6.263 Data Communication Networks

Fall 2005

1 Course Staff

Web site: http://web.mit.edu/modiano/www/teach2.htm

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Textbook: *Data Networks*, Bertsekas and Gallager (2nd Edition), available from Quantum books.

Supplementary reading (reserve items):

- *Computer Networks*, Peterson and Davie (2nd Edition)
- *High performance communication networks*, Walrand and Varaiya
- *High Speed Networks*, Stallings
- *Computer Networks*, Tanenbaum
- *TCP/IP Illustrated*, Stevens
- *Queueing Systems, Volume 1: Theory*, Kleinrock

2 Assignments

- There will 10 problem sets. Problem sets will be graded on a basis of $\surd-, \surd, \surd+$ You may collaborate on problem sets, but you must indicate for each problem the name(s) of your collaborator(s). The schedule for problem sets is as follows:
  - PS 1: issued Sep. 13, due Sep. 20

- PS 2: issued Sep. 20, due Sep. 27
- PS 3: issued Sep. 27, due Oct. 4
- PS 4: issued Oct. 4, due Oct. 13
- PS 5: issued Oct. 13, due Oct. 20
- PS 6: issued Oct. 20, due Nov. 1
- PS 7: issued Nov. 1, due Nov. 8
- PS 8: issued Nov. 8, due Nov. 15
- PS 9: issued Nov. 15, due Nov. 22
- PS 10: issued Nov. 22, due Dec. 1

- **Exams.** There will be an in-class midterm on Oct. 25 There will be a final during finals week (time and place TBA).

- **Project.** There is a required project. The project may be theoretical, simulation-based, or oriented towards implementation. The project may be individual or group-based. Suggested project topics are given in this handout, but you may select other suitable topics. The project will involve a proposal, oral presentation to the class and final written report, not to exceed ten pages. While you are encouraged to attend as many oral presentations as possible, attendance at presentations (other than your own) is optional. Each person will have 20 mn (the time for a project will be proportional to the number of people in the project).

  The main dates are:

  - Oct. 2: first project proposal due (one page). Sign up for meeting with instructor.
  - Oct. 6 through 12: appointments with instructors to discuss proposals. Appointment times will be made available on the preceding week.
  - Nov. 15: Draft of project due.
  - Dec. 6, 8: presentations.
  - Dec. 9: final written project due by e-mail at 5 PM to instructors or instructors' offices as hardcopy.

- **Reading.** Required reading will be posted on the web site of the course and/or handed out in class. There will be a set of required reading assignments, clearly designated on the web site. Besides the required reading, there will be supplementary readings. While you are encouraged to read all the optional readings, you are required to select two papers on which to write paper reports. Each paper report is limited to one page in length. Each report should contain a a summary of the main points of the paper and a thoughtful critique. The critique may discuss the applicability, significance, assumptions, or other features of the paper.

  The dates for the reading reports are as follows:

  - Oct. 27: First paper report due.

- Nov. 29: Second paper report due.

All paper reports are due electronically or in hard copy to both instructors by 5 PM on the due date.

3 Grading.

The grade will be determined by the following weights: 25 % Midterm, 30 % Project, 35 % Final, 4 % Paper reports, 6 % Problem Sets.

4 Syllabus

The syllabus is organized around five main topics: queueing, routing, switching, congestion control and coding. The material will be covered in the lectures and the required reading. For some topics, the material will be mainly contained in the lecture notes.

- Lecture 1: Introduction, tree algorithms.
- Lecture 2: Shortest paths.
- Lectures 3,4: BGP, P2P, OSPF.
- Lecture 5: Markov chains, queues, Little's law. Lecture 6: M/M/... queues. Lectures 7, 8: M/G queues, use of transforms.
- Lecture 6: networks and reversibility.
- Lecture 7: ALOHA and collision issues.
- Lecture 9: ALOHA. Lecture 10: Details of 802.11, applications of queueing.
- Lectures 11 and 12: Optimal routing, traffic engineering.
- Lecture 13: TCP.
- Lecture 14: AQM.
- Lectures 15 and 16: Overview of switching, basic switching theory, matching and stability issues.
- Lecture 17: Compression, separation.
- Lecture 18-20: Principles of network coding.
- Lectures 21-22: Network Security.
- Lecture 23: Summary and advanced topics.

5 Suggestions for projects.

- Interaction between ARQ and coding: retransmission versus heavier coding.
- Congestion control methods and their analysis.
- Proposals for routing mechanisms.
- Analysis and comparison of routing mechanisms.
- Building larger routers from small routers: analysis and proposed methods.
- To code or not in ALOHA.
- Queueing analysis of SYN flooding.
- Queueing analysis of 802.11
- Path lengths for different recovery methods.
- Pricing and routing.
- The effect of routing path choices on router buffer management.