MAS477 Introduction to Graph Theory
2023 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.

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| Lecture | MW 9AM-10:15AM | Classroom: E6, 3438 |
| Instructor | Sang-il Oum (엄상일) | `https://dimag.ibs.re.kr/home/sangil/` |
| | Email: `sangil@kaist.edu` | |
| | Office: E6-1 Room 3403, KAIST or B321, Discrete Mathematics Group, Institute for Basic Science, 55 Expo-ro. | |
| Recitation | To be determined. | |
| | We will discuss homework solutions. | |
| Course website | `http://klms.kaist.ac.kr/`. | |
| Textbook | No main textbook. | |
| | Main references: | |

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

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| Grading | 20% Homework, 30% Midterm, 50% Final. |
| | The lowest score and the second lowest scores from assignments will be dropped. You will earn $A$ if (but not only if) your score is at least $80 - \varepsilon$, $B$ if your score is at least $70 - \varepsilon$, $C$ if your score is at least $60 - \varepsilon$, for some $\varepsilon \geq 0$ to be determined later. |
| Midterm Exam | T.B.A. |
| Final Exam | T.B.A. |
| | There will be no make-up exams. Exams will be "closed book", "closed note". Calculators are not allowed in the exams. Any violation of honor code will be reported. |
| Homework | Homework will be given every week on Wednesdays, posted on KLMS. The assignment is due at 10PM of the following Tuesday. You may collaborate with other students. But **homework should be written by yourself independently and you must understand your solution.** |
| | Students are required to need to make a PDF file and upload the homework to the GradeScope.com. The instruction will be posted on KLMS. |

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

No lectures on : Oct 9 (Hangul Day), Nov 29 (KAIST Admission Interview Date)

- For week 14-15, we may cover alternative materials or invite guest lecturers.

- 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