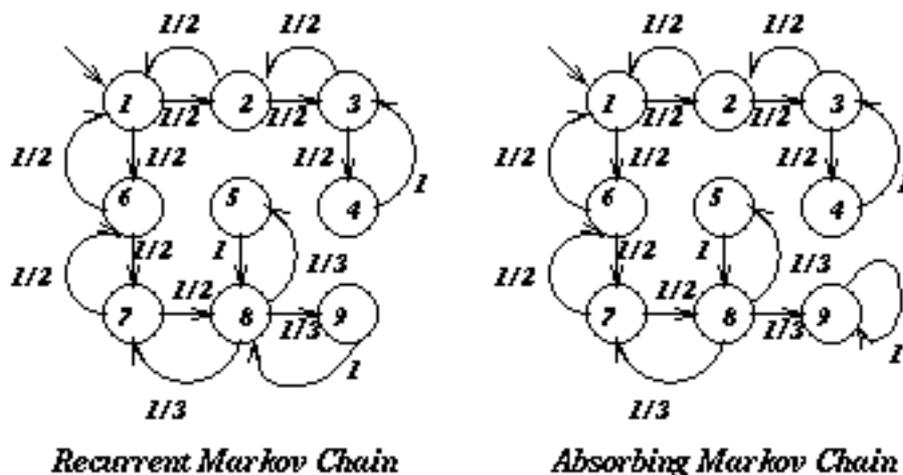


CS554 Markov Chains in CS, Fall 2011



Michael Thomason

Class: 1:25-2:15pm in CL206

Office Hours in CL316: for 30 minutes after this class and 10:15-11:15am MWF (Often around at other times but not guaranteed available.)

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If you send email, expect delays. Note that email isn't viable for detailed technical questions and answers in this kind of material: use the office hours or make an appointment. No grades will be sent by email.

Description

Many applications in computer science deal with processes that evolve in time or space. If the evolution is probabilistic, these are stochastic or random processes. Many systems have inherent randomness due to natural variability, noise, or other factors; and even deterministic systems are often studied via probability models due to their size or because the inputs to which they respond are described by probabilities.

This course begins with basic probability, then concentrates on finite-state Markov chains, a restricted kind of stochastic process with numerous applications in CS. We will use handouts in class and a set of lecture notes on Markov chains (get the current version of the notes at Graphics Creations). You will also run MatLab to use its statistical toolbox and a few m-files supplied in the course for some computations. MatLab is available on all CS unix/solaris machines.

This course is for students who want an introduction to Markov chains in computer science. It is not intended to replace mathematics courses in probability or stochastic processes. CS554 can be taken for undergrad credit—talk to the instructor.

Topics

Basic probability: Axioms of probability; properties arising from axioms; conditional probability; random variables; expectation and variance; normal distribution

Probability vs statistics; large number laws

Course Notes on Markov Chains from Graphics Creations: Markov property; Discrete-parameter Markov chains; classification of states; absorbing chains; recurrent chains; Continuous-parameter Markov chains

Plus diverse handouts in class including HMMs (Hidden Markov Models) and PSTs (probabilistic suffix trees)

There will be illustrations of applications in CS as time permits.

Prereq and Grading

Prereq is CS 311 for discrete math in CS. Simple matrix operations are used extensively, and there are minor references to calculus. We will be proving some basic properties and deriving some basic equations.

If you already have a good mathematical background in probability, do not take this course. It repeats too much material to be useful, and you should instead find a second course in stochastic processes or some other topic.

There will be three in-class, closed book exams for 100 pts each. Exams will be spaced about evenly through the semester (in recent years, exams have been late September, mid-November, and early December). We can discuss take-home exams in lieu of some of the in-class exams. There will be about 100 pts total of graded homework in five or six problems of 15 to 30 pts each. Graduate credit will require additional and/or alternate assignments compared to undergrad credit, and this will include some different questions on exams.

Homework to be turned in for grading *is not optional*. It will be handed out in class, will have a specific due-date, and will get a grade of 0 if late. You must work alone on graded homework, but other homework and exercises are for your practice and discussion. You are responsible for all assignments and all handouts.

Students who have a disability that requires accomodation should make an appointment with the Office of Disability Services to discuss specific needs.

And yes, there really was a person named Markov—a Russian mathematician (A. A. Markov 1856-1922).

