Stochastic models BMETE95MM11

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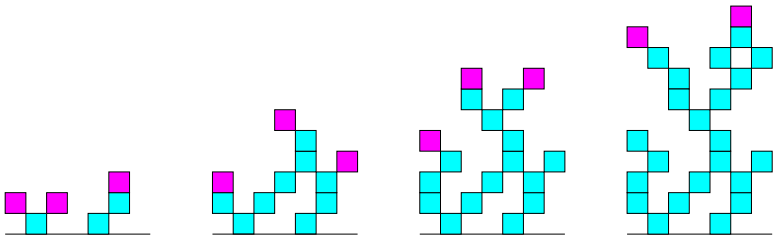
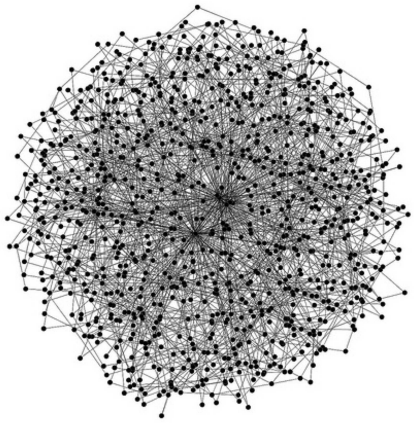
Probability theory is a rapidly developing subject, increasingly important in other parts of mathematics, in physics, and applications. The aim of the course is to introduce several different probabilistic models and phenomena, with a variety of motivations, such as statistical physics, PDEs, computer science, combinatorics, group theory, game theory, social networks.



Topics may include:

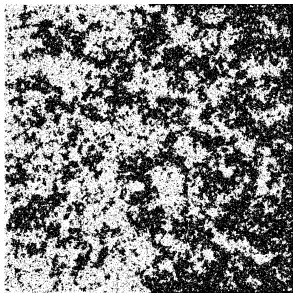


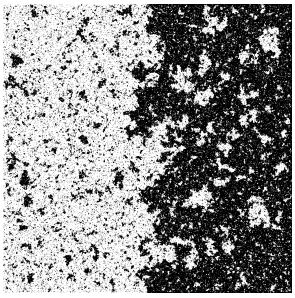
Markov chain mixing times, random walks on graphs and groups, recurrence vs transience, electric networks.

Random graph models: Galton-Watson trees, Erdős-Rényi graphs, Barabási-Albert scale-free networks.

Percolation models. Correlation inequalities, contour methods.

Basics of statistical physics: Gibbs measures and phase transitions. Ising, Potts, Fortuin-Kastelyn random cluster models, colorings.





Combinatorics and hydrodynamics of interacting particle systems (simple exclusion and growth models).

Self-organized criticality in sandpile models.

Solving PDEs with randomized games.

Some recurring methods:

Couplings and stochastic domination, martingales, large deviations, ergodicity, spectral theory, discrete isoperimetric inequalities.