

CS M152A (ECE M116L)

Introductory Digital Design Laboratory

Winter 2022

Administrative

- Instructor: Majid Sarrafzadeh
 - Office Hours: By appointment only (majid@cs.ucla.edu)
- TA – Lab 6: Parth Shah (parthushah8@ucla.edu)
- Lab Location:
 - Remote: Zoom (TBD)
 - In-person: BH3428

| Section | TA | Instructed Hours | Office Hours (Open Lab) |
|---------|----------------------|------------------|-------------------------|
| Lab 1 | Migyeong Gwak | MW 10-11:50am | W 8-9:50am |
| Lab 2 | Dipti Ranjan Sahu | MW 12-1:50pm | F 10-11:50pm |
| Lab 3 | Tyler Davis Albarran | MW 2-3:50pm | F 11-12:50pm |
| Lab 4 | Shuwen Qiu | TR 10-11:50am | F 4-5:50pm |
| Lab 5 | Samuel Lee | TR 12-1:50pm | R 4-5:50pm |
| Lab 6 | Parth Shah | TR 2-3:50pm | F 2-3:50pm |

Introduction

In light of the spread of the SARS-CoV-2 Omicron variant, we're making changes to the start of winter quarter to reduce the risk of a rise in new COVID-19 cases at UCLA. Classes will be held remotely for the first two weeks of the winter quarter. We intend to return to in-person instruction on Jan. 18. Please visit the [covid-19 website](#) for more details.

In this lab, you will get hands-on experience with design implementation on Field-Programmable-Gate-Arrays (FPGAs). You will apply what you've learned in CS51A (combinatorial and sequential logic) and implement some designs using modern design tools and Hardware Description Language (HDL).

We have designed several projects for you to implement using the Xilinx ISE design and implementation environment. These projects are intended as tutorials for you to learn how to put designs together, implement them in Verilog HDL, generate the programming file, as well as proving the design both in simulation and on real hardware.

The projects are not designed in such a way that you will spend a significant amount of time in the lab while keeping yourself awake with lots of caffeinated drinks. Instead, you should treat the lab sessions as a time to work with the hardware and interact with the TAs. **You will find that working on the designs on your own computer using the free version of ISE (Webpack), and sufficiently simulating the designs ahead of time before testing them on the FPGA boards makes one's life much easier in this course.**

Team Work

You will be working in two (or three) person teams. The team is formed at the beginning of the quarter and is not subject to any change throughout the quarter. The teammates will also share the same score for the course.

Each team will be assigned a workbench with an FPGA board and a PC workstation. Keep in mind that your team will be sharing the same workbench with five other teams from the other sessions. Try to keep the workload balanced within the team.

Lab Conducts

- FACE MASK REQUIRED in the lab.
- Treat each other with the courtesy and decency that you would treat a colleague.
- Respect the lab equipment that you are assigned to and be considerate to the other teams that share the same workstation with you.
- Keep your assigned workstation clean. Keep the lab free of the trash.
- No food or drinks are allowed in the lab.
- Under no circumstances should you take the lab equipment outside of the lab.
- If you must use the cell phone, kindly step outside of the lab.

Lab Access

The lab is only accessible to the students in a TA's presence. You are strongly encouraged to work outside of the lab to find all the bugs first before testing the design in a lab session.

In general, you should only attend your assigned lab session as we have limited space. You may attend other instructed lab sessions. However, the students who are assigned to that session have priority over the hardware.

You are free to attend any open lab hours. Try to stick with the same workstation that you have always used unless the workstation is already occupied.

Miscellaneous

- While the course syllabus and structure are similar between sections, the sections are separate in terms of grading and other class activities. Please only contact the instructor or the TA in charge of the section you are enrolled in.
- All deadlines are fixed and there will be no extensions.

Computer Use

The PC workstation is only for coursework-related purposes, and they have restricted internet access. Do not leave your design files on the computer. Do not clutter the screen with files. Use a USB thumb drive, github or a cloud-based file storage service to transfer files between your own computer and the workstation.

No grades will be given to a team if the design files are lost on the lab computers without a backup.

Lab time is limited. Use your best judgment on what's the best use of your allotted lab time.

Academic Integrity

The Office of the Dean of Students has summarized University policy on academic integrity. Here are the relevant links:

- Student Conduct Code: [view](#)
- **Academic Dishonesty:** All forms of academic misconduct or research misconduct, including, but not limited to, cheating, fabrication or falsification, plagiarism, multiple submissions, or facilitating academic misconduct that occurs in academic exercises or submissions.
- **Cheating:** Cheating includes, but is not limited to, the use of unauthorized materials, information, or study aids in any academic exercise; the alteration of any answers on a graded document before submitting it for re-grading; or the failure to observe the expressed procedures or instructions of an academic exercise (e.g., examination instructions regarding alternate seating or conversation during an examination).
- **Plagiarism:** Plagiarism includes, but is not limited to, the use of another person's work (including words, ideas, designs, or data) without giving appropriate attribution or citation. This includes, but is not limited to, representing, with or without the intent to deceive, part or all of an entire work obtained by purchase or otherwise, as the Student's original work; the omission of or failure to acknowledge the true source of the work or representing an altered but identifiable work of another person or the Student's own previous work as if it were the Student's original or new work. Unless otherwise specified by the faculty member, all submissions, whether in a draft or final form, to meet

course requirements (including a paper, project, exam, computer program, oral presentation, or other work) must either be the Student's own work or must clearly acknowledge the source.

These summaries don't specifically address programming assignments in detail, so we state our policy here. Of course, you understand that your work on programming assignments must be your own. But we understand that high-level discussions about approaches to a problem have educational value and are acceptable. So where do we draw the line? We'll decide each case on its merits, but here are some categorizations:

Acceptable:

- Clarifying what an assignment is requiring
- Discussing algorithms for solving a problem, perhaps accompanied by pictures, without writing any code
- Helping someone find a minor problem with their code, provided that offering such assistance doesn't require examining more than a few lines of code
- Turning in someone's work without crediting the author of that work, if the source of that work is a CS152A instructor or TA

Unacceptable

- Turning in any portion of someone's work without crediting the author of that work, if the source of that work is not a CS152A instructor or TA
- Using project solutions from earlier offerings of this or any other class
- Writing for another student a code fragment that solves any portion of a project assignment
- Receiving from another person (other than a CS152A instructor or TA) a code fragment that solves any portion of a programming assignment
- Helping the same person find problems with their code more than a few times for a particular assignment

You must abide both by this policy and the policies expressed in the UCLA Student Conduct Code ([view](#)). In accordance with University policy, we will submit cases of suspected cheating to the Dean.

Project Submission

For each lab, the following should be submitted:

- **Project Code:** the Xilinx ISE project folder should be cleaned up (Project > Cleanup Project Files), zipped, and uploaded to the corresponding assignment page on the course website
- **Lab Report (Electronic Version):** the lab report should be uploaded to the corresponding assignment page

Lab Report Guideline

Lab reports should contain the following sections. The percentage in the brackets represents the percentage score for the section.

1. **Introduction and requirement (10%).** Summarize background information about the lab and the detailed design requirements. It's very important to make sure you are designing the right thing before starting.
2. **Design description (15%).** Document the design aspects including the basic description of the design, modular architecture, interactions among the modules, and interface of each major module. You should include schematics for the system architecture. You can also include figures for state machines and Verilog code when needed.
3. **Simulation documentation (10%).** Document all the simulation efforts (what requirements are tested and what the test cases are), document bugs found during simulation, and provide simulation waveforms.
4. **Conclusion (5%).** Summary of the design. Difficulties you encountered, and how you dealt with them. General suggestions for improving the lab, if any.

Grading

You will be graded on a curve based on your performance in the course. The grading breakdown is as follows:

- Quiz (2%)
- Attendance (8%)
- Lab 1 (15%)
- Lab 2 (20%)
- Lab 3 (25%)
- Lab 4 (30%)

Each lab/project is graded based on the following components:

- Lab reports (40%). See the Lab Report sections.
- Demo (60%). Note that before the deadline, only complete and correct demos are accepted.
 - Demo on time: 60%
 - One-session late demo (only for Lab 3): $45\% \times (\text{correctness})$, where correctness refers to the percent of the demo you are able to finish by the late session

Schedule

| Week # | Mon Lab | Tue. Lab | Wed. Lab | Thurs. Lab |
|---------------------|--|--|--|-------------------------------|
| Week 1 (Jan. 3) | Intro - Syllabus | Intro - Syllabus | FPGA & Verilog Lab 0 Begin | FPGA & Verilog Lab 0 Begin |
| Week 2 (Jan. 10) | Q/A over Zoom | Q/A over Zoom | Lab 1 Intro | Lab 1 Intro |
| Week 3 (Jan. 17) | <i>Martin Luther King, Jr. holiday</i> | Lab 1 Quiz | Lab 1 Demo Due Quiz | Lab 1 Demo Due |
| Week 4 (Jan. 24) | Lab 2 Intro | Lab 2 Intro | Lab 2 | Lab 2 |
| Week 5 (Jan. 31) | Lab 2 | Lab 2 | Lab 2 Demo Due | Lab 2 Demo Due |
| Week 6 (Feb. 7) | Lab 3 Intro | Lab 3 Intro | Lab 3 | Lab 3 |
| Week 7 (Feb. 14) | Lab 4 Intro | Lab 4 Intro | Lab 3 Demo Due | Lab 3 Demo Due |
| Week 8 (Feb. 21) | <i>Presidents' Day holiday</i> | Lab 4 Proposal Due Lab 3 Late Demo Due | Lab 4 Proposal Due Lab 3 Late Demo Due | Lab 4 |
| Week 9 (Feb. 28) | Lab 4 | Lab 4 | Lab 4 | Lab 4 |
| Week 10 (Mar. 7) | Lab 4 | Lab 4 | Lab 4 Demo Due | Lab 4 Demo Due |
| No Final Exam | | | | |