EE 550 Course Syllabus – Fall 2018
Data Networks: Design and Analysis

Handouts

All PDF handouts shall be placed in the "Course Information and Links" folder of DEN (including the syllabus and problem sets).

Instructor

Michael J. Neely (EEB 520, mikejneely@gmail.com, 213-740-3505)
Office hours: After class, Tu/Th 9:30-11:30am (EEB 520)

- When contacting me by email, please put "EE 550" in the subject.
- Feel free ask about problem set questions or project ideas before they are due. In most cases, the professor is comfortable giving hints and/or guiding students to work out solutions.

Teaching assistant

TBA

Class location and time:

Tuesday/Thursday 8:00-9:20am (OHE 100b)

Course notes and supplemental reading

- "Notes on Markov chains, Travel Times, and Opportunistic Routing"
  http://ee.usc.edu/stochastic-nets/docs/markov-chains-travel-times.pdf
- "Notes on Capacity and Connectivity in Large Networks"
  http://ee.usc.edu/stochastic-nets/docs/notes-capacity-large-networks.pdf
- *Data Networks (2nd ed.)* by D. Bertsekas and R. Gallager. (Chapter 3 on queueing, chapter 2 on coding and ARQ)
  http://web.mit.edu/dimitrib/www/datanets.html
- "Network Optimization: Notes and Exercises":
  http://ee.usc.edu/stochastic-nets/docs/network-optimization-notes.pdf
- Backpressure routing and Lyapunov optimization wiki links:
  http://en.wikipedia.org/wiki/Backpressure_routing
  http://en.wikipedia.org/wiki/Lyapunov_optimization
- *Computer Networks: A Systems Approach* by L. Peterson and B. Davie.
- R. Srikant and L. Ying, *Communication Networks: An Optimization, Control, and Stochastic Networks Perspective*, 2013.

A. *Example student papers related to EE 550 topics/projects (The first paper originated from an EE 550 project)*

- J. Paek and M. J. Neely, "Mathematical Analysis of Throughput Bounds in Random Access with ZigZag Decoding," Mobile Networks and Applications, vol. 16, no. 2, pp. 255-266, 2011.
- R. Urgaonkar and M. J. Neely, "Network Capacity Region and Minimum Energy Function for a Delay-Tolerant Mobile Ad Hoc Network," IEEE/ACM Transactions on Networking, vol. 19, no. 4, pp. 1137-1150, Aug. 2011.
- H. Yu and M. J. Neely, "A Simple Parallel Algorihtm with an O(1/T) Convergence Rate for General Convex Programs," SIAM Journal on Optimization, vol. 27, no. 2, pp. 759-783, 2017.

Grading:

Homeworks 20%, Midterm 35%, Final 40%, Mini Project 5%. Class participation may factor into the homework score.

The following minimum letter grades are guaranteed to students with a weighted total score that is within the specified intervals: 85-100 (A), 65-85 (B: grades of B+ and A- are also given), 45-65 (C: Grades of C+ and B- are also given). The above thresholds may be adjusted at the end of the semester at the discretion of the instructor. Any such adjustments will be in favor of a higher letter grade.

Statement for students with disabilities:

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on academic integrity:

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect ones own academic work from misuse by others as well as to avoid using anothers work as ones own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: http://www.usc.edu/dept/publications/SCAMPUS/gov/. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

Important dates (locations to be announced later):
- Thanksgiving holiday: Wednesday-Sunday Nov. 21-25, 2018.
- Last lecture: Thursday Nov. 29, 2018.
- **Midterm exam:** Thursday Oct. 11, 8-10am (location TBA)
- **Final exam:** Tuesday Dec. 11, 2018, 4:30-6:30pm (location TBA)

B. Course mini-projects

Mini-projects are chances for you to design your own extended problem set questions, with answers. You can work alone, or in groups of up to 3 people. Due dates will be assigned to individual students, starting in week 2 of the course. You are expected to give a presentation (in professor or TA office hours) and a short 2-3 page writeup (using, for example, latex). Further descriptions of the mini-project, with some examples, are given as a PDF file on DEN.

I. TENTATIVE COURSE OUTLINE

- Markov chains and indicators for bit pattern problem, Opportunistic routing, Large network analysis
- Error detection codes
- CRC codes, Burst error detection, Framing, flags and overhead
- Shortest path problems, Bellman-Ford, Dijkstra, bi-criteria optimization
- Min cost subject to constraint, Pareto optimality
- Calculus solutions, Lagrange multipliers for 1-constraint, convex programs
- Convex program examples, Network flows, drift-plus-penalty method for convex programs, Fast TCP
- Drift-plus-penalty method for convex programs, Fast TCP, Power-aware formulations
- Student example problems
- ARQ, Stop and wait, Go-back-n, correctness proofs
- RN/SN modulus, Selective repeat, Review of queue/renewal theory
- M/G/1 analysis, Markov chain truncation for admission control
- Optical networks and wavelength continuity constraints
- Multiple access via Aloha, CSMA
- Multiple access student competition
- CSMA-CD, special topics and student presentations
- Network calculus for delay and queue guarantees