Point Loma Nazarene University
CSC 454: Computer Architecture and Assembly Language
(4 units)
Fall 2018

Instructor:

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Office hours:

M,W,F 10:30-12:00   TR 8:00-9:30, 1:30-2:00

Meeting Times and Location:

Lecture: M,W,F 8:30-9:35   BAC 103
Lab: F   7:30-8:30   LW 220 (Bresee Lab)

Text:

Patterson and Hennessy, Computer Organization and Design. 5th edition. Morgan Kauffman. Expect to cover most sections of chapters 1-6 along with Appendices A and B.

Catalog Description:

This course covers the fundamentals of current pipelined computer designs. Experience with assembly language programming and digital logic and circuit design will be used to motivate the need for certain facets of the more general instruction set architecture. Throughout the course, performance issues, hardware constraints, and memory hierarchy will be shown to inform processor design. Additional topics include integer and floating point arithmetic, I/O and considerations surrounding multi-core architectures. Lecture three hours and laboratory two hours each week.

Course Objectives:
- To provide an in-depth treatment of computer architecture, including digital logic, digital systems, computer pipelines, memory organization and processor design, both single and multi-core.
- To gain further understanding of computer organization and architecture by studying the MIPS assembly language and writing and analyzing programs using the SPIM simulator.
- To gain a better overall perspective of the interrelationship between computer architecture and other aspects of computer science including compilers, operating systems and programming.
- To gain an understanding of the tradeoffs considered when designing for increased performance including parallelism, power, convenience, and cost.

Course Learning Outcomes:

Students will analyze the interaction between hardware and software. Students will collaborate effectively in teams.

Course Organization:

Lectures: Cover the highlights of chapters assigned – not a substitute for reading. PowerPoint slides can be found on Canvas. The lecture time will be broken up with peer discussions and problem solving. The answers to the problems presented on the slides will not be on the slides, so be prepared to take notes on your peer discussions.

Homework/ Homework quizzes:
Much of your work at home will be reading and working through examples from the book. This is essential to learning the material.

Eight quizzes will be given during the semester. Frequently, practice problems will be given to help prepare for these quizzes. While the practice problems are optional, I would highly recommend them. Quiz problems will be more "mechanical" and memorization than what you will find on exams and are designed to keep you current. While **quizzes cannot be made up,** each student will be allowed to drop 1 homework quiz grade**.** All of the quizzes combined are worth 1 exam grade.

Expected quiz dates

Aug. 29	Sept. 5	Sept. 12	Sept. 28
Oct. 5 (take home)	Oct. 17	Nov. 12	Nov. 19

Exams: There will be 2 exams. Exams will cover lecture as well as lab material. The first will cover chapters 1, 2 and Appendix A. The second will cover Appendix B and chapters 3 and 4. Students missing a midterm exam for a school function must arrange to take the exam in advance. Missed exams will likely result in a grade of 0. **Exams are currently scheduled for Sept. 19 and Oct. 31.**

Labs and Lab Projects: Labs will be demoed at the beginning (first 15 minutes) of the lab period in which they are due. Late labs are not accepted, but partial credit is awarded. Students may work alone, or in groups of 2 on the labs. If I suspect collaboration beyond a group of 2, interviews will be conducted and a grade of zero is possible for all collaborators. The grading method for each lab will be discussed when the lab is assigned. Students who are unable to answer questions about labs on their exams will be required to complete labs individually in the future.

Final Exam: Cumulative exam covering lecture and lab material. The Final exam is scheduled for **Friday of finals week at 7:30 A.M.**

Grading:

Homework/Quizzes	15%		Exams	30%
Labs	30%		Final Exam	25%

Final grades will be determined as follows:

100-93%	A	80-82%	B-	67-69%	D+
90-92%	A-	77-79%	C+	63-66%	D
87-89%	B+	73-76%	C	60-62%	D-
83-86%	B	70-72%	C-	0-59%	F

Credit Hour Information:
In the interest of providing sufficient time to accomplish the stated course learning outcomes, this class meets the PLNU credit hour policy for a 4 unit class delivered over 15 weeks. Specific details about how the class meets the credit hour requirements can be provided upon request.

It is anticipated that you will spend a minimum of 37.5 participation hours per credit hour in your course. The estimated time expectations for this course are shown below:

Assignments	Total Course Hours
Reading	30
Written Homework	25
Lectures	40
Labs and Lab assignments	45
Exams and Quizzes	10
TOTAL	150 (for 4 course units)

University Mission:
Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

MICS Department Mission:
The Mathematical, Information, and Computer Sciences department at Point Loma Nazarene University is committed to maintaining a curriculum that provides its students with the tools to be productive, the passion to continue learning, and Christian perspectives to provide a basis for making sound value judgments.

Attendance:
Attendance is expected at each class session. In the event of an absence you are responsible for the material covered in class and the assignments given that day.

Regular and punctual attendance at all classes is considered essential to optimum academic achievement. If the student is absent from more than 10 percent of class meetings, the faculty member can file a written report which may result in de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university drop date or, after that date, receive the appropriate grade for their work and participation. See http://catalog.pointloma.edu/content.php?catoid=24&navoid=1581#Class_Attendance in the Undergraduate Academic Catalog.

Class Enrollment:
It is the student's responsibility to maintain his/her class schedule. Should the need arise to drop this course (personal emergencies, poor performance, etc.), the student has the responsibility to follow through (provided the drop date meets the stated calendar deadline established by the university), not the

instructor. Simply ceasing to attend this course or failing to follow through to arrange for a change of registration (drop/add) may easily result in a grade of F on the official transcript.

Academic Accommodations:
While all students are expected to meet the minimum standards for completion of this course as established by the instructor, students with disabilities may require academic adjustments, modifications or auxiliary aids/services. At Point Loma Nazarene University (PLNU), these students are requested to register with the Disability Resource Center (DRC), located in the Bond Academic Center. (DRC@pointloma.edu or 619-849-2486). The DRC's policies and procedures for assisting such students in the development of an appropriate academic adjustment plan (AP) allows PLNU to comply with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. Section 504 (a) prohibits discrimination against students with special needs and guarantees all qualified students equal access to and benefits of PLNU programs and activities. After the student files the required documentation, the DRC, in conjunction with the student, will develop an AP to meet that student's specific learning needs. The DRC will thereafter email the student's AP to all faculty who teach courses in which the student is enrolled each semester. The AP must be implemented in all such courses.

If students do not wish to avail themselves of some or all of the elements of their AP in a particular course, it is the responsibility of those students to notify their professor in that course. PLNU highly recommends that DRC students speak with their professors during the first two weeks of each semester about the applicability of their AP in that particular course and/or if they do not desire to take advantage of some or all of the elements of their AP in that course.

Academic Honesty:
Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog. See http://catalog.pointloma.edu/content.php?catoid=24&navoid=1581#Academic_Honesty for definitions of kinds of academic dishonesty and for further policy information.

Final Exam: Date and Time:
The final exam date and time is set by the university at the beginning of the semester and may not be changed by the instructor. This schedule can be found on the university website and in the course calendar. No requests for early examinations will be approved. Only in the case that a student is required to take three exams during the same day of finals week, is an instructor authorized to consider changing the exam date and time for that particular student.

Copyright Protected Materials:
Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

Anticipated Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
Syllabus, basic computer organization: 1.1-1.5	Aug 28 Monday Sched	29 Quiz A1, 2.1-2.3 assembly	30	31 2.4 2's complement Introduce SPIM Lab: MIPs 1
Sept 3 Labor day	4	5 Quiz on binary, hex, 2s complement 2.5 assembly to machine lang	6	7 2.6, 2.7 logical operations and loops Lab: MIPs 2
10 A2-A6: assemblers, printing strings, Quiz preparation	11	12 Quiz: tracing with jumps, instruction translation Lecture: A6, 2.8, 2.9	13	14 Continue with 2.9 MIPS lab 3
17 2.10 addressing modes Review	18	19 Exam 1	20	22 No formal class meeting Dr. Carter at conferece
24 1.6-1.10 performance and power, start circuits	25	26 K maps, B1, B2	27	28 Quiz on K maps First Logisim lab
Oct 1 3.1 – 3.3 addition, subtraction, overflow, multiplication	2	3 3.4 division 3.5 fp representation B3, B4 mux and decoder	4	5 Take home quiz covering 10/1 and 10/2 material Dr. Carter at conference
8 Start basic ALU first part B5, B6	9	10 Basic ALU SLT and branch Design ALU	11	12 Second Logisim (ALU) lab
15 B7, B8 VHDL, flip flops	16	17 Quiz Bitcoin ethics	18	19 Fall Break
22 Work on ALU lab	23	24 Start datapath, Rtype and Mem instr	25	26 ALU lab due 4.3-4.4 branches, control + exercises
29 Go over exercises, Review	30	31 Exam 2	Nov 1	2 4.5 pipelining theory
5 4.6 more pipelining	6	7 4.7 data hazards	8	9 4.8 Control hazards 4.10 ILP Exercises prep for quiz
12 Quiz 5.1-5.3 Memory basics	13	14 5.4 cache performance	15	16 More cache, cache exercises
19 Quiz Intro to cache project	20	21 Thanksgiving	22 Thanks	23 Thanksgiving
26 Work on cache lab	27	28 5.7 VM 5.10 cache coherence	29	30 Introduce || architecture 6.1-6.3 Work on cache lab
Dec. 3 6.4-6.5 more parallel	4	5 More parallel	6	7 Cache lab due Review
10	11	12	13	14 Final exam 7:30