MN755 Communication Networks Control
Course Information

Lecturer: Yannis Paschalidis, Center for Information and Systems Engineering (CISE), and Department of Manufacturing Engineering, 15 St. Mary's St., Room 144, tel: x0434, e-mail: yannisp@bu.edu, url: http://ionia.bu.edu/. Office hours: By appointment or via e-mail.

Time and place: TR 2:00-4:00, Rm 105 MFG.

Course Description and Topics: The objective of this course is to provide a systems and control perspective into communication networks research. It will emphasize fundamental systems issues in networking and survey a variety of techniques that have recently been used to address them, including, queueing theory, optimization, large deviations, Markov decision theory, and game theory. Topics will vary from year to year, depending on recent developments in the field. Some illustrative topics include:

1. Network Services and Layered Architectures.
2. Performance Analysis in Networks.
3. Traffic Management and Congestion Control.
4. Traffic Modeling.
5. Admission Control.
6. Flow Control and TCP/IP.
7. Routing.
8. Network Economics and Pricing.
9. Resource Allocation and Location Detection in Sensor and ad-hoc wireless networks.

Prerequisites: Some background in probability and stochastic processes (e.g., at the level of SC534 or MN714), some modest background in optimization (e.g., at the level of MN524/SC524), and some degree of mathematical maturity, or consent of instructor.

Textbook: The required textbook for the course is:
[BeGa92] D.P. Bertsekas and R.G. Gallager, *Data Networks*, Prentice Hall, 2nd Edition, 1992.
Its coverage of networks and protocols is a bit outdated but it appears to be the most advanced and technical textbook available on the subject. It emphasizes fundamental principles which also is the primary objective of the course.

[BeGa92] will be complemented by
[LGWi00] A. Leon-Garcia and I. Widjaja, *Communication Networks*, McGraw-Hill, 2000,
which is less technical but covers the very latest network architectures and protocols.

We will also heavily depend on notes taken in class and other material (e.g., research papers) I will be distributing.

Other useful books you might want to consult include:

On communication networks:

[WaVa00] J. Walrand and P. Varaiya, *High-Performance Communication Networks*, Morgan Kaufmann, 2000.

[Ke97] S. Keshav, *An Engineering Approach to Computer Networking*, Addison-Wesley, 1997.

On stochastic processes:

[Ga96] R.G. Gallager, *Discrete Stochastic Processes*, Kluwer, 1996.

On optimization:

[BeTs97] D. Bertsimas and J.N. Tsitsiklis, *Introduction to Linear Optimization*, Athena Scientific, 1997.

[Be99] D.P. Bertsekas, *Nonlinear Programming*, Athena Scientific, 2nd Edition, 1999.

On dynamic programming:

[Be95] D.P. Bertsekas, *Dynamic Programming and Optimal Control*, Vols 1 and 2, Athena Scientific, 1995.

On real analysis and linear algebra:

[Rud] W. Rudin, *Principles of mathematical analysis (Third edition)*, McGraw Hill, 1976.

[Str] G. Strang, *Linear algebra and its applications (Third edition)*, Harcourt Brace Jovanovich, 1988.

Grading:

1. 20% Homework.
2. 40% Mid-term.
3. 40% Final or Project (will be decided).

Rules of Conduct: You *may* collaborate in study groups on the solution of homeworks. You *must*, however, write up solutions on your own. If you do collaborate you *should* acknowledge your collaborators in the write-up for each problem (I view this as essential !) Also, if you used other material in obtaining a solution (e.g., other books and papers) you *should* reference your source. The due day on homeworks is *strict*.

Web Site: Problem Sets and other course material will be posted on the Web. The URL for the course is `http://ionia.bu.edu/` ("Teaching Menu" and the course number).