Chapter 0

Preface
0.1 Lab Overview

Welcome to the ECE 272 lab manual! ECE 272 is the companion lab to ECE 271, the Digital Logic Design Class. This lab focuses on design hierarchy that begins with schematic capture and finishes with Verilog Hardware Description Language. The lab starts in Chapter 1 by introducing Lattice Diamond—the software suite that will be used throughout the lab to synthesize designs, simulate them, and program the FPGA. Chapters 2 through 4 use methods and skills learned in ECE 271—added to and refined over time—to construct different parts of a voltmeter, such as driver software for a digital display module. These will then finally be compiled together in Chapter 5 with an ADC into a complete product. Chapter 6, the final lab, will be open-ended and encourage you to do your own research and problem solving to come up with an experiment or project to show your mastery of the material. This lab provides the skills and tools needed to design digital logic systems and integrate them with other digital or analog systems.

0.2 Objectives

- Materials
- Lab Manual Conventions
- Etiquette
- Resources
- Academic Dishonesty
- Preparation

0.3 Materials

- Lattice MachX02 Breakout development kit
- Button board (8pushbtn.0)
- 4 Digit 7 Segment Display Board (4_digit.0)
- USB to mini cable
- Tool kit
- Soldering iron tip and barrel nut
- Solder
0.4 Installing Lattice Diamond

1. Create an account on Lattice’s webpage
   http://www.latticesemi.com/

2. Navigate to ‘Products, Design Software & Intellectual Property, Lattice Diamond’

3. Click ‘Downloads’ and select the most recent version for your operating system, for example ‘Diamond 3.5 64-Bit for Windows’
   If you are not logged in, the actual program download may not appear

4. Request license by clicking on ‘Licensing’ then ‘Lattice Diamond Software Free License’ and following the instructions
   Find your physical address by following the instructions at the top of the page
   Make sure you choose your Wi-Fi adapter, not your Ethernet port

5. Download license file and place it into the correct folder

6. Install based on your operating system
   Choose node-locked license when prompted for license settings

   If you are using Windows 8, Diamond must be run in compatibility mode. This can be done by right-clicking the shortcut, selecting properties, then checking the compatibility mode box in the compatibility tab and selecting Windows 7

0.5 Lab Manual Conventions

This lab uses the following symbols. Many of these are important and should not be ignored or skipped.

- This symbol indicates an important note that should be remembered/memorized. Paying attention to notes like these will make tasks easier and more efficient.

- This symbol designates caution, and the information in this caution-table should be read thoroughly, and adhered to, before moving ahead. If the caution warning is ignored, the task may appear impossible and/or lead to damaged TekBot and systems.

- This symbol represents something that helps you make your task easier by reminding you to perform a particular task before the next step. These reminder symbols are not normally critical things to complete, but can make things easier.

- The innovation symbol will give information to enrich your experience. These sections will give more insight into the what, why, and how the task being done. Use these to learn more, or to get ideas for cool innovations.
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Italicized writing is used to indicate the exact text on the menu or button for the next step in the lab manual.

The entire lab is divided into various sections, in order to break up the tasks. Typically, each section will have the Section Overview as the introductory paragraphs and information detailing the tasks in the Procedure paragraphs. Towards the end, there are Study Questions (which will be your homework from this lab), and/or Challenges. Challenges are extra credit and are great learning opportunities.

0.6 Etiquette

Proper etiquette in the labs is very important when working with other students or the Teaching Assistants (TAs). Engineers work with many different types of people and need to be able to do so efficiently. Another part of proper lab etiquette is also cleanliness in the lab. Engineers work in a variety of spaces. Sometimes they work in spaces that are exclusively theirs, but many work in shared spaces. When sharing work spaces, it's important to respect others that must use that space by keeping it clean and removing any mess when finished.

Students

Students are expected to:

- **Prepare for each lab.**
  Some labs require a prelab and background research before lab. Students should review appropriate sections in the lab manual before going to lab. This is important to make sure all the required tools are available and you have time to think conduct any necessary background research before lab.

- **Ask questions.**
  Students should talk to their peers and the TAs when questions arise. Other people may have a different perspective on an issue.

- **Respect their peers.**
  Everybody comes from a different background and has a different level of knowledge.

Teaching Assistants (TAs)

Teaching Assistants are expected to:

- **Ensure the lab is prepared.**
  TAs make sure the lab is kept in good working condition and the provided materials are ready for the students during lab.

- **Fairly assess student performance.**
  TAs should outline their requirements for full credit on prelabs and study questions at the beginning of the term and grade to this standard for the term.

- **Help students think through problems in lab.**
  TAs will not give instant answers to problems encountered. They are available to guide students towards the correct answer.

Workspace

Keeping a workspace clean is very important. A messy workspace can be a safety hazard and create a chaotic environment. It is much easier to lose a small component when there are other items cluttering the table top. It is also important to keep a workspace clean because there are other classes that use the same room for their labs. Respect the lab and the other people that are working in the lab.
0.7 Resources

There are many sources of information available for students in need of help. There is a hierarchy that students should follow to ask questions before going straight to the instructor. When a student has a question they should start on the first level to ask questions and progress from there without skipping levels.

1. Peers
A student’s peers should be the first people to ask when a question arises. Asking peers not only helps the student with the question, but it reinforces the concept to the person asked when they explain it. A student has many peers so the total amount of time available with peers is much more than any other resource.

2. Teaching Assistants
Teaching Assistants (TAs) have gone through this material before and are confident with the content, making them a valuable source of information. They have recent experience as a student in course and can offer insight regarding the course.

3. Instructor
Going to the instructor or professor with a question should only happen when other students and the TAs couldn’t help. There is only a limited amount of time that an instructor is available for students to ask questions. Instructors will know the most about a topic and how it pertains to the course. Try to visit their office hours at least once during the term. Bring prepared questions or some suggestions on how to improve the lab.

0.8 Academic Dishonesty

The following is taken from the Oregon University System, Oregon State University Student Conduct Code and for more information please refer to it.

1. Academic or Scholarly Dishonesty is defined as an act of deception in which a Student seeks to claim credit for the work or effort of another person, or uses unauthorized materials or fabricated information in any academic work or research, either through the Student's own efforts or the efforts of another.

2. It includes:
   
   (a) CHEATING – use or attempted use of unauthorized materials, information or study aids, or an act of deceit by which a Student attempts to misrepresent mastery of academic effort or information. This includes but is not limited to unauthorized copying or collaboration on a test or assignment, using prohibited materials and texts, any misuse of an electronic device, or using any deceptive means to gain academic credit.
   
   (b) FABRICATION – falsification or invention of any information including but not limited to falsifying research, inventing or exaggerating data, or listing incorrect or fictitious references.
   
   (c) ASSISTING – helping another commit an act of academic dishonesty. This includes but is not limited to paying or bribing someone to acquire a test or assignment, changing someone's grades or academic records, taking a test/doing an assignment for someone else by any means, including misuse of an electronic device. It is a violation of Oregon state law to create and offer to sell part or all of an educational assignment to another person (ORS 165.114)
   
   (d) TAMPERING – altering or interfering with evaluation instruments or documents.
   
   (e) PLAGIARISM – representing the words or ideas of another person or presenting someone else's words, ideas, artistry or data as one's own, or using one's own previously submitted work. Plagiarism includes but is not limited to copying another person's work (including unpublished material) without appropriate referencing, presenting someone else's opinions and theories as one's own, or working jointly on a project and then submitting it as one's own work.

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1 http://arcweb.sos.state.or.us/pages/rules/oars_500/oar_576/576_015.html
3. Academic Dishonesty cases are handled initially by the academic units, following the process outlined in the University's Academic Dishonesty Report Form, and will also be referred to SCCS for action under these rules.

0.9 Preparation

Proper preparation allows for a smoother and more efficient lab time. Make sure to follow these steps before starting each lab.

1. Start with a clean work space.
   Often times, the electronic components used in lab are very small, and if dropped, they could be easily lost (among usual desktop clutter). Therefore, put away papers, keyboards, mice, clothing, etc.

2. Keep your parts neatly organized.
   Often times, parts come neatly packaged and ready for use. Do not dump all of these parts together, such as in a box. Instead, if parts come separated in small bags, try to keep them that way. When taking parts out of their packages, using a small container to keep them organized. Some people use ice cube trays, kitchen bowls, or other containers.

3. Care for your tools.
   The quality of electronics assembly is based on your own experience, and on the tools you use for the assembly. Hence, try to keep your tools in the best condition possible. When using cutting tools, try not to cut things that the tools are not designed to cut. An important lab rule to remember is to take care of your soldering iron properly.

4. Make sure you have everything you will need.
   When working with electronics, there is nothing more annoying than not having the parts you need, and/or having to stop what you are doing to go find them. Prevent this by double-checking that you have what is needed before starting the lab. This includes manuals, tools, components, pens, and paper.