar with proofs using mathematical induction.

Lecture	Lecture videos will be posted online.
Instructor	Sang-il Oum (엄상일) https://dimag.ibs.re.kr/home/sangil/ Email: sangil@kaist.edu Office: E6-1 Room 3403, KAIST or Discrete Mathematics Group, Institute for Basic Science, 55 Expo-ro.
Office Hours	T.B.A. (On Zoom with the professor or the TA to discuss homework problems.)
Course website	http://klms.kaist.ac.kr/ .
Textbook	No main textbook. Main references: <ol style="list-style-type: none">1. R. Diestel, “Graph Theory”, 5th edition. Springer http://diestel-graph-theory.com/ From KAIST, you can access it online at https://doi.org/10.1007/978-3-662-53622-3 If you are at home, then you can use the KAIST library website to access it remotely.2. A. Bondy, U. S. R. Murty, “Graph Theory”, Springer
Grading	25% Homework, 30% Midterm, 40% Final, 5% Active participation (Asking questions etc.), The lowest score and the second lowest scores from assignments will be dropped. You will earn <i>A</i> if (but not only if) your score is at least $80 - \varepsilon$, <i>B</i> if your score is at least $70 - \varepsilon$, <i>C</i> if your score is at least $60 - \varepsilon$, for some $\varepsilon \geq 0$ to be determined later. Students may choose to receive the S/U grading instead of the A/B/C/D/F grading.
Midterm Exam	T.B.A.
Final Exam	T.B.A. Midterm and final exams will be take-home exams. 12 hours will be given and students will need to type their solution into a PDF file (L ^A T _E X preferred) and upload it to a website that will be announced. Students must not collaborate with other students on exams. There will be no make-up exams. Any violation of honor code will be reported.

Homework Homework will be given weekly online on Thursday. The assignment is due at the following Monday night. You may collaborate with other students. But **homework should be written by yourself independently and you must understand your solution.** Students will need to make a PDF file and upload the homework to a website to be announced.

Plan

- Week 1-2** Basics. Reviews. (chapter 1)
- Week 2-4** Matchings (chapter 2)
- Week 4-5** Connectivity (chapter 3)
- Week 6-7** Planar graphs (chapter 4)
- Week 8** Midterm Exam
- Week 9-10** Coloring (chapter 5)
- Week 11-12** Flows (chapter 6)
- Week 13-14** Extremal Graph Theory (chapter 7)
- Week 14** Ramsey Theory for Graphs (chapter 9)
- Week 15** Graph minors and well-quasi-ordering (chapter 12)
- Week 16** Final Exam

- For week 14-15, we may cover alternative materials.

- Hint for the course: Definitions are very important!

Attend the class, Ask questions, Do the homework, Solve exercise problems.

You should learn how to prove mathematically. Most of the homework problems and exam problems will require you to prove something that were NOT proven in class.

- Try to be familiar with mathematical induction. In particular the “strong induction” is very useful. Be familiar with the well-ordering principle. (Every non-empty set of positive integers has the minimum element.) Thus, it is recommended to take “Discrete Mathematics” (MAS275) before taking this course