

Graduate course in Spring 2010

Meets TR 11-12:20pm in Carver 0004

Prerequisites: Probability at an undergraduate level, and some linear algebra.

Mixing in Markov Chains and Random Graphs

Summary: In Markov chains, which model many systems, it is of interest to know how long it takes to get ‘close’ to equilibrium, that is when things are ‘mixed’ to a certain degree. One can imagine a system may have ‘bottlenecks’ or is composed of long ‘fingers’ which prevent mixing in small times. Understanding the ‘mixing time’ of a system is a basic concern, and has many applications in several fields (physics, cs, statistics).

In the past twenty years or so, a theory which combines probabilistic ideas, geometry, combinatorics, and spectral eigenvalue and potential theoretic methods has been developed. In this course, we focus first on the interesting methods, and then look at applications in random graphs which model ‘real world’ networks.

The order and selection of topics will depend on class interests.

First part: We study probabilistic techniques, geometry, and spectral and potential theoretic methods which connect together to form a mathematical basis for ‘mixing’ in Markov chains.

Text: Levin-Peres-Wilmer Markov Chains and Mixing Times [chapters 1-7, 12-13]

Electronic version available at <http://www.uoregon.edu/~dlevin/MARKOV/>

Second part: We consider applications to certain random graph models of ‘real world networks’ which arise in social, biological, and other contexts.

Text: Durrett Random Graph Dynamics [parts of chapters 4, 6]

Electronic page (chapter 1 available) at <http://www.math.cornell.edu/~durrett/RGD/RGD.html>