MAS583B TOPICS IN MATHEMATICS (FIXED-PARAMETER ALGORITHMS)

2014 Spring, KAIST

The study of fixed-parameter algorithms is motivated by effective algorithms for solving NP-hard problems under some assumptions. The field of studying such algorithms, commonly known as *Parameterized Complexity*, is originated by R. Downey and M. Fellows in 1990s. Since then, there are so much developments and this field has been attracting a lot of attentions recently. In this course we aim to discuss the concept of fixed-parameter tractable algorithms and survey various algorithmic techniques to obtain efficient fixed-parameter tractable algorithms.

There are no formal prerequisite for this course, though it will be helpful to know the definition of some basic concepts appearing in discrete mathematics, such as graphs. This course does not require any programming skills.

We are very lucky to have Prof. M. Fellows, who is a founder of this field, to give a special guest lecture.

Lecture	MW 10:30AM-11:45AM Classroom: E6-1, Room 2412
Instructor	Sang-il Oum (sangil@kaist.edu) Office: E6-1 Room 3403.
Office Hours	Wednesday 4PM or by appointments. (tentative)
Course website	http://klms.kaist.ac.kr/
Textbook	Main textbook: Niedermeier, *Invitation to fixed-parameter algorithms*, Oxford, 2006. (link) (KAIST Library has an e-book license for this book.) Reference: Downey, Fellows, *Fundamentals of Parameterized Complexity*, Springer, 2013. (link)
Grading	25% Homework, 50% Final (Oral Exam), 25% Presentation. The lowest score from assignments will be dropped. There will be no make-up exams.
Homework	Homework will be given weekly or biweekly in class on Wednesday. The assignment is due at the beginning of class on the following Monday. You may collaborate with other students. But **homework should be written by yourself independently and you must understand your solution.**

Tentative schedule

- **Week 1 (March 3, 5):** Chapter 1. Introduction to Fixed-Parameter Algorithms.
- **Week 2 (March 10, 12):** Chapter 4. Vertex Cover—An Illustrative Example. Chapter 2. Preliminaries and Agreements.
- **Week 3 (March 17, 19):** Chapter 3. Parameterized Complexity Theory — A Primer. Chapter 5. The Art of Problem Parameterization. Bounded Search Trees.
- **Week 4 (March 24, 26): Special Guest Lectures by Prof. Mike Fellows (Charles Darwin University, Australia).**
- **Week 5 (April 7, 9):** Chapter 9. Dynamic programming. Chapter 10. Tree Decompositions of Graphs.
- **Week 6 (April 14, 16):** Chapter 10. Tree Decompositions of Graphs. II
- **Week 7-8 (April 28, 30, May 7):** Chapter 11. Further Techniques.
- **Week 9 (May 12, 14):** Kernelization.
- **Week 10 (May 19, 21):** Kernelization II.
- **Week 11 (May 26, 28):** Chapter 13. Parameterized Complexity Theory / Student presentation.
- **Week 12 (June 2):** Student presentation.
- **Week 13 (June 9, 11):** Student presentation.

Guest lectures by Dr. Eun-jung Kim (LAMSADE, France) will be given for the weeks 9-11.

No lectures on : March 31 and April 2 (Conference trip), May 5 (Children's day), June 4 (Election day), April 21, 23 (Midterm Exam Week).