CEG2136 Computer Architecture I (Fall 2023)
Lab General Instructions

LABORATORY INSTRUCTIONS

Instructions for each lab will be posted on your CEG2136 BrightSpace Virtual Campus under the Laboratories section.

Attendance

- Please be available at the beginning of the laboratory session until you finish and demonstrate your lab.
- Lab sessions will start by taking attendance.
- There will be a 15-20 minute introduction in which the TAs will explain the experiment.

Working group

- Laboratory groups will consist of two students; teams of three students will be accepted if the total number of students in a class exceeds the lab capacity.
- To self enroll in a 2-student lab group:
  1. Click on "Groups" in your Navbar
  2. Click on **View Available Groups**
  3. Look at the groups that are open for enrollment. Click the number of members (ex. **1/2**) to see who has already enrolled. Click **Join Group** to join. If you have a preferred lab partner in the same lab class, select the first group with 0/2 members and enroll yourself and your lab partner as well.
- Students should stay in the same group for the whole semester.
- Only one lab report will be submitted by each group through the Virtual Campus, before or on the day specified in the Labs Calendar posted in the "Housekeeping" section. Your lab report will be prepared according to the guidelines outlined below.
- Only students registered in CEG2136 will be allowed to access the stations of room CBY B302 or CBY B402 during the course's laboratory hours.
- Every student must attend their regularly scheduled lab session.

DEMONSTRATION AND LABORATORY REPORT

Pre-lab Preparation

- All members of the group must participate in the preparation of the lab, as the TA will award marks by asking questions individually on the experiment.
- Each group is required to design circuit diagrams in Quartus schematic designing environment, simulate in Quartus simulator and demonstrate with the FPGA circuit board.

- Students will be prepared upon arrival at the lab sessions. Pre-lab preparation will be verified by TAs and will include:

  1. Studying the lab instructions and related references in order to be able to answer any questions related to the problem(s) solved in the lab session.

  2. Designing the lab circuits (to be appended to your lab report), including
     a) all truth tables and/or state tables, Karnaugh maps, logic equations,
     b) the schematics of the designed circuits, preferably captured with the Quartus Graphical Editor.

  Marks are awarded if the student showed the pre-lab during the lab session. Components of the prelab preparation, such as schematics, tables and programs may be included in the lab report, as well.

Lab activity

Marks are awarded for work shown during the lab time and are given for:

1. **Schematic Capture (design)** should be executed before coming to the lab, in the frame of the Pre-lab preparation.
2. **Simulation.** The TAs will be presented with a demonstration of simulated operation of your circuit. The simulation must be fully functional in order to award the marks. If the simulation does not work perfectly, what are the chances that the design will work properly on the board?

Make sure you show your schematic designs, simulation outputs and demonstrations to your TA within given lab hours.

3. **Demo.** Circuit verification consists in live demonstration and explanations of operation of your experimental circuits.
   - The demonstration includes demonstrating a working system.
   - The development should satisfy the requirements of the experiment outlined in the lab instructions.
   - The demonstration will count as a component of each lab. To obtain full marks, simulation results and demonstrations must be explained to TAs using theoretical knowledge gained from classroom lectures. Partial marks can be awarded if the demonstration is not fully functional; this is based on how much of the functionality is missing.

Laboratory Report

- One lab report is expected from each group after each lab.
- Reports are due 2-3 days before the first session of the following lab, as specified in the Labs Calendar posted on BS in the "Housekeeping" section. Note that, because of different levels of complexity, most of the labs may require more than a week for completion. The date of the lab sessions along with the submission deadlines will be also posted on BS along with the instructions for each lab.
- The report must be typed using 8.5 x 11" paper format and will be uploaded as a .doc attached file in your corresponding lab Virtual Campus account.

- Handwritten reports will NOT be accepted.
- Neatness is required.
- The style of the lab reports should be formal.
- Take screen shots (print-screen) of schematic designs and simulation outputs to include in the lab report as proofs.
- Check your spelling and grammar.
- Do not recopy the lab manual in your report.
- The report will be graded on clarity and content, neither on length nor on the quality of the artwork but should include flowcharts to explain any development.
- Marked reports will be returned before preparing the report of the following lab.
- Late submission of lab reports will result in a 10% deduction for each late day.

Report Structure

Here is a list and brief description of the different sections a laboratory report may contain, depending on, and addressing the requirements of specific lab instructions. Note that the purpose of a laboratory report is to present your results to others and, as such, should be well presented.

Cover page

A cover page should include the course code, title of the experiment, students' names and ID numbers, the name of the teaching assistant(s) and the date in which the experiment was performed.

Theoretical Part

1. Presentation of the lab problem in a nutshell
   Give a brief introduction to the lab and why you might think this is important or not. Should clearly state the objectives and sub-objectives (if any), in the students' own words, **not** the lab manual's (marks will be deducted if copy & paste from the lab manual).

2. Discussion of the problem (specifications/requirements, diagrams, flowcharts)
   Explain briefly the problem and the requirements to solve it, using a diagram if required.

3. Discussion of the algorithmic solution
   Explain the used algorithm to solve the problem and the block components you are going to use.

Design

1. Presentation of the design that solves the lab problems: *A right design should include: correct truth and/or state tables, Karnaugh maps, logic equations and correct diagrams of the designed circuits* (you can refer here to the appended *Pre-lab* #2 or you can import here parts of it). *The report should contain screenshots of the logic diagrams; the students may choose to draw their own diagrams, but the screenshots must be provided as well* (from *Lab activity* #1).

2. Discussion of used components

   Explain each component and its implementation and give the circuit diagram.

3. Discussion of actual solution

   Explain the actual implementation of the whole design and give the circuit diagrams.

4. Discussion of tool (Optional)

   Give brief explanation of the used tool and any related equipment. You may give your own comments on the tool.

5. Discussion of challenging problems (Bonus) *Discuss any challenging problem that you encountered when trying to solve the problem, whether it was the tool or the algorithm or the code or some other factor.*

Simulation and Verification of Real Implementation

1. Shown simulation/synthesis results. *Give your simulation results, including the appropriate screenshots that contain the compilation results and time diagrams.* All screenshots must be clear enough to read (from *Lab activity* #2).
2. Experimental verification of operation of your circuits. *Give your verification results and comment on your results whether you end up with a working or non-working design* (based on *Lab activity* #3).

Discussion and Conclusions

Provide a pertinent discussion of what problems were encountered and what was learned from the lab, as well as a short conclusion. Explain any errors that you got or your successful design. If you have a discrepancy between your design and actual implementation, explain why. Discussions and conclusions are the areas which show your understanding of the concepts and, as an engineer, what you took from each session is what that matters once you graduate.

Report Format

Marks are awarded based on the following criteria:

- Be brief, concise and to the point. Your report should be prepared as a logical and easy to follow flow of ideas.
- The report should
  - be a self-contained reading (no need to refer to other documents in order to understand what the experiment was about and to follow what was done).
  - be sectioned as a formal report and these sections need to be mentioned in the contents page (with page numbers). In addition to that, all pages must have a page number at the bottom centre of the page.
  - have page margins of 1 inch on each side with recommendation that the titles not exceeding font size 16 and content not exceeding font size 12.
- All tables and figures should be named and indexed after the contents page.
- All Boolean expressions must be simplified and the steps for the same must be shown clearly (e.g., De-Morgan's laws).
- Prelab needs to be attached along with each lab report either as a separate file or after the report as Appendix.
- Your report should come in a maximum of 25 pages including appendices, cover page and table of contents. **If you fail to constrain your report to 25 pages, you will lose a mark for every extra page.**

Hint: A good report should be brief and self-explanatory to people who don't have a strong background in this area, i.e., it can serve as a reference for us in the future and there is no hidden information. So, if you think there is any type of information you might need in the future to understand this report, then you should add it.

Don't ignore the rules about plagiarism!

LABORATORY REGULATIONS

for students physically present in the lab

- Please do not place your coat, bags etc. on the working benches.
- It is highly recommended that you observe caution in working with equipment to avoid any risk to yourself and to your partner or cause damage to the lab or lab equipment.
- Make sure you clean your bench before you leave. Any trash should be put in its place.
- In order to finish your experiment in the time allotted, it is advisable that you stay at your workbench and not wander around the lab.
- Equipment is not to be taken out of the laboratory premises. No exceptions will be made.
- Each group will be held responsible for the maintenance of the station(s) it is utilizing.
- If you break or lose any part of the equipment, you must replace it or pay for it; otherwise, appropriate actions will be taken against the entire group.
- If the station is not tidied up after the completion of the laboratory session, the group will be penalized through a deduction of marks on the lab component of the course.
- As mentioned in the EECS regulations, there is absolutely no food or drinks allowed inside the laboratory premises.
- There is no writing allowed on the anti-static mats or any other property for that matter.