

Communication Networks I

Columbia E6761, Fall Semester, 2014

TR 10:10am-11:25am

- **Instructor:** Javad Ghaderi
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Office Hours: TBA
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- **Course Webpage:** <http://www.ee.columbia.edu/~jghaderi/teaching/E6761>. It will have the announcements, homework assignments, and class material, etc.
- **Prerequisites:** Knowledge of Probability at the level of IEOR E3658. Prior exposure to computer network protocols at the level of CSEE W4119 is helpful but not required.
- **Description:** The course provides an analytical approach to the design of (data) communication networks. Necessary tools are discussed for performance analysis and design of network protocols and algorithms. The analysis is supported by practical engineering applications in layered Internet protocols in Data link layer, Network layer, and Transport layer. The necessary analytical background is provided during the class by review of relevant aspects of stochastic processes, control, and optimization.
- **Textbook:** The course is primarily based on the lecture notes provided during the class. Most of the topics are selected from the following textbooks:
 - *Communication Networks: An Optimization, Control and Stochastic Networks Perspective* by R. Srikant and Lei Ying, Cambridge University Press, 2014.
 - *Data Networks* by Dimitri Bertsekas and Robert G. Gallager, Prentice Hall; 2nd edition, 1992. Available freely online at <http://web.mit.edu/dimitrib/www/datanets.html>.
 - *Communication Network Analysis* by Bruce Hajek, Available online at <http://www.ifp.illinois.edu/~hajek/Papers/networkanalysis.html>.
- **Homework:** There will be frequent homework assignments which are an integral part of learning in this course. You should spend enough time on the homework problems.
- **Grades:** Homework: 30%, Midterm: 30%, Final: 40%.
- **Syllabus:**
 - Overview of Internet Architecture
 - Fundamentals of Performance Evaluation: Operational Laws, Markov Chains, Queuing Theory
 - Link Layer: Medium Access Algorithms
 - Network Layer: Packet Switch Routers, Scheduling Algorithms, Routing Algorithms
 - Transport Layer: TCP, Congestion Control
 - Layering as Optimization Decomposition: Network Utility Maximization
 - Other Networks: Telephone Networks, Server Farms