

CS/ECE 438: Communication Networks

Fall 2005

Instructor:

Prof. Robin Kravets
Office: 3114 SC
Phone: 244-6026
Email: rhk@cs.uiuc.edu
Office hours: Mondays 10 -12

Class TA:

| Name | e-mail | Office Hours | Location |
|--------------|--|--------------|----------|
| Robin Snader | ta438@cs.uiuc.edu | MW 1-2 | 3109 SC |

Class Webpage:

<http://www-courses.cs.uiuc.edu/class/cs438/>

Class News group:

[class.cs438](mailto:class.cs438@news.cs.uiuc.edu) on news.cs.uiuc.edu

Course Description:

We shall explore the issues for networked communication from local area networks up to the global Internet and shall study a range of solutions to the associated problems. The course will focus on the TCP/IP protocol suite, but will also touch on other protocols. If time permits, we shall also discuss one or two current topics in network research.

The course will involve a significant amount of Unix-based network programming using the C language. This programming experience is intended to provide you with a solid understanding of the services provided by the TCP/IP protocol suite used on the Internet. If you are not already familiar with ANSI C, you will need to learn it quickly.

In addition to our emphasis on network protocols and algorithms, we shall also touch on performance measurement and apply some basic notions of probability and statistics to performance prediction.

Grading Policy:

| | |
|-----------------------------------|-----|
| Homework (7 in total) | 15% |
| Mid-term Exam | 20% |
| Programming Projects (4 in total) | 35% |
| Final Exam | 30% |

Homework and Project deadlines:

All homework is due in class on the specified Monday. Homework must be handed in as a hard copy. We highly recommend that you print out your homework. This will make the graders' jobs easier and alleviate problems with deciphering your handwriting. If you do decide to handwrite your homework, anything that is not legible will be marked wrong. On the due date, a TA will sit at the back of the room to collect problem sets. Assignments are due as you walk in and the TA will leave at 2:10pm. Solution sets will be handed out the following Wednesday in class. No discussion of homework problems will be allowed on the newsgroup or during office hours between the due date and the publishing of the solutions. Homework will be accepted up to the time the solution set is published as long as you find a TA and hand them your homework in person. We will not accept homework handed in via mailboxes or slid under doors

Examinations:

No make-up exams will be given unless an acceptable reason is presented to the instructor or TAs at least one week before the examination date. Exams will be closed-book exams. No calculators or crib-sheets will be permitted.

Re-Grades:

Re-grade requests must be submitted in writing on a separate piece of paper within one week of being returned. Do not write on the original exam. If you do, we will not regrade your HW or exam. We will look at the questions you requested to be regrades, but the entire HW or exam will be regarded. If any grading errors are found, the grade will be changed to reflect these errors. Both positive and negative changes will be made.

Late Policy for MPs:

Late programming assignments will be penalized 2% per hour late.

Academic Honesty:

The course policy for academic honesty is based on Rule 33 of the *Code of Policies and Regulations Applying to All Students*, which states: "It is the responsibility of the student to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions..."

We encourage you to discuss interpretations of problems and assignments with each other but we expect that you will construct and write up your own solutions to any assignment that you turn in for credit. The exception is projects explicitly stated to be performed in teams, for which you may collaborate with your team members as necessary provided that you name all team members on everything turned in.

Your work in this class **must** be your own. You may discuss, in broad terms, such things as strategies for completing machine problems. Be aware that, as a general rule, pseudo-code is not "broad terms". The programs and exams you hand in, however, must contain only your own work. Your program will be checked against other programs in the class for similarities. If you have any questions about this policy, please talk to the staff. In the past, we have caught students cheating by copying programs from other students without their knowledge. To avoid having your work copied without your knowledge, refrain from leaving source code prints lying around the lab, protect your files, don't give your passwords to anyone, and enter your passwords in a way that cannot be seen by others. Do not leave a login session active on an unattended workstation. Use xlock if you must leave briefly, or use some similar measure (or log out!) in other labs; remember that it's a violation of the lab policy (and probably the other lab policies) to leave your workstation unattended for any extended period of time. Report any suspicious behavior to the lab sitters or the TAs.

If students are found to have collaborated excessively or to have blatantly cheated (e.g., by copying or sharing answers during an examination), all involved will at a minimum receive grades of 0 for the first infraction. Further infractions will result in failure in the course and/or recommendation for dismissal from the university.

Class News Group:

You are required to check the class newsgroup and course webpage on a daily basis. Important announcements will be post there. It will also include answers to students' questions that you will likely find helpful.

Graduate Students:

Graduate students MAY take this course for four hours instead of three. (Undergraduates take this course for three hours credit.) Those taking the class for more credit are expected to do more work. In this case, the four hour students will do a term paper.

Books

The primary textbook used for this course is:

- Larry L. Peterson and Bruce S. Davies [2003]. *Computer Networks: A Systems Approach, Third Edition*. Morgan Kaufmann Publishers, San Mateo, California.

The following book is recommended (not required) for the Unix network programming portion of the course:

- W. Richard Stevens, [2003] *UNIX Network Programming (Subtitled Volume I: The Sockets Networking API)* Third Edition, Prentice Hall.

This "second edition" by Stevens is the first volume of a three volume set that has the same title and roughly the same coverage as the original 1990 book:

- W. Richard Stevens, *UNIX Network Programming*, Prentice-Hall, 1990 Edition.

While the three volume set includes much more material and is more up-to-date, it also leaves out some of the essential preliminary material on UNIX programming that was in the 1990 edition. If you have very little experience with Unix network programming you are advised to read chapters 1, 2, 3 and 6 of the first edition. You would then be prepared to take advantage of Volume 1 of the second edition. If you have previous Unix programming experience you may prefer to begin with the second edition. Also, Chapter 26 of the third edition 23 (or chapter of the second edition) covers UNIX threads which basically allow forking inside a process. In 338 you will be asked to use threads, although some of the more advanced aspects of threads will not be needed.

Finally, you will need to have (or quickly acquire) a good knowledge of the ANSI C programming language, including the use of pointers, structures, typedef, and header files. Thus, you should have a basic book on ANSI C (such as the one by Kernighan and Ritchie, but there are many nice books on ANSI C), unless you are experienced enough in C programming to just use the man pages on the workstations for help.

Other textbooks on networks and data communications:

- S. Tanenbaum, *Computer Networks*, 4th edition, Prentice-Hall, Inc., 2002.
- W. Stallings, *Data and Computer Communications*, 5th edition, Prentice-Hall, Inc., 1996.
- D. E. Comer and R. E. Droms, *Computer Networks and Internets*, 2nd edition, Prentice-Hall, Inc., 1998.
- R. Gallager and D. P. Bertsekas, *Data Networks*, 2nd edition, Prentice-Hall, Inc., 1991.

C programming

- H. M. Deitel and P. J. Deitel, *C: How to Program*, 2nd edition, Prentice-Hall, Inc., 1994. Comments from one student who used the book:
"It's a thick book, and it starts right at the very basic beginning. But I thought it was very well written, providing more than just the basics but also relevant programming tips and warnings. It covers the standard library, but not really UNIX-specific stuff. Since then, I've found it to be a really good reference."

Probability and Statistics

- S. M. Ross, *A First Course in Probability*, 5th edition, Prentice-Hall, Inc., 1997.

Schedule

Note: All dates are subject to change.

| Date | Topic | Readings | Assignments |
|--------|--|---|---|
| Aug 24 | Overview | Peterson and Davie: Chapter 1 | HW1 (out), Project 1 (out) |
| Aug 29 | Cycle Analysis | | |
| Aug 31 | Introduction to UNIX Network Programming | Stevens Unix Network Programming | |
| Sep 5 | Labor Day | | |
| Sep 7 | Direct Link Networks | Peterson and Davie: Chapter 2 | HW1 (due), HW2 (out) |
| Sep 9 | | | Project 1 (due), Project 2 (out) |
| Sep 12 | Direct Link Networks | Peterson and Davie: Chapter 2 | |
| Sep 14 | More Network Programming | Stevens Unix Network Programming Sample code | |
| Sep 19 | Direct Link Networks | Peterson and Davie: Chapter 2 | HW2 (due), HW3 (out) |
| Sep 21 | Reliability | | |
| Sep 23 | | | Project 2 (due), Project 3 (out) 1/4 unit project proposal (due) |
| Sep 26 | Direct Link Networks | Peterson and Davie: Chapter 2 | |
| Sep 28 | Media Access Control | | |
| Oct 3 | IEEE 802.11 | | HW3 (due), HW4 (out) |
| Oct 5 | Packet Switched Networks | Peterson and Davie: Chapter 3 | |
| Oct 10 | Bridges | | |
| Oct 12 | Switches | | |
| Oct 14 | Midterm review | | Design document for MP3 (due) |
| Oct 17 | In-class review Session | | HW4 (due), HW5 (out) |
| Oct 17 | Midterm - 7:00 - 8:30pm | | |
| Oct 19 | Internetworking | Peterson and Davie: Chapter 4 and Section 9.1 | |
| Oct 24 | Routing | | |
| Oct 26 | Mobility | | |
| Oct 31 | Internetworking | Peterson and Davie: Chapter 4 and Section 9.1 | HW5 (due), HW6 (out) |
| Nov 2 | Global Internet Multicast and IPv6 | | |
| Nov 4 | | | Project 3 (due), Project 4 (out) |
| Nov 7 | End-to-End Protocols | Peterson and Davie: Chapter 5 | |
| Nov 9 | | | |
| Nov 14 | Congestion Control | Peterson and Davie: Chapter 6 | HW6 (due), HW7 (out) |
| Nov 16 | | | |
| Nov 21 | Thanksgiving Break | | |
| Nov 23 | Thanksgiving Break | | |
| Nov 28 | Congestion Control | Peterson and Davie: Chapter 6 | |
| Nov 30 | QoS DoS | | |
| Dec 2 | | | Project 4 Code (due) |
| Dec 5 | | | HW7 (due) |
| Dec 7 | Performance: Metrics, Analysis, and Examples | Bertsekas and Gallager Sections 3.1-3.3 | Project 4 Writeup (due) Grad project due |
| | Final review | | |
| Dec 16 | Final: 1:30 - 4:30 PM | | |