

CSEE W4119 - Computer Networks

(Call # 22496)

Course Information

Professor Dan Rubenstein

Spring 2009

Contact Information			
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Office Hours	M 10-11, Tu 11-12 or by appt.	M 5-6, Th 5-6	W 4-5, F 1-2

Course URL: <http://www.cs.columbia.edu/~danr/4119>.

Also see Courseworks (<https://courseworks.columbia.edu/>) for additional handouts, etc.

Course meeting time / location: 1:10pm - 2:25 pm on M,W in Mudd 1024

Pre-Requisites

C or Java programming, Course in algorithms, Course in probability

Description

Topics: Introduction to computer networks and the technical foundations of the Internet, including applications, protocols, local area networks, algorithms for routing and congestion control, security, elementary performance evaluation. Several programming assignments required.

This course is a joint EE/CS course. It requires both skill at programming and math/algorithms/probability.

Grading

Your grade consists of:

10% **Homework:** Unless otherwise specified, homework will be due one week after it is assigned and should be turned directly to the TAs by 5pm on the day that it is due. CVN students are permitted the 24 hour extension.

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.

25% **Programming Assignments:** same rules as homework. You should write your own code. Note our ability to check the compiled code for similarities. **Students caught copying code or providing code for copying are subject to disciplinary action, including the possibility of failure or expulsion.**

25% **Mid-term:** March 11 in-class, closed book, no calculators.

40% **Final:** TBD by registrar, closed book, no calculators.

Exams: I try to test your understanding of a concept, and not just straightforward regurgitation of formulae, i.e., **why** certain rules, laws, and techniques hold and are used. Hence, I 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.

A note on effort: Your grade will mainly be a reflection of how you perform on the midterm and final. Homework grades don't have much of an effect, as long as homework is turned in (i.e., most students typically get most of the problems right). **You should do the homework so that you learn the material.** If you find yourself copying or getting solutions from someone else without putting in the effort of solving them yourself, you'll probably find yourself doing poorly on the exams. You won't get much sympathy from me if you come crying to me at the end of the term that you did well on the homework yet poorly on the midterm and final.

If you are a bad test-taker, there is hope! Show me (i.e., in office hours and class) that you understand what is going on, and I take that into account when assigning the final grade.

How much I care about helping students is directly proportional to how much you seem to care about the class (i.e., via attendance, homework, coming to office hours). I have nothing personal against students who think the class is a waste of their time or think they have better things to do with their time. I also have lots to do besides teaching, and will only make the extra effort for those students who earn it by putting in the extra effort themselves (active in class, active at office hours).

Reading / Texts

The textbooks provide a guide for the course, but the course is not entirely contained within the required text.

- **Required:** James F. Kurose and Keith W. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*, 4th ed. Addison-Wesley, 2007, ISBN 0-321-49770-8 (ISBN-13: 978-0-321-49770-3)
- **Optional:** Dimitri Bertsekas and Robert Gallager *Data Networks (2nd ed.)*, Prentice Hall, 1992. ISBN 0-13-200916-1. Significant mathematical treatment (graduate 6000 level - practical stuff a bit out of date).
- **Optional:** Andrew S. Tanenbaum, *Computer Networks (4th ed.)*, Prentice Hall, 2003. ISBN 0-13-066102-3. A lot like Kurose/Ross
- **Optional:** Alberto Leon-Garcia and Indra Widjaja, *Communication Networks: Fundamental Concepts and Key Architectures, 2nd ed.*, McGraw-Hill, 2004. ISBN 0-07-246352X. A bit more mathematical than Kurose-Ross, but less than B&G.

Computing Accounts

You need access to a computer with Berkeley Sockets or the Java equivalent

Cheating

In short: don't do it. Be warned now - I take cheating very seriously. If you are caught cheating on the midterm or final, you will fail the class and I will likely take additional action which can result in your suspension or expulsion from Columbia. It's not worth putting yourself in this position.

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.

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 TAs first *before* doing something you (and I) might consider unethical. Both I and the TAs 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.

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...

Things to know about Professor Rubenstein

- I teach what I believe is fundamental material. Often, this means I gravitate toward the theoretical side and de-emphasize practical details, which I assume Columbia students are more than capable of picking up on their own. I expect students to have decent mathematical sophistication (i.e., know probability and algorithms). The way I teach does **not** prepare you directly for a job as a network programmer, or give you the know-how to work at CUIT, or hack Skype, build your own P2P software, etc. It's not *what* is taught, so much as the thought process behind the evaluation and understanding.

Not everyone agrees with me that this is what should be taught in a networking class. If you disagree with me, the smart thing to do is to drop the course.

- I often write on the board (i.e., I don't like to use slides, I don't always handouts, etc.) so if you want to know what is going on in class, come to class, or get a friend to take notes. Strangely enough, if you're paying attention, I believe you learn a lot more when taking notes yourself. For some reason, when you just read off of notes, your brain tricks itself into thinking it's seen everything when it hasn't.
- I use the book as a rough guide, but I don't follow it verbatim. I will leave out lots of material that is covered in the book, and will interject material that I think is relevant (i.e., a more theoretical/mathematical treatment than what is provided in the book). **Some students hate this.** Sorry, one book is too hard and outdated for this course (Bertsekas and Gallager), the others (including Kurose and Ross) are too lightweight.
- I respond to e-mail in batches. I get between 50-100 e-mails a day that require a response. I read everything as it comes in (Unless traveling, I check e-mail several times during the day, before I go to bed, when I wake up, etc.) but if an e-mail takes more than a minute to craft a response, I usually wait to answer it. Roughly once or twice a week, I do a sweep of my inbox and respond to e-mails in a batch. So if you have questions on the homework and cannot come to office hours, my advice is to not wait until the last minute if you want me to answer questions via e-mail.

Tentative Course Schedule: CSEE 4119 Spring'09

Date	#	Topics/chapters covered	Reading	Assigned	Due
1/21	1	Course Overview; Protocol Layers & Encapsulation	1		
1/26	2	IP, Connection-oriented and connectionless flows; Socket Programming;	2.1, 2.7, 2.8	PA #1	
1/28	3	APP: DNS/http	2.2, 2.5		
2/2	4	APP: P2P: Search & DHTs	2.6		
2/4	5	APP: P2P: BitTorrent		HW #2	PA #1
2/9	6	*** Catchup ***			
2/11	7	TRA: MUX/DeMux; Reliable Data Transfer: Alternating-Bit Protocol	3.1-3.4		HW #2
2/16	8	TRA: Pipelined Reliable Data Transfer: Selective Repeat / Go-Back-N / Parity & Network Coding Techniques PA #3			
2/18	9	TRA: Flow and Congestion Control	3.6		
2/23	10	TRA: Connection Setup & Teardown; TCP case study	3.5, 3.7		
2/25	11	TRA: Inter-flow fairness (max-min, proportional, TCP)		HW #4	PA #3
3/2	12	*** Catchup ***			
3/4	13	*** Catchup ***			HW #4
3/9	14	*** Catchup and/or Midterm review ***			
3/11	15	MIDTERM (in class)			
3/16	–	Spring Break - no class			
3/18	–	Spring Break - no class			
3/23	16	NET: Switching / Fast Lookups / Flow Identification	4.1-4.4		
3/25	17	NET: Routing I	4.5		
3/30	18	NET: Routing II			
4/1	19	NET: Case Studies (BGP, etc.)	4.6		
4/6	20	NET: Multicast and Anycast	4.7		
4/8	21	LINK: Bit error Detection/Correction techniques	5.1, 5.2		
4/13	22	LINK: Bit error cont'd			
4/15	23	LINK: MAC	5.3		
4/20	24	LINK: MAC II			
4/22	25	*** Catchup and/or review ***			
4/27	26	*** Catchup and/or review ***			
4/29	28	*** Catchup and/or review ***			
5/4	29	*** Catchup and/or review ***			
TBD		FINAL EXAM: Location TBD			