332: 519 Advanced Topics in Systems Engineering
Spring 1999
Game Theory with Applications to Communication, Networking, and Control Systems

Textbook: T. Basar and J. Olsder, *Dynamic Noncooperative Game Theory*, SIAM, Philadelphia, 1999. (this is a slightly revised version of the *Academic Press* 2nd edition of the same book published in 1995.)

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Office Hours: M 7;30–9:00 pm, F 11:00–12:30 am

Class Web Site: http://www.ece.rutgers.edu/~gajic/519b.html

TOPICS

Week 1: Course overview. Introduction to games with historical development of games. Introduction to extensive game form. Examples. (Chapter 1, class notes).

Week 2: Introduction to normal game form. Introduction to static games in Euclidean spaces. Introduction to dynamic games. (class notes, Chapter 4).

Week 3: *Finite zero-sum static games* in normal form (matrix games). (Sections 2.1–2.4)

Week 4: *Finite zero-sum static games* in extensive form. (Sections 2.4–2.6).

Week 5: *Nash strategies for finite* noncooperative *static* games. (Sections 3.1–3.3, 3.5)

Week 6: *Stackelberg* strategies *for finite* noncooperative *static* games. (Section 3.6). Braess paradox (Section 4.7).

Week 7: *Nash strategies* in Euclidean spaces (*infinite static* games). (Section 4.3).

Week 8: *Stackelberg strategies* in Euclidean spaces (Section 4.4). Dynamic games and *dynamic optimization* (Section 5.5; class notes).

Week 9: *Open-loop dynamic Nash strategies in continous-time* (Section 6.5 and class notes).

Week 10: *Nash feedback strategies* for infinite *dynamic* games. (Section 6.5, class notes) Isaacs equation of differential zero-sum games. (Section 8.2, class notes).

Week 11: *Stackelberg strategies* in continuous-time for infinite *dynamic* games. (Section 7.6).

Week 12: Exam

Week 13: Applications to Communications and Networking (discussions of journal papers)*.

Week 14: Applications to Communications and Networking (discussions of journal papers)*.

Grading:

70% Exam (based on theory and simple demonstration examples)

30% Term Paper (in students' areas of interest), up to 4 printed, single spaced, two-column pages (conference paper format) with the classroom presentation on May 12, 1999, 6:30–9:20.pm.

* The papers of the following authors in communications and networking will be discussed: Lazar, Basar, Orda, Shenker, Altman, Korilis, Douligeris, Mazumdar, Shah, Mandayam, Goodman, and others time permitting. Papers dealing with applications of game theory to controls will not be discussed in class. Control students will write term papers based on important journal papers dealing with applications of game theory to control systems.