

SPRING 2013

MATH 595: Integrable Combinatorics

Section IC, CRN51218

12:30-1:50 TR, 7 Illini Hall

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Course description: This topics course aims at tracking integrable structures in combinatorial objects such as: triangulations, maps, trees, alternating sign matrices, plane partitions and networks. Integrability arises both as a consequence of the symmetries of the problem and the possibility of introducing parametric deformations that preserve them. It provides powerful algebraic and analytic tools for exact enumeration and more.

Plan of the course:

0. A quick introduction to statistical physics
1. Lorentzian Triangulations
2. Planar maps and their intrinsic geometry
3. Alternating sign matrices and their combinatorial family
4. Plane Partitions: the ASM-DPP conjecture
5. T-system: Lambda-determinant and Cluster Algebra

The course is largely self-contained. No prerequisites. We include a quick introduction to all the necessary concepts and basic tools of statistical physics. Combinatorial methods will be developed when needed (generating functions, infinite matrices, determinants, decorated trees, lattice paths, networks, cluster algebras, etc.).

Reading material:

Lecture at the International Congress of Mathematical Physics 2012:

<http://arxiv.org/abs/1210.4514>

Slides by D. Bressoud: www.macalester.edu/~bressoud/talks/2009/asm-ASU.pdf

Method of assessment:

Class participation, and response to open homework problems.