Theory of Networked Systems – Syllabus
CSCI 4963/6963, ISYE 4961, ECSE 4963/6960

General Information

Meeting time and place: MR 12:00pm- 1:50pm, Russell Sage Laboratory 5510
Instructor: Stacy Patterson sep@cs.rpi.edu
Office hours: M 2:00pm – 3:00pm or by appointment, Lally 301
Web site: http://www.cs.rpi.edu/~pattes3/tns/
Textbook: "Lecture Notes on Network Systems" by Francesco Bullo (pdf available on course web site)

Course Description

Networked systems are systems composed of dynamic units that interact over a network. These systems can be used to perform team objectives with applications ranging from formation flying to distributed computation. This course will cover a variety of modeling and analysis techniques for different types of networked systems. The course will also survey recent research on real-world networked systems applications including power networks, social networks, and sensor networks.

This course will be similar in spirit to the following courses:

- UCSB - Distributed Algorithms and Network Systems
- Technion - Networked Dynamic Systems: Analysis and Design

Pre-requisites

This course is math-intensive, and "mathematical maturity" is required. A qualified student should have taken undergraduate courses on:

- Multivariable Calculus and Matrix Algebra (e.g., MATH 2010)
- Numerical optimization
- Probability theory (e.g., MATP 4600)

CSCI-2300 is required for CS undergrads only. No background in controls or dynamical systems is needed.

There will be some short programming assignments, so basic programming knowledge is required. You can use MATLAB (recommended) or any language of your choice.

Learning Outcomes

Upon successful completion of this course a student is able to:

- Describe and analyze key algorithms for networked systems
- Develop mathematical formulations for new algorithms for networked systems
- Identify important applications of networked systems design and analysis
- Critically evaluate publications on networked systems algorithms and applications
- Perform basic research in networked systems, including writing a short research publication.

Schedule

The course schedule is divided into three parts:

1. I will give lectures on the basic concepts and theory of networked systems (about 8 weeks)
2. Students will present and discuss selected papers (about 4 weeks)
3. Students research project presentations (about 2 weeks)

An up-to-date schedule will be maintained on the course web site.

Grading

Grading will be based on the following:

- Homework: 20%
- Paper Presentations: 20%
- Project: 45%
- Class Participation: 15%

There is no final exam.

Homework

There will be 3 to 5 short homework assignments. They will consist of some mathematical analysis and proofs and some simulations. Homework is due in class on the day specified on the assignment. Late assignments lose 20% per day.

Project

A large part of the course grade is based on a research project. Students may work on projects alone or with a partner. Groups of three may also be allowed if approved by me. There are different expectations for the project depending on whether you are enrolled in the course at a 4000 or 6000 level. For the 6000 level, projects must be *research* projects. As such, they must contribute new theory and/or applications to the networked systems community. The results should be a research publication suitable for a high-quality conference or workshop. You are encouraged to come up with a project that relates to your research. For the 4000 level, the scope of a project can be (for example) a literature survey on a specific topic, a simulation-based comparison of several solutions to a problem, or application of an existing solution to a new problem setting.
For all projects, the requirements are:

1. A meeting with me to discuss and approve your project proposal
   By Oct. 24, 2014 (preferably sooner)
2. A short project status report (1 – 2 single-column pages) with 5 to 10 references
   Due Nov. 3, 2014 in class
3. A project presentation in class
   Dec 1, 2014 to Dec. 4, 2014
4. A project report in 2-column conference style, 4 – 6 double-column pages
   Due Dec. 7, 2014 at 11:59 pm, via email

Students with Special Needs

Federal law requires all colleges and universities to provide specified types of assistance to students with disabilities. If you have such special assistance, please obtain an authorizing memo from Disability Services for Students by contacting Mark Smith, Dean of Students, in the Dean of Students Office (x6266). Information about a student's special needs will be treated as confidential. Please submit a copy of your authorizing memo to me well in advance of any affected assignment. Failure to do so may result in a lack of special accommodations

Academic Integrity

If someone else's work (code, slides, research publications, etc.) is used to produce any work you do for this course, you must (1) indicate how this work was used, and (2) acknowledge this work in a bibliography section. For homework assignments, discussion is allowed, but you must write up solutions on your own. You must also write your own code. For presentations, you must create your own slides.

Violation of these policies will be considered a breach of academic integrity, and the student will be subject to penalties outlined in The Rensselaer Handbook of Student Rights and Responsibilities, including "an academic (grade) penalty administered by the professor and/or disciplinary action through the Rensselaer judicial process described in this handbook."