

18.177: Integrable Probability

Fall 2016, MIT

Course information

- The lectures meet on Tuesdays and Thursdays from 9.30am to 11am in 2-142.
- The instructor is Vadim Gorin (vadicgor@mit.edu)
- Office hours of V.G. are on Tuesdays from 5pm to 6pm in 2-277. If you can not make it, then feel free to send an e-mail to set up appointments at alternative times. I am also glad to answer questions via e-mails.
- There will be 3-4 problem sets. If you are taking this class for credit, then your final grade will be the sum of the grades for homeworks.

Suggested literature.

Unfortunately, there is no extensive textbook covering the topics of the class so far. I will try to give references to the articles, where the material of each lecture can be looked up.

The following books and review articles are related to the class:

1. J. Baik, P. Deift, T. Suidan, Combinatorics and Random Matrix Theory (Graduate Studies in Mathematics);
2. A. Borodin, V. Gorin, Lectures on Integrable Probability;
3. A. Borodin, L. Petrov, Integrable probability: From representation theory to Macdonald processes;
4. I. Corwin, The Kardar-Parisi-Zhang equation and universality class;
5. K. Johansson, Random matrices and determinantal processes;
6. I. G. Macdonald, Symmetric functions and Hall polynomials, Second Edition;
7. D. Romik, The Surprising Mathematics of Longest Increasing Subsequences.

Preliminary plan for the course (subject to change):

Sep 08. First Lecture

Sep 13. Symmetric functions

Sep 15. NO LECTURE

Sep 20. Domino tilings: combinatorics

Sep 22. Domino tilings: variational problem and limit shape

Sep 27. Domino tilings: random matrix limit

Sep 29. Determinantal point processes I

Oct 4. Determinantal point processes II

Oct 6. Asymptotic analysis of DPP through difference operators

Oct 11. NO LECTURE

Oct 13. Asymptotic analysis of DPP through contour integrals

Oct 18. Determinantal point processes III: 2d setting

Oct 20. Asymptotic analysis of DPP in 2d setting

Oct 25. Shuffling algorithms and interacting particle systems

Oct 27. Local limits: first instances of the universality

Nov 1. Conceptual reasons for local universal behavior I

Nov 3. Conceptual reasons for local universal behavior II

Nov 8. Loop equations I

Nov 10. Loop equations II

Nov 15. Differential Operators and Schur generating functions I

Nov 17. Differential Operators and Schur generating functions II

Nov 22. Differential Operators and Schur generating functions III

Nov 24. NO LECTURE

Nov 29. Gaussian Free Field

Dec 1. Conceptual reasons for the universal appearance of GFF

Dec 6. Macdonald processes I

Dec 8. Macdonald processes II

Dec 13. q -TASEP and KPZ