Analytic Combinatorics, with Applications

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Description: This course is meant to serve as an introduction to *analytic combinatorics* – the application of complex analytic and symbolic tools to problems of asymptotic enumerative combinatorics and the analysis of large random structures which are fundamental to our understanding of the typical behavior of algorithms and other processes arising in computer science, information theory, and other application domains.

We will attempt to cover much of the core theory, along with illustrative examples. A tentative list of core topics includes

- Symbolic methods – Deriving ordinary, exponential, multivariate generating functions.
- Complex asymptotic methods – Rational/meromorphic/algebraic singularity analysis, Laplace's method.
- Methods for proving limit laws, large deviations.

If time permits, we may discuss in more detail important extensions and applications (e.g., Mellin and Poisson transforms, which are ubiquitous in the analysis of digital trees, pattern matching statistics, etc.).

Textbook: We will use the book *Analytic Combinatorics*, by Flajolet and Sedgewick, which is freely available online.

Prerequisites: Students should be comfortable with probability at a graduate level. Background in complex analysis and algorithms/data structures is helpful but not required.

Method of assessment: Class participation and responses to problem sets.