ENG SC700 A1 Noncooperative Networks

Syllabus

**Time and place:** Spring 2004, Mon-Wed 14:00-16:00, PSY B55.

**Instructor:** Prof. Murat Alanyali. Office: 8 Saint Mary’s Street, Room PHO 336. Phone: 3-5909. E-mail: alanyali@bu.edu.

**Description:** The objective of this course is to provide a game-theoretic perspective to distributed systems. The emphasis will be on applications in communication networks, in particular on recent research activity in distributed network architectures. The course will cover a range of topics including autonomous routing, flow control, resource pricing, power control in wireless networks, and bandwidth auctions. These topics will be considered within the frameworks of game theory, measurement-based control and stochastic approximations, all of which will be reviewed during the course.

**Prerequisites:** A graduate level course on random processes, or consent of instructor.

**Office Hours:** Mon-Wed 16:00-18:00, right after class, in PHO 336. Other times are available via appointment.

**Tentative outline:**

1. **Computer networks:** The OSI model, TCP/IP, wireless networking, contemporary network architectures, challenges in distributed network control.
2. **Game theory:** Normal-form games, mixed strategies, notions of equilibrium and efficiency, inefficiency of non-cooperation.
4. **Stochastic approximations:** Overview of probability and Markov processes, martingales, fluid limits, averaging principles.
5. **Evolutionary games:** Overview of nonlinear systems, basic evolutionary dynamics, stability of Nash equilibria, potential games, distributed optimization.
6. **Applications:** Routing games, Braess’ paradox, flow control and resource pricing, distributed network control via learning automata, power control in wireless cellular networks, incentives for cooperation in ad-hoc networks, bandwidth auctions.

**References:** The course will rely on class notes and preprints that will be handed out during the semester. In addition, the following references will be on reserve in the Engineering Library:

- Basar and Olsder, Dynamic Noncooperative Game Theory, 1982.
- D. Bertsekas and R.G. Gallager, Data Networks, 1992
- Bertsekas and Tsitsiklis, Parallel and Distributed Computation, 1989.

**Grading:** Homework: 1/3, Midterm: 1/3, Project: 1/3.