EE 550 Course Syllabus – Fall 2021
Data Networks: Design and Analysis

Basic information

Classes are on campus and will also be held and recorded on zoom. Any changes will be announced in advance.

- EE 550, Fall 2021
- Lecture: Tuesday/Thursday 8-9:50am (KAP 156)
  `https://usc.zoom.us/j/99833428410`
- Discussion: Friday 1-1:50pm (KAP 163)
  `https://usc.zoom.us/j/97131829144`
- Units: 4
- Pre-req: EE 503 and 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/`

Zoom IDs

- Lecture (Tu/Th 8-9:50am): 99833428410
- Discussion (Friday 1-1:50pm): 97131829144
- Office hours for Instructor (after class 10-11am): 5784818320
- Office hours for TA (TBA):

Instructor

Michael J. Neely (EEB 520)
mikejneely@gmail.com (please put "EE 550" in subject)
Office hours: After class, Tu/Th 10am-11am (Engineering cafe outside EEB, or EEB 520 if rain)
Neely office hours link:
`https://usc.zoom.us/j/5784818320`

Teaching assistant

Joni Shaska
shaska@usc.edu (please put "EE 550" in subject)
Office hours: TBA

Office hours

The instructor (Neely) will typically hold office hours at the Engineering Cafe (outside the EEB building). If there are no tables, or if there is rain, he will hold office hours in EEB 520. Office hours will also be available at the same time on zoom. The TA (Shaska) will hold office hours by zoom. See times and zoom ids given above.

Piazza

Please sign up for the Piazza discussion page here:
`https:/piazza.com/usc/fall2021/ee550`

Course notes and supplemental reading

- "Notes on Multiple Access" (on blackboard)
- "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 Aug. 24, 2021
- Last day of classes: Friday Dec. 3, 2021
- **Midterm exam:** Thursday Oct. 7, 2021, 8-10am (online, instructions will be announced)
- **Final exam:** Tuesday Dec. 14, 2021, 4:30-6:30pm (online, instructions will be announced)
- **Project presentation date:** Staggered uniformly between midterm-last day. Each team of students has a different presentation date. You will be informed of your due date in the third week of the course. Projects can be presented online during office hours.

Course projects

You can work individually or in a team of 2-3 students. Teams are encouraged. The project is work approximately 2-3 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 question "why is this interesting?" and "why did you investigate this problem?" You are expected to give a presentation (in professor or TA office hours) a week before the due date. **Due dates for presentation will be staggered for each team of students throughout the semester, so that each team has a different due date.** You can present your project at a date before your due date if desired. 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. The final writeup (5-10 pages) can take feedback from the presentation into consideration. Please label your project files with last names of all team members. 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 4:30pm of the due date.
- Late policy: No late homework will be accepted. A late assignment results in a zero grade.
- Make-up Exams: No make-up exams will be given. If you cannot make the exam dates due to a class conflict, you must notify me well in advance (before the course drop date). If I cannot accommodate your schedule, you must drop the class. In case of a required business trip or medical emergency, a signed letter from your manager or doctor is required. This letter must include the telephone number of your doctor or supervisor.
- Grade adjustment: If you dispute any scoring of a problem on an exam or homework set, you have one week from the date that the graded paper is returned to request a change in the grade. After this time, no further alterations will be considered. All requests for a change in grade must be submitted in writing to me.

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`