

EE 550 Course Syllabus – Spring 2024

Data Networks: Design and Analysis

Basic information

- EE 550, Spring 2024
- Lecture: Tuesday/Thursday 2-3:50pm (WPH B36)
- Discussion: Monday 12-12:50pm (DMC 151)
- Units: 4
- Pre-req: EE 503
- Recommended preparation: Familiarity with the basics of computer networks such as provided in EE 250 or EE 450

Blackboard website

Course materials and zoom links for lectures and discussions are available on the Blackboard website for the class. Homeworks will also be turned in on the Blackboard website. Find Blackboard at the following link:

<https://blackboard.usc.edu/>

Instructor

Michael J. Neely (EEB 520)
mikejneely@gmail.com (please put “EE 550” in subject)
Office hours: Tu/Th 12-1pm

Teaching assistant

Kamiar Asgari (PHE 320)
kamiaras@usc.edu (please put “EE 550” in subject)
Office hours: TBA

Piazza

Please sign up for the Piazza discussion page here:
<https://piazza.com/usc/spring2024/ee550>

Course notes and supplemental reading

- “Notes on Multiple Access” (on blackboard)
<https://ee.usc.edu/stochastic-nets/docs/multi-access-renewal-theory.pdf>
- “Notes on Capacity and Connectivity in Large Networks”
<http://ee.usc.edu/stochastic-nets/docs/notes-capacity-large-networks.pdf>
- “Network Optimization: Notes and Exercises”:
<http://ee.usc.edu/stochastic-nets/docs/network-optimization-notes.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>
- Backpressure routing and Lyapunov optimization wiki links:
http://en.wikipedia.org/wiki/Backpressure_routing
http://en.wikipedia.org/wiki/Lyapunov_optimization
- “Notes on Markov chains, Travel Times, and Opportunistic Routing”
<http://ee.usc.edu/stochastic-nets/docs/markov-chains-travel-times.pdf>
- *Computer Networks: A Systems Approach* by L. Peterson and B. Davie.
- *Performance Modeling and Design of Computer Systems* by M Harchol-Balter.

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.

Important dates (locations to be announced later):

- First day of classes: Tuesday Jan. 9, 2024
- Last day of classes: Thursday April 25, 2024
- Spring recess: March 11-15 (no class)
- **Midterm exam:** Thursday March 7, 2024 (in class)
- **Final exam:** Thursday May 2, 2024 (2-4pm, location TBA)
- MLK holiday: Jan 15 (no class)
- **Project presentation date:** You will present your project to either the instructor or the TA in office hours on a date staggered uniformly between the midterm and the last day of class. You will be informed of your due date in the third week of the course. Based on your presentation, you may be given specific feedback. You can use this feedback to revise your project and turn in your final report. You are encouraged to turn in the final report within 1-2 weeks after the presentation. Projects that are received early may be allowed to go through one extra revision stage. The firm deadline for all written final projects is the last day of class.

Course projects

You can work individually or in a team of 2-3 students. Teams are encouraged. The project has a point value approximately equal to 3 problem sets. For ideas, you can look at course examples, problem set questions, and research papers related to the course material. You should provide a motivating introduction, clearly formulate the question, and then provide an extended solution. The question should be interesting. Be prepared to answer the questions “why is this interesting?” and “why did you investigate this problem?” and “how does this relate to the EE 550 course material?” You are expected to give a presentation (in professor or TA office hours) on or before your presentation due date. Due dates for presentation will be staggered for each team of students throughout the semester. Each team has a different due date. You will receive feedback based on your presentation. You are encouraged to finalize your project within a week of that feedback, but no later than the last day of class. If desired, you can present your project before your due date to get early feedback. You are also encouraged to talk with the instructor or TA about your project before the due date. The final writeup (5-10 pages) should take feedback from the presentation into consideration. Please label your project files with last names of all team members. Any emails of the final report should be cc-d to all project members, the TA, and the instructor. Further descriptions of the project, with some examples, are given as a PDF file on blackboard.

I. TENTATIVE COURSE OUTLINE

- Renewal theory and Multiple access (Aloha, CSMA, ZigZag).
- Multiple access student competition.
- Network scheduling, $N \times N$ switch.
- Markov chains and indicators for bit pattern problem, Opportunistic routing.
- 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
- Error detection codes, CRC, Burst error detection
- Large network analysis
- M/G/1 analysis, Markov chain truncation for admission control
- If time permits: ARQ, optical networks, network calculus

A. *Assignment submission policy*

- Scan and upload your work into the blackboard system by 9pm of the due date.

B. *Academic Conduct*

Plagiarism (presenting someone else’s ideas as your own, either verbatim or recast in your own words) is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” <https://policy.usc.edu/scampus-part-b/>. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

C. Support Systems

- Student Counseling Services (SCS) – (213) 740-7711 ? 24/7 on call Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.
<https://engemannshc.usc.edu/counseling/>
- National Suicide Prevention Lifeline – 1-800-273-8255 Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.
<http://www.suicidepreventionlifeline.org>
- Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 - 24/7 on call Free and confidential therapy services, workshops, and training for situations related to gender-based harm.
<https://engemannshc.usc.edu/rsvp/>
- Sexual Assault Resource Center For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website:
<http://sarc.usc.edu/>
- Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086 Works with faculty, staff, visitors, applicants, and students around issues of protected class.
<https://equity.usc.edu/>
- Bias Assessment Response and Support Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response.
<https://studentaffairs.usc.edu/bias-assessment-response-support/>
- The Office of Disability Services and Programs Provides certification for students with disabilities and helps arrange relevant accommodations.
<http://dsp.usc.edu>
- Student Support and Advocacy – (213) 821-4710 Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic.
<https://studentaffairs.usc.edu/ssa/>
- Diversity at USC Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students.
<https://diversity.usc.edu/>
- USC Emergency Information Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible,
<http://emergency.usc.edu>
- USC Department of Public Safety – 213-740-4321 (UPC) and 323-442-1000 (HSC) for 24-hour emergency assistance or to report a crime. Provides overall safety to USC community.
<http://dps.usc.edu>