EE E4710 - An Introduction to Network Engineering
Course Information

Professor Dan Rubenstein Spring 2003

Course Resources

Contact Information		
	Dan Rubenstein (Instructor)	Sambarta (Bobby) Bhattacharjee (TA)
Office	CEPSR 816	TBD
Phone	(212) 854-0050	TBD
e-mail	dsr100@columbia.edu	sb483@columbia.edu
Mailbox	in Mudd 1312	TBD
Office Hours	TBD or by appt.	TBD

Course URL: http://www.cs.columbia.edu/~danr/4710

Course meeting time / location: 11:00 pm - 12:15 pm on Tu, Th in 1024 Mudd

Pre-Requisites

Probability (e.g., SIEO 3658). Communication Theory (e.g., ELEN 3701) recommended

Description

Topics: Covers theoretical fundamentals of network engineering. Topics include theoretical underpinnings of the physical layer; design, protocols and analysis of the data-link layer and medium access sublayer; design, routing algorithms and prefix addressing for the network layer, and evaluation of congestion control and connection setup/teardown algorithms for the transport layer.

Grading

Your grade consists of:

20% **Homework:** Unless otherwise specified, homework will be due one week after it is assigned and should be turned in at the beginning of class. At that time, you must turn in a physical copy of the assignment. E-mailed homework and late assignments **will not** be accepted unless approved in advance. Approval will only be given under extreme circumstances. You are expected to produce your work in a timely manner.

You may discuss and work on questions with other students in the class. However, you should write your solutions on your own. In other words, if I were to later ask you to re-derive one of your homework solutions or to solve a similar problem when you were without your friends, you should be able to do so or have a clear understanding of how to approach the problem. This can only be learned by doing, so you should do your homework.

35% **Mid-term:** 3/13 in-class, closed book.

45% **Final:** Date TBD

A note on exams: I am more interested in your gaining an understanding of and developing an intuition for **why** certain rules, laws, and techniques hold and are used. I am less interested in your ability to memorize these rules, laws and techniques and blindly apply them without intuition as to why they work. Thus, I will try to design the midterm and final questions to test your understanding of the concepts, not your memorization skills. I realize that some memorization will undoubtedly be required, but hopefully the memorized concepts will be those that can be re-derived via your intuition.

Reading / Texts

You should do the assigned reading **before** class.

- **Required:** Dimitri Bertsekas and Robert Gallager *Data Networks (2nd ed.)*, Prentice Hall, 1992. ISBN 0-13-200916-1.
- **Additional (optional):** James F. Kurose and Keith W. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*, Addison-Wesley, 2000. ISBN 0-20-147711-4
- **Additional (optional):** Andrew S. Tanenbaum, *Computer Networks* (3rd ed.), Prentice Hall, 1996. ISBN 0-13-349945-64.
- **Additional (optional):** Alberto Leon-Garcia and Indra Widjaja, *Communication Networks: Fundamental Concepts and Key Architectures*, McGraw-Hill, 2000. ISBN 0-07-022839-6.
- **Additional (optional):** Srinivasan Keshav, *An Engineering Approach to Computer Networking*, Addison-Wesley. ISBN 0-201-63442.
- **Additional (optional):** Jean Walrand and Pravin Varaiya, *High Performance Communication Networkse* (2nd ed.), Morgan Kaufmann, 1999. ISBN 1-55860-574-6.
- **Additional (optional):** Jean Walrand, *Communication Networks: A First Course (2nd ed.)*, McGraw-Hill, 1998. ISBN 0-256-17404-0.

Computing Accounts

The course does not require computing facilities or computing accounts.

Cheating

In short: don't do it. You must use common sense about when to collaborate / use notes / calculators, etc. If you are unsure of a policy, you should ask me or the TA first *before* doing something you (and I) might consider unethical. Both I and Angelos have and will be putting a lot of time into teaching you this course. Our goal is to teach you the material. Grades on homeworks, midterms, and finals are not only a means to evaluate you, but also a means to force you to learn the course material. Thus, when you cheat, you not only deceive me and Angelos, you also hurt the school's reputation by producing unknowledgeable graduates. In the long run, you hurt yourself, because you wasted your time. If a grade is that important to you then you should be putting in the extra effort, i.e., reading the book, coming to office hours, etc.

If you do your own work but facilitate someone else's cheating, you run a risk of getting in trouble as well. This is because you run the risk of having me determine who copied from whom. If you feel that someone is pressuring you to help them in a way that makes you uncomfortable, come talk to me / send me e-mail. You should feel free (and actually I would encourage you) to

- Discuss homework problems / give hints / work together through a part of a problem that you are stuck on
- Study for the midterm / final together

Student Feedback

I'm always looking for ways to improve the course. If you have any comments or criticism about the course, or find any mistakes or misleading facts / comments in the lecture, please feel free to contact me. This includes comments on the material being covered, teaching style, pace of the class, workload, etc. I will try and accommodate, but I can't make any promises...

Syllabus and Schedule

Schedule subject to change...

Date	#	Topics/chapters covered	Reading (before class)	Assigned	Due
1/21	1	Intro / Internet Protocol Stack	Chapter 1		
1/23	2	Probability refresher: discrete		HW #1 [,] (due 2/4)	
1/28	3	Probability refresher: continuous			
1/30	4	**NO CLASS**			
2/4	5	Physical Layer			HW #1 (solutions)
2/6	6	Datalink Layer: Error Detection and Correction		HW #2 (due 2/13)	
2/11	7	Datalink Layer: stop & wait, sliding window and their analysis			
2/13	8	Datalink Layer: Medium Access sublayer, collision avoidance: TDMA, FDMA, CDMA			HW #2 (solutions)
2/18	9	Network Layer: Shortest path routing algorithms		HW #3 (due 2/25)	
2/20	10	Network Layer: Distance Vector and Link State			
2/25	11	Network Layer: Multicast, Tunneling			HW #3 (solutions)
2/27	12	Network Layer: Addressing (CIDR)		HW #4 (due 3/6)	
3/4	13	Network Layer wrapup			
3/6	14	Transport Layer: reliability			HW #4 (solutions)
3/11	15	Transport Layer: congestion control			
3/13	16	**MIDTERM EXAM**			
3/18	17	**Spring Break: NO CLASS**			
3/20	18	**Spring Break: NO CLASS**			
3/25	19	Transport Layer: congestion control II (AQM)		HW #5 (due 4/1)	
3/27	20	Catchup / review			
4/1	21	Transport Layer: multimedia (jitter control, ...)			HW #5 (solutions)
4/3	22	Transport Layer: Multicast group concept			
4/8	23	Transport Layer: Fairness I (TCP, max-min)		HW #6 (due 4/15)	
4/10	24	Transport Layer: Fairness II (proportional)			
4/15	25	Transport Layer: wrapup			HW #6 (solutions)
4/17	26	Application Layer: DNS model		HW #7 (due 4/24)	
4/22	27	Application Layer: P2P model			
4/24	28	Large-scale phenomena: self-similar traffic, heavy-tailed distributions		HW #8 (due 5/1)	HW #7 (solutions)
4/30	29	Large-scale phenomena: Internet power law growth			
5/1	30	Review or special topics			HW #8 (solutions)
5/14		**Final Exam**			