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Selected Topics in Markov Chains and Optimization

Instructor

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Teaching Assistant

None
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Department: Electronic Systems Engg.

Course Time: Tu., Th., 11:30 to 1 pm.

Lecture venue: Old conf. room

Detailed Course Page: None

Announcements

None

Brief description of the course

To introduce graduate level students advanced topics in Markov chains, graphs and combinatorics, and optimization.

Prerequisites

Graduate level stochastic processes and basic optimization theory.

Syllabus

Finite state Markov Chains: Rate of convergence to steady state, Eigenstructure of the transition matrix, Perron-Frobenius Theorem, Reversible transition matrices, bounds on convergence rates; Markov Chain Monte Carlo: Knapsack problemâ€”Target distribution sampler, Gibbs sampling, Metropolis-Hastings algorithm, Simulated Annealing, Examples from Bayesian networks and inference problems; Topics in Graph Theory: Matchings and Factors with applications, Connectivity and Paths; Enumeration combinatorics: Generating functions, Sieve methods, Posets; Semidefinite Programming: Quadratically Constrained Quadratic Programming (QCQP), Maximum Eigenvalue and Matrix Norm minimization, Applications to combinatorial problems

Course outcomes

Students will get a flavor of fairly advanced topics in Markov chains, graph theory, combinatorics and optimization useful to their research, build upon existing theory towards applications. In some cases, research papers are directly discussed.

Grading policy

Homeworks: 30%

Mid Term: 20%

Final exam: 50%

Assignments

Exercise problems from books and some research papers.

Resources

Norris J.R., Markov Chains, Cambridge University Press, ISBN-10: 0521633966.

Hajek Bruce, An Exploration of Random Processes for Engineers (course notes for EC-534, â€œRandom Processesâ€•), http://www.ifp.illinois.edu/~hajek/

Bremaud Pierre, Markov Chains: Gibbs Fields, Monte Carlo Simulation and Queues,â€• Springer, 1999

West Douglas, Introduction to Graph Theory, Pearson 2nd ed., ISBN-10: 0130144002.

Vandenberghe L. and Boyd S., Semidefinite Programming, in SIAM Review, March â€™96