

CSI 250 – Computer Organization and Architecture – Spring 2022

Professor: Shaun D. Ramsey, Ph.D. (Dr. Ramsey (Doc) with *he/him/his* pronouns)

Email: sramsey2@washcoll.edu

Faculty Office: DUNN N106a

Office Hours: M: 11:00am-12:00pm, W 4:30-5:20pm (or by drop-in and appointment)

QSC Drop-In: TBD but right here in DUNN N103 twice a week!

Class meetings: CSI 250-10 MWF 1:30 DUNN N103

Potential Additional Text: Essentials of Computer Architecture by Comer

Required Online Textbook:

1. Sign in or create an account at <https://learn.zybooks.com>
2. Enter zyBook code: WASHCOLLCSI250Ramsey-Spring2022
3. Subscribe

(You can also get copies at the bookstore.)

Web: <http://shaunramsey.com/250>

Discord: <https://discord.gg/Kn766VM>

COVID: I will not come to in-person class sick! Please, do not come to class sick! But do let me know if you must miss because of sickness. In the event that we ALL need to pivot to online, we will be using discord. So, follow the url up above and get into my discord server. Hopefully we make it through the semester relatively healthy.

Overview and Advising: This course is effectively a survey course covering a broad range of organization and architecture components and concepts. Digital logic, type representations and main memory will be considered. In addition, assembly and assembly related issues will cover another large chunk of this course. As a survey of the field of architecture, this course covers many aspects that come together to form a cohesive basis for further study in the field.

Mandates and Suggestions: Get into a group. You may point out errors and problem solution errors and discuss design and approaches with others, but all code and homework submissions must be of your own creation as that is the only way to learn. Copying the homework of another might help you pass an assignment, but your ability with programming and problem solving will definitely reveal itself during the examinations. So, do the work and in in your own work (anything else is considered plagiarism)!

Celebrations: Celebrations should be completed entirely alone in “one” sitting that does not involve communication with others. You’re free to use notes and online sources (as long as you cite them and all work that you complete is your own). In other words, if you find an answer online that does not constitute submitting your own work, even if cited, that will be considered academic dishonesty. You should also report any such findings to me so that I may work to remove such findings. Celebrations will happen every two weeks and are your place to show your objective masteries.

Grade Breakdown:

This is a mastery based course in which you will have many attempts at each of the 29 learning objectives. Celebrations will be given every two weeks covering all objectives to that point. You may earn a successful pass (1 point) for each learning objective twice. This leaves a total of 58 points possible from learning objectives. In addition, there are 5 points available for “participation.” These points are created by posting “potential” celebration problems or by posting solutions to someone else’s posted celebration problem. Each successful post or solution is worth one point. You may wait until I weigh in on a problem before solving it to make sure you receive credit or that the problem is a legitimate one that is worth solution points. Lastly, there is a group presentation during finals week that is a case study of other topics in architecture. Potential topics might include: pipelines, scoreboarding, optimizations, Moore’s Law and others graded on correctness, timeliness, and engagement. The tables below show the distribution of points and grades.

Topic	Points Available	Grade	Points
Learning Objectives	58	A	65-73 Points
Participation Points	5	B	56-64 Points
Group Project	10	C	44-55 Points
Total	73	D	32-43 Points

Attendance: Attendance is strongly encouraged and will be tracked. You should expect me to reach out to you if you miss a class, but it is your responsibility to make-up missed class time and coursework.

Lateness: As a general rule, late assignments receive a grade of 0 (because there is no opportunity or time to make them up in this class). I encourage you to do the assignments! We learn this material by doing it! Late celebrations will also not be accepted, but that’s okay, you can get another shot on the next one. So hand them in on time in case I want to go over one.

Accommodations: If you have an accommodation that has been reported to the college, please let me know as soon as possible so I can work to meet your accommodation. Please notify me of any necessary accommodation at least two weeks prior to the requirement so we can make it happen. If you suspect you might need an accommodation, I recommend that you speak with OAS as soon as possible. You may reach out to them via oas@washcoll.edu

Academic Honesty: You are always subject to the Honor Code of Washington College. All work must be your own. When handing in any assignment you are required to cite every reference, including web pages and classmates. Failure to do so will be considered plagiarism. If you have a question on whether something will be considered cheating or plagiarism, just ask! You will be expected to state you have followed the Honor Code of Washington College on all homework, project and exam submissions and I am required to report all issues of Academic Integrity.

Career Center: The Career Center is a wonderful center dedicated to helping you enter

the work force. You can receive mock interviews there, attend a career fair, and even attend a workshop on graduate school admissions. For more information on these programs and other ways to connect with the Center for Career Development, please stop in or contact Nanette Cooley at ncooley2@washcoll.edu.

Quantitative Skills Center: The QSC can help you with all your number needs! Struggling in a class with numbers? Want to check over your work before handing it in? Just like working with a knowledgeable tutor nearby? Or lounging on a comfy couch? Then the QSC is for you! The Quantitative Skills Center is a peer tutoring service provided to all members of the Washington College community. Consider making a one-on-one appointment or stopping by for drop-in hours. For more information, visit the QSC's website or email the director, Jesse Andrews, at jandrews4@washcoll.edu. Appointments need to be reserved two days in advance, so be sure to plan ahead! They use <https://washcoll.mywconline.com/> to schedule individual appointments which are free!

Counseling Center: We all experience stressful and difficult events as a normal part of life and especially right now. As your instructor, I am not qualified to serve as a counselor, but I am a useful ear. So please feel welcome to open a discourse with me. I may guide you to a counselor and if you do need an actual counselor, Washington College offers counseling services on-campus that are available to you at no cost. All counseling services provided are completely confidential and in no way connected to your academic record. I strongly encourage you to take advantage of this valuable resource. Please contact The Office of Counseling Services (Health Services) at 410-778-7261, or email: vanderson2@washcoll.edu to schedule an appointment..

Tentative Schedule:

Week 1, 1/24, BITS: Binary, Ascii, Two's-Complement

Week 2, 1/31, BITS: Other bases, floating point representations, naming and 2^n

Week 3, 2/7, MIPS: Memory alignment/endianness and the load-store machine

Week 4, 2/14, MIPS: Branching, Jumping and the SLT

Week 5, 2/21, MIPS: Make-up Day, Direct Memory Mapped I/O, Assembly

Week 6, 2/28, MIPS: Assemblers and Compilers

Week 7, 3/7, DL: Gates, Truth Tables and Boolean Equations

Week -, 3/14, Spring Break - No Classes

Week 8, 3/21, DL: Reminders, Mux, Decoders

Week 9, 3/28, DL: Timing, Clocks, Sync

Week 10, 4/4, No Class Weds, DL: Register Files: PROC: IM, ADD, DM

Week 11, 4/11, PROC: CTRL, How it works, j, jal, beq, bne, slt

Week 12, 4/18, MEM: Caches, Hits, Misses, Bits, Writes, Cache Math

Week 13, 4/25, MEM: Valid, Dirty, set-associative cache

Week 14, 5/2 - No Class Friday, MEM: Locality Principles, Memory Hierarchies, 5/4 is the last day for discussion points

Week 15, 5/9 - Finals Week - Final Group Presentation

Learning Masteries:

1. (BIT1) I understand unsigned binary (and can convert back and forth between decimal and binary).
2. (BIT2) I understand ASCII and the conversion between binary and ASCII
3. (BIT3) I understand two's complement and signed binary numbers (and can convert to/from them and decimal).
4. (BIT4) I understand hexadecimal and octal and the relationship between binary and these bases (and can convert between them).
5. (BIT5) I understand floating point representations.
6. (BIT6) I understand naming conventions with and using powers of two up to "peta" and may use them fluidly.
7. (MIPS1) I understand how the load/store instructions operate.
8. (MIPS2) I understand memory alignment, endians and memory loading.
9. (MIPS3) I understand branching/jumping and pseudoinstructions (slt).
10. (MIPS4) I understand the basic idea and can use direct memory mapped input/output.
11. (MIPS5) I understand the relationship between assembly and machine code including opcodes.
12. (MIPS6) I understand assemblers, how they're used and why they are used.
13. (MIPS7) I understand the compilation process and how programming languages use assembly.
14. (DL1) I understand a transistor (tri-state buffer) and roughly how it is used to form gates.
15. (DL2) I can translate functions to/from boolean equations and truth tables.
16. (DL3) I can put together a combinational circuit to/from a boolean equation or truth table.
17. (DL4) I understand decoders and multiplexors and can use them.
18. (DL5) I understand timing diagrams and its relationship to digital hardware.
19. (DL6) I understand the clock and synchronized circuits.
20. (DL7) I understand the register file, how to use it and why it is used.
21. (PROC1) I understand the PC and the execution loop.

22. (PROC2) I understand IM, RF, ADD, DM parts of processor design.
23. (PROC3) I understand CTRL and how it is used in combination with other processor components.
24. (PROC4) I understand how to extend a processor for j, jal, beq, bne, or slt instructions.
25. (MEM1) I understand how memory access times, cache misses and hits and their relationship.
26. (MEM2) I understand valid bits, dirty bits, write approaches and how they affect timing.
27. (MEM3) I understand thrashing and how a set-associative cache helps to solve this problem.
28. (MEM4) I understand the principles of temporal and spatial locality and how they apply to caches.
29. (MEM5) I understand memory hierarchies and their affect on performance.

Note: This document and a tentative week by week schedule are available from the website listed above and on Canvas!