CS 447 : Networks and Data Communications (online)

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Southern Illinois University at Edwardsville

Summer 2020 Syllabus

Course Information:

📖	Title:	CS 447 : Networks and Data Communications (online) (3 Credits)
🖧	Location:	Online through Zoom. `Meeting ID:` **945-9376-9074**
🕐	Time:	T & R 10:00 – 12:40 p.m.
🌐	Course Website:	http://www.cs.siue.edu/~tgamage/courses/447M20
✤	Assignment Dropbox:	Blackboard https://bb.siue.edu

Contact Information:

✉	Email:	tgamage@siue.edu
🌐	Web Site:	http://www.cs.siue.edu/~tgamage
📅	Office Hours:	*by appointment thru Zoom. Email me first*

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

1. to gain a fundamental understanding of how modern communication networks and their underlying mechanisms work;
2. to become proficient in the TCP/IP protocol suite and in applied networking – network programming, diagnosis, basic penetration testing, network engineering, performance analysis – through hands-on activities;
3. to kick-start cybersecurity education.
4. to facilitate a learning environment to strengthen participants' *theoretical* and *empirical* knowledge; and
5. to improve participants' critical thinking, reading, and writing skills;

By the end of the semester, students are expected to be proficient in networking programming with insight into underlying network mechanisms. The content of this course is influenced by and was developed in accordance with the IEEE/ACM Computer Science Curriculum Guidelines (2013) https://www.acm.org/binaries/content/assets/education/cs2013_web_final.pdf.

1   Course Prerequisites

CS340 – Data Structure and Algorithms (**graph theory**), and CS314 – Operating Systems (**system programming**). Fluency and significant experience in an imperative programming language (e.g. C, C++, Java, Python), and **Unix/Linux** is a **MUST** for the hands-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.

1.1   Technology Requirements

Due to COVID-19, all exams will be held online through Blackboard. Student will need access to following technology to take online exams.

- Respondus Lockdown Browser. Download the version found at http://www.respondus.com/lockdown/information.pl?ID=332313667
- A computer running Windows/Mac (..an unfortunate limitation of the Lockdown Browser)
- A webcam (for proctoring)

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
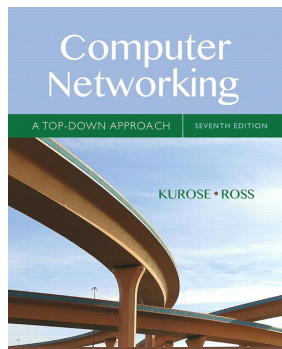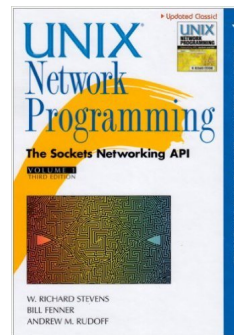
(a) [**PR7e**]   (b) [**SFR3e**]

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. All assigned work (Wireshark and Programming Assignments) will be available through the course website (not Blackboard).

Grading Allocation		BS	MS
Exams		40%	35%
Midterm	15% / 13%		
Final *(comprehensive!!)*	25% / 22%		
Attendance & Daily Pop Quizzes		10%	10%
Wireshark Labs		20%	15%
Programing Projects		30%	25%
Graduate Standing Project		–	15%

Final Letter Grade	
[88 ++	A
[78–88)	B
[70–78)	C
[60–70)	D
– 60)	F

3.1   Exams

- **Midterm** : Tuesday June 09th 11:25 – 12:40 p.m. (75 mins)
- **Final** : Thursday July 01st 11:00 – 12:40 p.m. (100 mins)

3.2   Attendance & Daily Quizzes

On each lecture day, there will be 1-2 pop quizzes that accounts for 10% of your final grade. In preparation, you are expected to read the relevant sections from **PR7e** (*see Tentative Schedule below*).

3.3 Wireshark Labs

There will be roughly ~3-4 Wireshark Labs with a 1 week deadline from the assigned day. In preparation, you are 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. If you don't run Linux natively, best alternative is to setup your own Linux virtual machine or see if you can setup a Linux dual boot (especially for students using Windows OS). Additionally `vm-02.cs.siue.edu` is explicitly available for CS447 students for remote usage.

3.5 Graduate Standing Project

Graduate students are required to conduct a mini-research project that is worth 15% 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 Blackboard.

- Tuesday May 19th, 2020 – A one page research proposal and a justification of your proposed research.
- Thursday June 11th 2020 – ~2-3 page research progress summary.
- Thursday July 02nd 2020 – 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**. Have a look at the USENIX security symposium proceedings `https://www.usenix.org/conference/usenixsecurityXX/technical-sessions` (*Replace XX with a 2-digit year (e.g. 19)*) for a quick "*get me up to speed*".

A typical graduate level research of this scope would include a bare-minimum 15-20 *highly cited* research papers, ideally culminating a fairly comprehensive literature survey and a taxonomy. Here's a sample for your review: `https://dl.acm.org/citation.cfm?id=3047307`.

You are to present your research to the class at the conclusion of your research during weeks 15 and 16. 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.

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.

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

You are expected to attend all live lectures and **proactively** participate in in-class discussions. A recording of each lecture will be available through the Zoom cloud storage. Additionally, In addition, I will also share all my live scribe notes. The video lectures do expire after 30 days, thus it is important for you to pay attention to the live lecture, take your own notes, and not solely depending on recorded lectures.

4.2   Late Policy

Unless otherwise noted or announced in-class, all deadlines are hard deadlines and assignments are due at the beginning of class on the due date. Assignments may be turned within 48 hours *grace period* after the deadline (except any final projects) with a 20% late penalty. No assignment is accepted beyond this grace period. Graduate project milestones do not have any grace periods.

4.3   Responsible Learning Policy

There is a no tolerance policy with regards to cheating. **Anyone caught cheating will fail the course**. Do your own work. Your exams, homeworks, and programming projects are subject to the academic honor code. 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 problem solving and/or exams;
- Collaboratively develop solutions to individual assignments;
- Using materials not allowed during problem solving and exams;
- Using materials not allowed for the programming projects.

You are expected to know and observe the SIUE Student Conduct Code (3C1) and Student Academic Code (3C2) found at `http://www.siue.edu/policies`. If you are unsure about what constitutes as plagiarism, check this website: `https://www.siue.edu/education/psychology/plagiarism.shtml`

4.3.1   Online Repositories

If you indent to keep any project source code in online repositories, ensure those repositories are **private** and **only accessible to you**. By making source code publicly available to others, you might be involuntarily participating in plagiarism.

4.3.2   Advice

This course will require a substantial amount of time reading and solving problems outside of class time. It is imperative that you keep up with the assigned reading and other tasks as much as possible. If you do not, it will be very difficult to be successful in this course.

Know the information, how to approach the problem/solution, and present it in a clear and organized manner. On exams and in programming projects, you are attempting to demonstrate understanding of concepts and the ability to solve problems. If I have to try to determine **how** you came up with your answer, then you will **not** receive full credit.

The following conditions are subject to loss of some or all credit for a given problem:

- Illegible work/answers
- work/answers that cannot be easily located
- no work
- missing/incorrect units
- compile-time and/or run-time errors

Solutions which clearly demonstrate understanding of the material, but have a minor error may receive partial credit. The final score for such problems is at the discretion of the grader and/or the instructor.

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.
d. 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.

4.4 Accessible Campus Community & Equitable Student Support: http://www.siue.edu/access

Students needing accommodations because of medical diagnosis or major life impairment will need to register with Accessible Campus Community & Equitable Student Support (ACCESS) and complete an intake process before accommodations will be given. Students who believe they have a diagnosis but do not have documentation should contact ACCESS for assistance and/or appropriate referral. The ACCESS office is located in the Student Success Center, Room 1270. You can also reach the office by e-mail at myaccess@siue.edu or by calling 618.650.3726. For more information on policies, procedures, or necessary forms, please visit the ACCESS website at www.siue.edu/access.

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 Projects, ME – Mid-Term, FE – Final

5 Tentative Schedule*

*Subject to adjustment and Change. 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 12, 14	Course Overview, TCP/IP Stack, Network Performance Socket Programming, **Application Layer:** HTTP, FTP	**PR7e**/01,02	WS00 > out WS00 < in
02	May 19, 21	DNS, SMTP, P2P **Transport Layer:** Reliable Data Transfer Principles	**PR7e**/02,03	M1 < in, WS01 > out WS01 < in, PR01 > out
03	May 26, 28	Reliable Data Transfer Principles	**PR7e**/03	
04	June 02, 04	TCP: Flow Control, Congestion Control, UDP **Network Layer:** Routing vs. Forwarding, Routers	**PR7e**/03,04	PR01 < in, WS02 > out WS02 < in, PR02 > out
05	Jun. 09‡, 11	Midterm Exam 12:25 – 01:40 p.m. IPv4 Addressing, DHCP, Subnetting	**PR7e**/04	M2 < in
06	Jun. 16, 18	Routing Protocols, ICMP, IPv6 RIP, OSPF, BGP	**PR7e**/05	PR02 < in, WS03 > out WS03 < in, PR03 > out
07	Jun. 23, 25	**Link Layer:** Error Detection and Correction ALOHA, Slotted ALOHA, CSMA, CSMA/CD	**PR7e**/06	
08	Jun. 30, Jul. 02§	**Network Security** Graduate Presentations and Final Exam: 12.00 – 01.40 p.m.	**PR7e**/08	PR03 < in M3 < in

‡Midterm Exam
§Graduate Project: In class presentations