

ELEN E6909– Spring 2017

Network Algorithms and Dynamics

- Times and Location: Mondays, Wednesdays 10:10am-11:25am, Mudd 825
- **Instructor:** Javad Ghaderi
Email: jghaderi@ee.columbia.edu
Office: Mudd 1328
TA: TBA
- **Course Webpage:** <http://netalgs.wikischolars.columbia.edu>. It will have the announcements, homework assignments, and class material, etc.
- **Prerequisites:** Probability, Elementary Stochastic Processes, Elementary Graph Theory, but more importantly, mathematical maturity and a level of comfort with reading and writing proofs.
- **Description:** This is a new special topics course. The course studies models, algorithms, and dynamics with focus on networked systems. The course covers various topics in network science, graph algorithms, random walks, epidemics, scheduling, load balancing, etc. The topics will be selected from the list below:
 - (i) Mathematical models of networks: random graphs, the small-world phenomenon, power-law distribution, preferential attachment, etc
 - (ii) Graph algorithms: matching, network flow problems
 - (ii) Dynamics: random walks, Markov chains, Ergodicity, long-run behavior, characterization of convergence rate to steady state, MCMC methods, epidemics and rumors, opinion dynamics in social networks
 - (iii) Other topics: server scheduling, load balancing, join the shortest queue, power of two choices, etc.
- **Textbook:**
 - *Epidemics and Rumours in Complex Networks* by M. Draief and L. Massoulié (Cambridge, 2009).
 - *Markov Chains, Gibbs Fields, Monte Carlo Simulation, and Queues* by Pierre Brémaud (Springer, 1999).
- Grading: based on (i) homework assignments, (ii) a midterm during the semester, and (iii) course project.