Syllabus

CS550: Advanced Operating Systems
http://www.cs.iit.edu/~iraicu/teaching/CS550-F23/

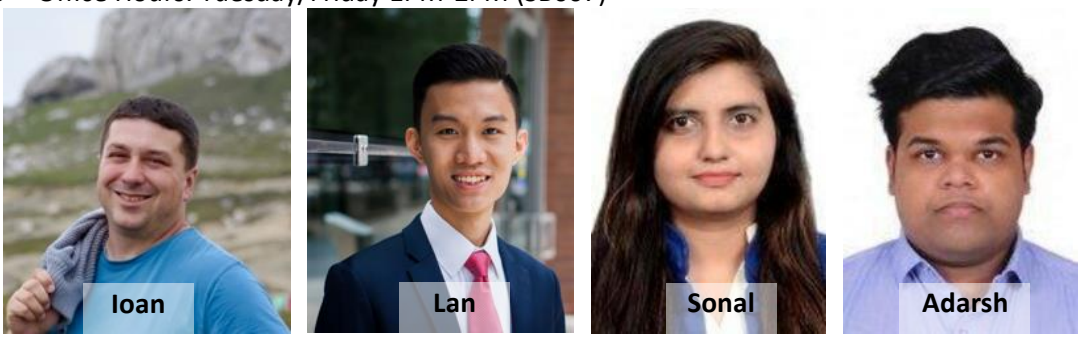
Semester: Fall 2023
Lecture Time: Tuesday/Thursday, 11:25AM - 12:40PM
Location: IIT Tower, Room 1F6-1

Professor:

- **Dr. Ioan Raicu** (iraicu@cs.iit.edu, 1-312-567-5704)
  - Office Hours: Tuesday 1PM-2PM (SB226B)

Teaching Assistants (cs550-ta-group@iit.edu**):**

- **Lan Nguyen**
  - Office Hours: Monday 1PM-2PM, Thursday 3PM-4PM (SB007)
- **Sonal Gaikwad**
  - Office Hours: Wednesday/Thursday 2PM-3PM (SB007)
- **Adarsh Agrawal**
  - Office Hours: Tuesday/Friday 1PM-2PM (SB007)



Course Description

This course covers general issues of design and implementation of distributed systems. The focus is on issues that are critical to the applications of distributed systems and computer networks, which include interprocess communication, distributed processing, sharing and replication of data and files. Approximately two third of the course will be devoted to basic concepts and techniques, and the remaining third will be on assorted current topics in advanced distributed systems. CS550 is a good foundational course for many other courses, such as CS546, CS553, CS554, and several CS595 special topic courses. Many of these graduate courses are part of the Master of Computer Science Specialization in Distributed and Cloud Computing.

Prerequisites

CS450 Operating Systems. Other courses that might contribute (but are not required) to having a better in depth understanding of this course are CS442, CS451, CS470, CS542, CS551, CS562, and CS570.

Required Texts

REQUIRED: Maarten van Steen and Andrew S. Tanenbaum. "Distributed Systems", Prentice Hall, 4th Edition, 2023

- https://www.distributed-systems.net/index.php/books/ds4/ (free download)

Detailed Course Topics (tentative)

- Introduction to Distributed Systems
- System Architectures & Client-Server Models
- Remote Procedure Call
- Remote Method Invocation
- Message/Stream-Oriented communication
- Processes and threads
- Accelerator Architectures
- Accelerator Programming
- Code migration and scheduling
- Naming
- Synchronization
- Consistency models
- Fault Tolerance
- Networked file systems
- Parallel File Systems
- Distributed File Systems

Written Assignments

There will be 3 assignments throughout the semester, each worth 5% of the total grade, and each taking about 2 weeks to complete. These assignments will be written questions and answers. The written assignments will overlap with the programming assignments. These assignments can be completed in groups of up to 3 students. These assignments will automatically be pulled from GitLab nightly.

Programming Assignments

There will be 3 programming assignments throughout the semester, each worth 10% of the total grade, and each taking about 2.5 weeks to complete. These assignments can be completed in groups of up to 3 students. The projects will require knowledge of Java, C, C++, and/or Python. It is expected that students know the basics of these languages. These assignments must all work in a Linux environment (in which they will be graded in). These assignments will automatically be pulled from GitLab nightly.

Project

There will be 1 major project assigned on Tuesday 11/07/23, spanning 4 weeks, involving the performance benchmarking of a real distributed system, a written report, and a poster presentation. Students are to complete this project in groups of up to 3 students. The evaluation will be done on the Chameleon Testbed. Everyone will conduct the same evaluation. More details will be given in class. Students will write a final report, and make a 10 minute oral presentation (as a group) on their results on Tuesday (11/28/23) or Thursday (11/30/23) from 11:25am – 2:30pm. The final report will be due on Wednesday 12/6/23. These assignments will automatically be pulled from GitLab nightly.

Computer Usage

Computer systems that will be used for development of projects (more information about access to these will be passed in the first several lectures):

- **Chameleon** (https://www.chameleoncloud.org)

Exam

There will be 1 final exam that will cover material from the entire semester. The exams will be individual, but students will be allowed to use their textbooks and any notes they have (on paper). No electronic devices such as phones, eReaders, tables, or laptops will be allowed. Stand-alone calculators will be allowed, as long as they do not have a browser (e.g. phones, tablets, laptops). The final exam will be worth 40% of the overall grade. In-class students must take the exam in class. Online students can take the exam at an official testing center or in class.

The final exam will be on Thursday November 2nd, 2023, from 11:25am – 1:25pm in IIT Tower 1F6-1.

There will be no makeup exams. Missing the final exam will result in a letter grade of E regardless of scores on assignments throughout the semester.

Late Policy

Assignments will be due at 11:59PM on the day of the due date, through GitLab. There will be a 1-hour grace period. Your GitHub repositories will be automatically pulled every night at 1AM. Any late submissions beyond the grace period will be penalized 20% every day it is late (an assignment that is more than 5 days late will receive zero credit). Exams cannot be taken late.

Important Dates (tentative)

- 08-22-23: First day of class
- 09-05-23: WA1 out
- 09-12-23: PA1 out
- 09-19-23: WA1 due, WA2 out
- 09-26-23: PA1 due, PA2 out
- 10-03-23: WA2 due
- 10-10-23: WA3 out
- 10-12-2023: PA2 due, PA3 out
- 10-24-23: WA3 due
- 10-26-23: Last lecture to be covered on final exam
- 10-31-23: PA3 due, Review session for final exam
- 11-02-23: Final exam
- 11-07-23: Project writeup out
- 11-21-23: Last lecture
- 11-23-23: NO CLASS – Thanksgiving Break
- 11-28-23: Final presentations – Part #1
- 11-30-23: Final presentations – Part #2
- 12-06-23: Final report due

Grades

Grading Policies:

- **Written Assignments (3):** 15%
- **Programming Assignments (3):** 30%
- **Project (1):** 15%
- **Exam (1):** 40%; -- no makeups

The following grading scale will be used:

- **A: 85% ~ 100%**
- **B: 70% ~ 84%**
- **C: 50% ~ 69%**
- **E: 0% ~ 49%**

Undergraduates registered for CS550 will have the same grading scale for A, B, and C. Letter grade D will be assigned between 40% and 49%. Letter grade E will be from 0% to 39%.

PhD student section (PhD students, make sure you are registered for the correct section):

PhD students registered for the PhD section must be in the upper quartile (75 percentile) of all the students in the class for both the overall grade and the final exam grade in order to receive an A grade (which will constitute a PASS on the Systems Qualifier Exam). PhD students registered for the PhD section must be between 50 percentile and 74 percentile of all the students in the class for both the overall grade and the final exam grade in order to receive a B grade (which could constitute a PASS on the Systems Qualifier Exam if other qualifier grades were As). If an A or B is not achieved for PhD students, letter grades C and E will follow the scale listed above.

Discussion Forum

This course will use BlackBoard to facilitate discussions and communication. BB should be the primary mechanism of communication between the students and the professor and the TAs. In order to reach all the TAs, and professor, please send email to cs550-ta-group@iit.edu.

Plagiarism Policy

Cheating will not be tolerated. We will use the MOSS: Measure Of Software Similarity system from Stanford (https://theory.stanford.edu/~aiken/moss/). It is used to automatically determine the similarity of programs (even if they are written in different programming languages). The supported languages are: C, C++, Java, C#, Python, Visual Basic, Javascript, FORTRAN, ML, Haskell, Lisp, Scheme, Pascal, Modula2, Ada, Perl, TCL, Matlab, VHDL, Verilog, Spice, MIPS assembly, a8086 assembly, a8086 assembly, MIPS assembly, HCL2.

You will receive a 0 on the assignment; extremely serious offences will fail the course and be reported to the university.

Some example screen shots from the MOSS system: