ELEC 8120 – Spring 2021
Principles of Network Performance Analysis

Catalog Data: (3) LEC. 3. Pr., ELEC 5120 or ELEC 6120, and ELEC 7410. Data network performance analysis, queueing systems, admission control, network traffic modeling, network calculus, flow and congestion control, wireless network analysis, and network simulation.

Textbook: Lecture notes will be distributed to the class.

References:

Course Objectives:
1. Address the analytical aspect of networking
2. Provide a big picture of the theoretical developments in communication networks
3. In-depth treatment of advanced analytical techniques for communication networks
4. Prepare graduate students for conducting research in the networking area. Helpful for both hands-on and theoretical research.

Prerequisites by Topic:
1. Telecommunication/data networks
2. Probability & stochastic processes

Class Room, Days and Time:
1. Class room: TBD
2. Class: Tuesday and Thursday, 2:00pm–3:15pm
3. Office hour: TBA

Topics & Class Schedule (75 minute classes):
1. Overview of stochastic process (1 class)
2. Single server queues: M/M/1, M/G/1, M/D/1, G/M/1, and fluid queues (8 classes)
3. Multi-server queues: M/M/m, M/G/∞, and multi-stage queues (4 classes)
4. Queueing networks (2 classes)
5. Effective bandwidth and admission control (3 classes)
6. Traffic modeling: self-similarity and long range dependence (3 classes)
7. Envelope process and network calculus (2 classes)
8. Flow and congestion control (2 classes)
9. Multiple access networks (2 class)
10. Network simulation (1 class)
11. Review/exams (3 classes)

Student Performance Evaluation:
Midterm exam: 35%
Homework: 45%
Final presentation/project: 20%

Homework:
Problems from the reference books and designed by the instructor, will be assigned throughout the semester to reinforce the class material.

Project/presentation:
A list of recommended topics will be provided at the beginning of the semester. Each student is required to complete one of the projects or make a presentation based on recent/related journal paper, with assistance from the instructor.

Class Attendance:
Class attendance is required.

Unannounced Quizzes:
Unannounced quizzes and their effect on course grade will be an integrated part of this course. No make-ups for missed quizzes.

Special Accommodations:
Any student requiring special accommodations should come by my office within the first two days of class, bringing your letter from the Office of Students with Disabilities.

Academic Honesty:
Please carefully read the Student Academic Honesty Code, which will be strictly followed throughout this course.

Contribution of Course to Meeting the Professional Component:
Engineering topics: 3 credits
66.6% engineering science (2 credits)
33.4% engineering design (1 credit)

Justification for Graduate Credit:
The proposed course covers advanced topics, focusing on the application of fundamental theory and mathematics on solving practical networking problems. This is suitable for a graduate level course with focus on applied research. It will be useful for preparing ECE graduate students for thesis work, especially in the wireless communications and networking area.

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