ECE4290/6290: Organization of Computers

SYLLABUS FALL-2023
Clemson University

Instructor

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Office Hours: Thursday 10:00am – 12:00pm

Class Location and Times

Day: Monday & Wednesday

Location: Riggs Hall 219

Time: 2:30pm ~ 3:45pm

Information on modality: In-person

Books

(*Recommended but NOT Required*) Textbook: Computer Organization and Design RISC-V Edition The Hardware Software Interface (2nd edition)

Prerequisites

No prerequisites for this course.

Course Description

Computer architecture including discussion of instruction set architecture, logic and operation, pipelining, memory hierarchies, CPU performance, cache access, and RISC-V design.

Learning Objectives / Outcomes

After completing this course, we will be able to:

1. Understand RISC-V instruction set encoding
2. Know how computer are performing operations
3. Evaluate the performance of the computers
4. How to build a single-cycle RISC-V processor with pipeline
5. Know the fundamental of cache and how to improve the cache performance

Topics Outlines

Topic / Module	Learning Outcomes	Assessments
Computer abstraction	Understand the concept of computer abstraction	HW; Lab; Exam
Instruction set architecture (ISA)	Learn interface between HW/SW	HW; Lab; Exam
Arithmetic operations	Register file and operations	HW; Lab; Exam
Binary/Hexadecimal number	Numbers that computer uses	HW; Lab; Exam
Logic and bitwise operation	Learn how the computer logic are working and operation	HW; Lab; Exam
Memory	Load/store instruction, datatype, address	HW; Lab; Exam
Digital circuit	Learn sequential digital circuit design	HW; Lab; Exam
Computer performance	Learn performance metrics, CPU time	HW; Lab; Exam
Pipelining	Learn concept, implement 5-stage pipeline	HW; Lab; Exam
Cache	Memory hierarchy, cache access, direct-mapped cache	HW; Lab; Exam

Class schedule (tentative)

Index	Date of class	Plan
1	8/23/2023	Class
2	8/28/2023	Class
3	8/30/2023	Class
4	9/4/2023	Labor Day, no class
5	9/6/2023	Class. Homework 1 & Lab 1 assign.
6	9/11/2023	Class
7	9/13/2023	Class
8	9/18/2023	Class. Homework 1 & Lab 1 due. Homework 2 & Lab 2 assign.
9	9/20/2023	Class
10	9/25/2023	Class.
11	9/27/2023	Class. Homework 2 & Lab 2 due. Homework 3 & Lab 3 assign.
12	10/2/2023	Class
13	10/4/2023	Class
14	10/9/2023	Class. Homework 3 & Lab 3 due. Homework 4 & Lab 4 assign.
15	10/11/2023	Class
16	10/16/2023	Fall break, no class
17	10/18/2023	Class.
18	10/23/2023	Midterm Exam.

19	10/25/2023	Class. Homework 4 & Lab 4 due. Homework 5 assign.
20	10/30/2023	Class
21	11/1/2023	Class
22	11/6/2023	Class
23	11/8/2023	Class. Homework 5 due. Homework 6 assign.
24	11/13/2023	Class
25	11/15/2023	Class
26	11/20/2023	Class. Homework 6 due. Homework 7 assign.
27	11/22/2023	Thanksgiving, no class.
28	11/27/2023	Class
29	11/29/2023	Class
30	12/4/2023	Class. Homework 7 due.
31	12/6/2023	Class
32	12/14/2023	3:00 – 5:30 pm, Final Exam

Grading Activities

Lab: 20%

Homework: 20%

Midterm Exam: 30%

Final Exam: 30%

On Class Quizzes: up to 4% extra

Grading System:

90 ~ 100 = As

80 ~ 89 = Bs

70 ~ 79 = Cs

60 ~ 69 = D

Below 60 = F

Grading Policy

Homework assignments are to be submitted through Canvas website or hand to the instructor on the assignment due date. Assignments submitted after the due date will be deducted 10 points for each day late.

Exams

All exams must be taken at the scheduled time unless a previous arrangement (with a good reason) has been made with the instructor

Absences

You are expected to attend each class punctually and remain for the entire class period. You need to inform the instructor in advance if you expect to miss a class or leave the course before the end of the semester. If you miss class your absence will be excused by the instructor only if a doctor's certificate or other evidence is submitted. You remain to be responsible for the work associated with the class you missed, even if your absence has a valid reason. There will be a number of unannounced popup quizzes during the semester.

Academic Integrity

As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.

All infractions of academic dishonesty by undergraduates must be reported to Undergraduate Studies for resolution through that office. In cases of plagiarism instructors may use the Plagiarism Resolution Form. See the Undergraduate Academic Integrity Policy website for additional information and the current catalogue for the policy. For graduate students, see the current Graduate School Handbook for all policies and procedures.

Accessibility

Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to this class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848, by emailing studentaccess@lists.clemson.edu, or by visiting Suite 239 in the Academic Success Center building. Appointments are strongly encouraged – drop-ins will be seen, if at all possible, but there could be a significant wait due to scheduled appointments. Students who have accommodations are strongly encouraged to request, obtain and send these to their instructors through the AIM portal as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information at the Student Accessibility website. Other information is at the university's Accessibility Portal.

The Clemson University Title IX Statement Regarding Non-Discrimination

The Clemson University Title IX statement: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual

violence as mandated by Title IX of the Education Amendments of 1972. This Title IX policy is located on the Campus Life website. Ms. Alesia Smith is the Clemson University Title IX Coordinator, and the Executive Director of Equity Compliance. Her office is located at 223 Brackett Hall, 864-656-0620. Remember, email is not a fully secured method of communication and should not be used to discuss Title IX issues.

Clemson University aspires to create a diverse community that welcomes people of different races, cultures, ages, genders, sexual orientation, religions, socioeconomic levels, political perspectives, abilities, opinions, values and experiences.

Emergency Preparation

Emergency procedures have been posted in all buildings and on all elevators. Students should be reminded to review these procedures for their own safety. All students and employees should be familiar with guidelines from the Clemson University Police Department. Visit here for information about safety.

Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

Ensure you are signed up for emergency alerts

Download the Rave Guardian app to your phone (https://www.clemson.edu/cusafety/cupd/rave-guardian/)

Learn what you can do to prepare yourself in the event of an active threat (http://www.clemson.edu/cusafety/EmergencyManagement/)