

CS211: COMPUTER ARCHITECTURE

Summer 2020

Mondays and Wednesdays, 6:00pm - 9:50pm (via Sakai Meetings)

Instructors:

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Course Description:

This course covers materials to illustrate how a high level program is converted to binary and is eventually executed by the hardware. We will cover a brief introduction to programming in C, how data and control represented in C is converted to binary and how the binary code is executed by the processor. This will involve programming in C, understanding and debugging X86 assembly, interfaces between the hardware and the software components, organization of hardware and how the various components interact.

1. Von Neumann architecture, hardware trends, performance, energy, cost metrics
2. Introduction to C programming
3. Assembly language techniques and instruction-set design
4. Boolean algebra, digital logic
5. The memory hierarchy
6. Performance
7. Input/Output concepts

Prerequisites: 01:198:112 Data Structures

Textbooks:

1. **Computer Systems: A Programmer's Perspective** 3rd Edition, by R.E.Bryant and D.R.O'Hallaron
Note: students can probably also use the second edition of the book (Required)
2. **Computer Organization and Design: The Hardware/Software Interface** by D.A.Patterson and J.L.Hennessy (**Recommended**)
Note: while this textbook is recommended, we will use portions of it for various lectures
3. **The C Programming Language** by B.W.Kernighan and D.M.Ritchie (**Recommended**)
Note: highly recommended for C programming

Grading Policy: Midterm (20%), Final (30%), Projects (45%), Class Participation (5%)

Important Dates:

Midterm July 22, 2020
Final Exam August 12, 2020

Tentative Schedule:

Monday	Wednesday
June 22: Introduction and C Programming June 29, 2019 - C Programming July 6, 2019 - Data Representation July 13, 2019 - Assembly Language July 20, 2019 - Assembly Language July 27, 2019 - Cache Design August 3, 2019 - Digital Logic August 10, 2019 - Digital Logic	June 24, 2019 - C Programming July 1, 2019 - C Programming July 8, 2019 - Assembly Language July 15, 2019 - Assembly Language July 22, 2019 - Midterm July 29, 2019 - Digital Logic August 5, 2019 - Digital Logic August 12, 2019 - Final Exam

Programming Assignment Policies:

There will be numerous programming assignments to improve your understanding of the subject. Programming assignments will be handed in via Sakai. We will provide instructions for packaging and handing in your assignments. You must follow these instructions exactly. If we cannot compile or run your programs, you will lose a significant portion of points. We will not accept late assignments. Programming assignments must be handed in by the specified time/date on Sakai.

You will have to If you don't already have an account on the Instructional Laboratory cluster go to <https://resources.cs.rutgers.edu/docs/computer-systems/student-systems/> and create one. iLab machines are located in Hill 248, 250, 252, and 254. All registered students have access to these rooms. There are a number of references to help you understand how to use the iLab systems. Please look at:

<https://resources.cs.rutgers.edu/docs/instructional-lab/>

You will be using a Unix environment for the programming assignments. For a primer on using the Bash environment, please refer to <http://tldp.org/LDP/Bash-Beginners-Guide/html/index.html> For an assortment of GNU/Linux command line tools, refer to this: <http://www.tldp.org/LDP/GNU-Linux-Tools-Summary/GNU-Linux-Tools-Summary.pdf>

Some other manuals that will be useful:

- (Vim) http://vimdoc.sourceforge.net/html/doc/usr_toc.html
- (Emacs) <http://www.gnu.org/software/emacs/manual>
- (Gcc) <http://gcc.gnu.org/onlinedocs/>
- (Make) <http://www.gnu.org/software/make/manual/>
- (Gdb) <http://www.gnu.org/software/gdb/documentation>

Rules for Collaboration:

You are free, even encouraged, to talk to your fellow classmates about your assignments. However, you cannot copy from one another in the assignments. If in doubt, follow Gilligan's Island rule. That is, after a joint discussion of an assignment, each student should discard all notes, go do something mind-numbing for an hour (like watching a couple of episodes of Gilligan's Island), and then recreate the solutions absolutely individually. The idea is to ensure that you fully understand and provide your own solutions, rather than blindly incorporate the solutions from the group discussion. We will use sophisticated plagiarism detection software and report any violation to office of student conduct. You must also follow the Department's Academic Integrity Policy: <https://www.cs.rutgers.edu/academics/undergraduate/academic-integrity-policy>. **Finally, copying from the web is also cheating.**

Acknowledgements:

This course borrows heavily from CS211 taught by Prof. Santosh Nagarakatte, Prof. Abhishek Bhattacharjee, Prof. Thu Nguyen), and Prof. Badri Nath.