Math 523-Spring 2022

Analytic Combinatorics

General information

Classtime zoom link: https://wustl.zoom.us/j/99666221464
Class time: MWF 1-1:50pm
Classroom: Eads 215
Professor: Greg Knese
Zoom Office hours: MW 9:30-10:30
Office hour link: https://wustl.zoom.us/j/99666221464
Email: geknese at wustl dot edu

Course format

The course will start online at the zoom link:
https://wustl.zoom.us/j/99666221464
At some point we will go back to in-person meeting in Eads 215.

Course description

Analytic combinatorics uses generating functions to encode counting sequences and complex analytic techniques to estimate their growth and statistics. The emphasis in this course will be on analytic combinatorics in several variables (ACSV). Topics include: intro to generating functions and analytic combinatorics, multivariate series and diagonals, latttice path enumeration, ACSV for smooth points, ACSV for non-smooth points. Prerequisites: sequences and series at the level of advanced calculus, undergraduate or graduate complex analysis.

Textbook

An Invitation to Analytic Combinatorics by Stephen Melczer.
Available here: https://melczer.ca/textbook/

Other references:

General ASCV website: https://acsvproject.com/

Analytic Combinatorics in Several Variables by Robin Pemantle and Mark Wilson.
Available here: **https://acsvproject.com/book/**

Analytic Combinatorics by Philippe Flajolet and Robert Sedgewick.
Available here: http://ac.cs.princeton.edu/home/AC.pdf
See also the extensive website with videos
http://ac.cs.princeton.edu/online/

Homework

There will be several homework assignments done through crowdmark:

app.crowdmark.com

Homework solutions should be written up clearly and in detail.

Presentations

Students will give presentations on a paper or topic in ACSV. The website https://acsvproject.com/ has many papers listed as possibilities. Details to be discussed later.

Course plan

I plan to cover as much of the textbook as possible at a comfortable pace.

1. Introduction and overview
2. Analytic combinatorics in one variable
    a. Rational power series
    b. D-finite power series
    c. D-Algebraic power series
3. Multivariate series
    a. Several complex variables
    b. Diagonals
    c. Multivariate Laurent expansions
    d. Sources of rational diagonals
4. Lattice path enumeration
5. ACSV for smooth points
6. Application to lattice walks
7. Automated analytic combinatorics
8. Non-smooth ACSV
    a. Poles on a hyperplane arrangement
    b. Multiple points
9. Lattice paths again

Grades:

1/3 homework
1/3 participation
1/3 presentation

Health Related information

If you become sick during the semester please let me know as soon as possible so we can make accommodations.