CS153 (Schulman), Spring 2022: Markov Chain Monte Carlo

This course will be an introduction to Markov chain methods in the theory of algorithms. Markov chains are used to sample from distributions of combinatorial or physical interest, e.g., spanning trees, colorings of a graph, contingency tables, matchings, the feasible region of a linear program, the Gibbs distribution of a statistical mechanics model. A closely related task is to estimate partition functions or the number of combinatorial objects of specified types.
The course will start with elementary examples, cover fundamentals of Markov chain theory, and then discuss methods for bounding mixing time.
Most chains used in algorithms are reversible (``detailed balance'').
Some attention will also be paid, however, to the more general not-necessarily-reversible case, which is of significance in non-equilibrium processes.

The course is light on prerequisites. Students should have some familiarity with algorithms at the level of cs38 (at least concurrently); and some familiarity with probability, but a full course is not necessary.