

Korea Advanced Institute of Science and Technology (KAIST)

Fall Semester 2010, MAS581 Topics in Mathematics: Analytic Combinatorics

This course is a gentle introduction to Analytic Combinatorics. We will start with generating functions, which describe the enumerative information of combinatorial structures in terms of power series as formal algebraic objects. We will study how certain combinatorial structures can naturally be decomposed into smaller building blocks and how such decompositions can be interpreted as functional operations of generating functions. Next we will view generating functions as analytic functions that map the complex plane into itself and study their analytic properties, e.g. singularity and singular expansions, from which we will extract asymptotic estimates of counting sequences. Finally we will study how this approach can be applied to various classes of maps and graphs on surfaces, in particular planar graphs.

Lectures Sept. 12, 3:00PM-6:00 PM
 Sept. 13-17, 4:00PM-6:00PM

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Office hours Sept. 13-17, 3:00PM-4:00PM

Textbook Flajolet and Sedgewick, *Analytic Combinatorics*, Cambridge University Press, 2009, <http://algo.inria.fr/flajolet/Publications/book.pdf>

Final exam Sept. 19, oral exam

Homework Homework will be given on Sept. 13 and 15 and collected at the beginning of class on Sept. 15 and 17.
 Students are encouraged to collaborate with one another.

Grading 20% Homework, 80% Exam

Plan Sept. 12, Symbolic methods and basic combinatorial constructions
 Sept. 13, Essentials from complex analysis
 Sept. 14, Singularity analysis
 Sept. 15, Enumeration of various types of trees
 Sept. 16, Enumeration of outerplanar graphs
 Sept. 17, Enumeration of planar graphs
 Sept. 19, Oral exam