CS 447 : Networks and Data Communications

Instructor: Thoshitha Gamage, Ph.D.
Southern Illinois University at Edwardsville

Summer 2017 Syllabus

Course Information:
  Title: CS 447 : Networks and Data Communications (3 Credits)
  Location: EB 0165
  Time: T & TR 11:00 – 01:40 p.m.
  Course Web site: http://www.cs.siue.edu/~tgamage/M17/CS447

Contact Information:
  Office: EB 3053
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  Web Site ⌂:   http://www.cs.siue.edu/~tgamage
  Office Hours: T & TR 01:45 – 03:00 p.m. *or by appointment*

This class is an undergraduate level introduction to computer networks with the following learning objectives:

1. to acquire fundamental understanding and knowledge of underlying mechanisms in modern computer networks;
2. to become proficient in essential applied network skills – socket programming, diagnosis, etc. – and protocols through programming projects; and
3. to become familiar with theoretical methods to analyze system performance of various aspects of modern computer networks.

By the end of the semester, students are expected to be proficient in networking programming, with insights into the underlying network mechanisms and protocol interactions. The content of this course is influenced by and was developed in accordance to the IEEE/ACM Computer Science Curriculum Guidelines (2013) http://www.acm.org/education/CS2013-final-report.pdf

1 Course Prerequisites

CS340 – Data Structure and Algorithms (**graph theory**), and CS314 – Operating Systems (**system programming**). In addition, fluency and significant experience in structured or imperative programming (e.g. C, C++, Java, Python), and **Unix/Linux** is a **MUST** for the hand-on experiments. If you do not meet these prerequisites, talk to the instructor immediately within the first week of classes. I reserve the right to drop participants from the course that do not meet these minimum prerequisites.

2 Textbook & Resources

[**Required**] [**PR7e**] Computer Networking: A Top-Down Approach 7th ed., Kurose and Ross, Pearson, ISBN 0-13-359414-9 Online:http://www-net.cs.umass.edu/kurose-ross-ppt-7e/
[**Supplemental**] [**SFR3e**] Unix Network Programming, Volume 1: The Sockets Networking API, 3nd ed., Stevens, Fenner & Rudoff, Prentice Hall, ISBN: 0131411551

[**Supplemental**] [**BH3e**] Beej's Guide to Network Programming, Online: http://beej.us/guide/bgnet/output/print/bgnet_USLetter.pdf
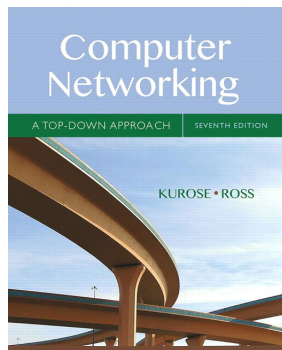
(a) [**PR7e**]
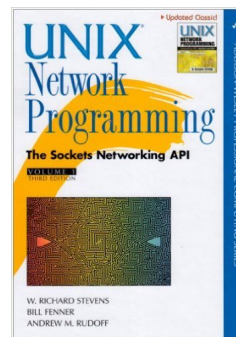
(b) [**SFR3e**]

My lecture notes are based on numerous textbooks from my personal library and recent literature, and typically have a **strong mathematical flavor** to them. You can find **PR7e** Authors' slides at http://www-net.cs.umass.edu/kurose-ross-ppt-7e/.

Students are also **required** to check the course website, Moodle, and the SIUE email account regularly for any important updates.

3   Assigned Work and Tentative Grading Policy

The following grade allocation breakdown is _**tentative**_, and may change during the semester. Unless the circumstances change, I am **NOT** planning on curving or rounding the final grade.

Grading Allocation		BS	MS
Exams		40%	40%
Midterm	15% / 15%		
Final _(comprehensive!!)_	25% / 25%		
Attendance & Scribing		5%	5%
Wireshark Labs		25%	20%
Programing Projects		30%	25%
Graduate Standing Project		–	10%

Final Letter Grade	
90–100	A
80–89	B
70–79	C
60–69	D
below 60	F

3.1   Exams

All exams and quizzes will be held in the lecture room.

- **Midterm** : Tuesday June 06th 12:25 – 01:40 p.m.
- **Final** : Thursday June 29th 12:00 – 01:40 p.m.

3.2   Class Participation

You are expected to **proactively** participate in in-class discussions. This aids your learning and that of your classmates, and provides valuable feedback on the lecture. Constructive and proactive participation in in-class discussions and scribing accounts for 5% of your final grade. I, therefore, expect you to attend each and every class.

In preparation for each lecture, you are expected to read the relevant sections from **PR7e** (_see Tentative Schedule below_). I will try my best to direct you to other relevant resources where applicable, but I fully expect you to **take the responsibility of your own learning** and come fully prepared to the class.

Each student is required to submit their scribe notes a **minimum of twice** (preferably once before and once after the mid term) for the semester. Scribe notes are due through *Moodle* within **48 hours** after each lecture. Only the top two scribe submissions (based on Moodle timestamp) will be counted as valid submissions. These scribe notes serve as a baseline set of complementary notes to you and to your colleagues, hence please take every effort to make them legible; Typed and/or clearly legible scanned notes are acceptable. **Photos of any form are not**.

3.3   Wireshark Labs

There will be roughly ~3-4 Wireshark Labs with a 1 class period deadline from the day each is assigned. In preparation, each student is expected to download and install Wireshark from the official website `https://www.wireshark.org/`.

3.4   Programming Projects

You will be given roughly ~3 hands-on network programming experiments. These will be posted in the course website. I will give you the option to choose a language of your choice for programming (though C++, Java, or Python is recommended) but your programs **must** compile and run on a Unix/Linux machine. Either setup your own Linux virtual machine or use one of the workstations in EB1036, which dual-boots to Linux, for your development and testing. Please see the tentative schedule for assignment due dates.

3.5   Graduate Standing Project

Graduate students are required to conduct a mini-research project that is worth 10% of their final grade. Ideally, this would be a fairly comprehensive literature survey of a topic of your choosing with some empirical validation. Your topic should be relevant to the theme of this course. Important milestones for your project are listed below. All assignments are due at the beginning of class through Moodle.

- Tuesday May 16th, 2017 – A one page research proposal and a justification of your proposed research.
- Tuesday June 06nd 2017 – ~2-3 page research progress summary.
- Thursday June 29th 2017 – Final report and in-class Presentation.

Places to look for a research topic includes (but not limited to) IEEE FOCS, ACM STOC, ISAAC, SODA, IEEE S&P, ACM CCS, SOCG, IEEE CCC, ACM PODC, IEEE IPDPS, CSF, DSN, IEEE ICDCS, USENIX, etc. Topics in Cybersecurity are **highly favorable**.

A typical graduate level research of this scope would include a bare-minimum 20-25 *highly cited* research papers. I reserve the right to decide which projects meet graduate standing and lower the grade for those who don't; hence, make sure to clearly exchange your research ideas with me, find out about my expectations, and set yourself up for success **early** in the semester.

You are to present your research to the class at the conclusion of your research during week 08. In addition, you are required to produce an IEEE conference style minimum 8-page paper of your research. A template can be found at `http://www.ieee.org/conferences_events/conferences/publishing/templates.html`. You are **highly encouraged** to produce your report using Latex.

In addition, graduate students may have additional mandatory questions in exams. Accordingly, graduate students will be graded on separate scale. Please refer Section 3 for the scale.

4   Course Requirements and Policies

4.1   Attendance Policy

Given our condensed time frame, I allow you to miss at most 1 class for the semester without any penalties. Medical emergencies are outside this "absentee allowance", but should be accompanied by proper documented proof of medical services. For planned absences, assignments should be turned in before the absence rather than after. I reserve the right to lower the grade of any student who is markedly deficient in attendance and/or in in-class participation. If you miss a class, it is *your* responsibility to find out what happened and to collect any material that was handed out in the class.

4.2   Late Policy

Unless otherwise noted or <u>announced in-class</u>, all deadlines are hard deadlines and are due at the beginning of class on the due date. Programming assignments typically have a 2 week deadline. Wireshark labs have a 1 week deadline. Assignments may be turned within 48 hours *grace period* after the deadline with a 20% late penalty. No assignment is accepted beyond that.

4.3   Responsible Learning Policy

I expect *you* to *own* your degree of success in this class *and*, I expect you to contribute to the success of others. Examples:

- Read outside the class on your own in preparation for each lecture, jot down any questions your encounter on your reading (strongly encouraged), and bring those to the class as discussion points;
- Be respectful of the learning environment. Refrain from activities that may disturb the flow of the lecture or the environment;
  - Do not engage in disruptive *"little talk"* while I am conducting the lecture; if you have a concern, raise your hand and grab my attention. be respective of your colleagues time and desire to learn.
  - Put your cell phones to vibrate mode and refrain from using your computers for casual web browsing. Take full advantage of the opportunity to learn.
- Cooperate with other students and to share your knowledge during in-class discussions. Respect the differences in learning and understanding of each other. Seek ways of taking advantage of those differences;
- If another student is confused, help him or her out without disturbing the class;
- I enjoy engaging in technical conversations with students with the goal of helping them create an accurate understanding of course material. Participating in such conversations is very favorable for your class participation grade;
- If I am systematically doing something that inhibits your learning, tell me;
- Engage in *proactive learning*: speak up when you don't understand, question assumptions, relate course material to your experience outside class, seek out additional experience and reading related to the class. You must *construct* your understanding of the material;
- If a lecture point is unclear, ask questions and ask me to repeat what I said, preferably in class, during office hours, or by e-mail. You are probably not alone in your confusion;
- Promptly review feedback you receive from me or other students to actively clarify the feedback if the material is still unclear and to incorporate the feedback in your future work;
- Spend adequate time on the course. Adequate time includes getting enough rest so that time you spend on course tasks is well-spent time. Adequate time includes proofreading and reviewing your assignments before you hand them in;
- Have high expectations of yourself: set goals for yourself and try to do your very best. Consciously think about the balance between what you do to earn a grade and what you do to learn (If I'm doing something that puts these in opposition to each other, please let me know.); and,
- Check your SIUE assigned student email and the course website regularly for important class announcements.

<u>IMPORTANT</u>: I strongly discourage you from getting into discussions with me about grades and how you can get a better one. This includes emailing me about possible ways to "bump" your grade. Such requests only mean one thing; that you have already fallen behind on your own expectations.
Do your own work. Your exams, homeworks, and programming projects are subject to the academic honor code. **DO NOT CHEAT IN ANY WAY: DO YOUR OWN WORK!**. Following activities will be considered academic dishonesty:

- Submitting work (such as assigned work, projects, and code) done by somebody else (this includes any human/electronic sources (such as web sites));
- Watching and copying your neighbors' solutions during quizzes and/or exams;
- Using materials not allowed during quizzes and exams;
- Using materials not allowed for the programming projects.

It is quite acceptable to ask others things like "Have you come across this particular issue/error/exception before?," and even having them briefly look briefly at your stack trace and/or its code. To have them spend hours helping develop or seriously rearrange your program's logic, on the other hand, is not acceptable. And, of course, it is unacceptable for two or more people to collaboratively develop the solutions to assignments. If you are tempted to collaborate on such assignments, **DON'T!!**.

I expect you to know and observe the SIUE Student Conduct Code (3C1) and Student Academic Code (3C2). Copying of other students' work, working together on individual assignments, plagiarism of published sources and other forms of academic dishonesty will result in zero credit on the assignment for all students involved and a lower grade in the class. A second offense (across the University) will result in an automatic **F** in the course and exposes the violator to University sanctions up to and including expulsion. All offenses will be reported to Student Affairs.

4.3.1   Advice

   a Don't wait until the last minute to do homework or projects. Labs get busy, computers break down, and people get sick. These are not sufficient excuses for an extension.
   b Save early; save often!
   c Contact me if you are confused. Don't wait for office hours; send an email.

4.4   Disability Support Services: http://www.siue.edu/dss

If you are a student with a disability that requires curricular or co-curricular accommodations, please go to Disability Support Services for coordination of these accommodations. All accommodations are individualized and require documentation of the functional impacts of the disability and severity. DSS is located in the Student Success Center, Room 1270; you may contact them to make an appointment by calling (618) 650-3726 or sending an email to disabilitysupport@siue.edu. Please visit the DSS website located online at www.siue.edu/dss for more information.

4.5   CS447 in a Nutshell

1	2	3	4	5	6	7	8
WS00	WS01	WS02			WS03		
		PR01		PR02		PR03	
	M1			M2			M3
				ME			FE

WS##   – Wireshark Labs
M#   – Graduate Standing Project Milestones
PR##   – Programming Assignments/Projects
ME   – Mid-Term Exam
FE   – Final Exam

5   Tentative Schedule*

*<mark>Subject to adjustment and Change.</mark> I reserve the right to change topics or add an item of related interest. All changes will be announced in class.

Week	Dates	Topics	References	Assignments/Exams
01	May 09, 11	Course Overview, TCP/IP Stack, Network Performance Socket Programming, **Application Layer:** HTTP, FTP	**PR7e**/01,02	WS00 > out WS00 < in
02	May 16, 18	DNS, SMTP, P2P **Transport Layer:** Reliable Data Transfer Principles	**PR7e**/02,03	M1 < in, WS01 > out WS01 < in, PR01 > out
03	May 23, 25	Reliable Data Transfer Principles	**PR7e**/03	PR01 < in, WS02 > out
04	May 30, Jun. 01	TCP: Flow Control, Congestion Control, UDP **Network Layer:** Routing vs. Forwarding, Routers	**PR7e**/03,04	WS02 < in PR02 > out
05	Jun. 06, 08[‡]	<mark>**Midterm Exam 12:25 – 01:40 p.m.**</mark> IPv4 Addressing, DHCP, Subnetting	**PR7e**/04	M2 < in PR02 < in
06	Jun. 13, 15	Routing Protocols, ICMP, IPv6 RIP, OSPF, BGP	**PR7e**/05	WS03 > out WS03 < in
07	Jun. 20, 22	**Link Layer:** Error Detection and Correction ALOHA, Slotted ALOHA, CSMA, CSMA/CD	**PR7e**/06	PR03 > out
08	Jun. 27, Jun. 29[§]	**Network Security** Graduate Presentations and <mark>**Final Exam: 12.00 – 01.40 p.m.**</mark>	**PR7e**/08	PR03 < in M3 < in

[‡]Midterm Exam
[§]Graduate Project: In class presentations