LAB 0: Lab Introduction

OBJECTIVES

- Understand what is expected of you in this course
- Get to know your Undergraduate Peer Instructor (UPI or PI).
- Receive your lab kit and assemble any necessary parts.
- Learn how to use a breadboard, create switch and LED circuits, and build a simple logic circuit.
- Students in 3701 no longer solder during the course. An appendix on soldering is included for those that are interested.

INTRODUCTION

Welcome to EEL3701C! Throughout this course, you will learn foundational topics in digital circuit design and apply these topics to various projects during your labs. Just as in any other course, the amount of knowledge received will be very positively correlated with the amount of effort put into learning the material. However, unlike many other courses, it is likely that 3701 shall prove to be challenging for all that are enrolled.

This course is primarily lab-driven. That is, most of the knowledge you gain through this course will come from working with the course material hands-on during lab assignments. Labs in 3701 are structured unlike any other course that you have taken previously. Most of the time spent on labs (excluding this introductory one) will be completing the pre-lab requirements. Pre-labs are designed to guide you in detail through the process of applying topics learned in lecture, and they will require significant time and effort to complete. Most students that follow the specified procedures require six to 12 hours on each prelab assignment; for those that do not, it could take much longer. It is therefore important to start early on these assignments to ensure that you have sufficient time and can get any necessary help to complete these pre-labs. With an appropriate understanding of the above, along with motivation and consistent effort, most individuals can succeed in this course, as well as ***build a working CPU*** (central processing unit, the main component in a microprocessor/computer) during the process.

You are no longer soldering in this course (an important skill for all electrical and computer engineers), but the included Appendix some examples of both good and bad electronics soldering joints.

LAB STRUCTURE

In this first lab, you will become familiar with what is expected of you, as well as begin to construct your lab kit. Before attending your assigned lab session, you will explore, understand, and agree to all lab rules and policies (in the Homework 0 Quiz). Then, within the lab, you will become formally introduced to your Undergraduate Peer Instructor, the individual responsible for hosting your lab session. Beyond introductions, your Peer Instructor will identify if anything additional is expected of you throughout the semester.

REQUIRED MATERIALS

- *Parts List*
- *Lab Rules and Policies*
- *Lab Submission Template (MS Word)*
- *Hardware: Getting Started*
- *Quartus 22.1 Installation Instructions*
- Re-read the course *syllabus*. Especially important is item 1 in § Course Requirements (about the policy for missing a lab).

SUPPLEMENTAL MATERIALS

- *Logic Circuit Design and Construction* Video (by Blake Shaffer)
  This video steps you through creating switch circuits, LED circuits, and logic circuits utilizing a breadboard
- *How to Use a Breadboard* Video (by Science Buddies)
  This video describes a breadboard and how to use one in great detail.

PRE-LAB PROCEDURE

1. Read the introductory sections of this document and all the required documents listed above **before your lab and prior to answering the pre-lab questions.** Download these files to your laptop computer for future reference.
2. Read and understand all items presented within the *Lab Rules & Policies* document. You should have already agreed to abide by these specifications in your Homework 0 Quiz; if not, complete this quiz now! You will not be admitted to Lab 0 without completing the Homework 0 Quiz.
3. Install Quartus Prime Lite Edition v22.1 and a simulator on your laptop computer prior to your lab. For most students, we recommend using ModelSim as your simulator. Refer to the *Quartus 22.1 Installation Instructions*.
4. Create your *Pre-Lab Report* using something like MS Word. Use the format specified in the *Lab Submission Template*. The report must be computer generated (even if parts of it are from clean and easy to read scans). Ultimately, you will save this file as *Lab0.pdf* for submission on Canvas. You will have a *Pre-Lab Report* for **every** lab. In this lab, only parts 5. i. a) – e) and 6 i) and iv) (see below), from the *Lab Rules & Policies* are relevant.
5. Create a short video, of no more than 15 seconds. The object of this video to get practice for our future labs. For this lab, only items 6 i) and iv) in the *Lab Rules & Policies* are required.
6. Take a screen shot of our slack, with the #announcements channel selected. Save this screen shot as a figure in the *Pre-Lab Requirements* section of your lab document.

PRE-LAB QUESTIONS

0. What minimum lab average is required to be **eligible** to pass the course?
1. How much time can you expect to spend on future pre-lab assignments?
2. When are your prelab submissions due in Canvas?
3. How late can you arrive for lab and still be admitted?
4. How late can you arrive for lab and still be allowed to take the lab quiz?
5. How many labs are you allowed to drop without an excuse?
6. Can any lab be dropped?
7. If you decide to drop a lab, are you required to turn in any pre-lab materials for that lab?

PRE-LAB PROCEDURE SUMMARY

1. Read and understand the Lab Rules and Policies document (as required in the Homework 0 Quiz).
2. Answer all pre-lab questions and complete all other pre-lab requirements.
3. Further prepare for your first lab session by reviewing how to use a breadboard.
4. Upload your lab report to the proper Canvas assignment. (This is **ALWAYS** required and will not be explicitly listed again.)
5. In all labs EXCEPT this one, you will also upload Quartus archive files to Canvas that show the circuits you designed during the pre-lab. (This is **ALWAYS** required and will not be explicitly listed again.)

IN-LAB PROCEDURE

In your first lab session, you will do several things in preparation for the remainder of the semester. Initially, you will meet your Peer Instructor (PI), the individual in charge of hosting your lab session.

At the beginning of the lab period, you will take a short syllabus quiz verifying that you read and understood the rules set out in the course *syllabus* and the *Lab Rules & Policies*. You will take a lab quiz during every lab session. Most lab quizzes will take 45 minutes to 1 hour, but this quiz shouldn't take longer than 15 minutes. Your PI will explain the process for taking a lab quiz during your lab period.

Once the lab quiz has completed, you will receive your lab kit. Compare the contents of your lab kit with the *Parts List*. Identify any missing parts; report this verbally immediately to your PI, email this to Dr. Schwartz and your PI, and state this in your Pre-Lab Report for Lab 1. If all parts are included, indicate this in your Pre-Lab Report for Lab 1. For documentation purposes, take pictures of all of the parts in your kit (chips on the foam, PCBs, breadboards, etc.) and include these images in your Pre-Lab Report for Lab 1.

Once all students have confirmed their lab kit is complete, your PI will demonstrate building a simple logic circuit. Follow along on your breadboard and take special note of how to build active-high and active-low switch and LED circuits. These will be important for future labs.

IN-LAB PROCEDURE SUMMARY

1. Meet your PI and become familiar with their style of teaching.
2. Receive your lab kit and verify that all components are accounted for. If any parts are missing, immediately notify your PI.
3. Demonstrate to your PI that Quartus 22.1 is installed on your computer.
4. Follow along as your PI demonstrates the creation of a simple logic circuit. After your PI has completed the demonstration, construct that circuit yourself with your own hardware.

APPENDIX

See *Electronic Assembly handout from Chapter 3 of the MIT 6270 Manual* for instructions on how to solder.

The following figures might be helpful to show some good (and bad) soldering examples.

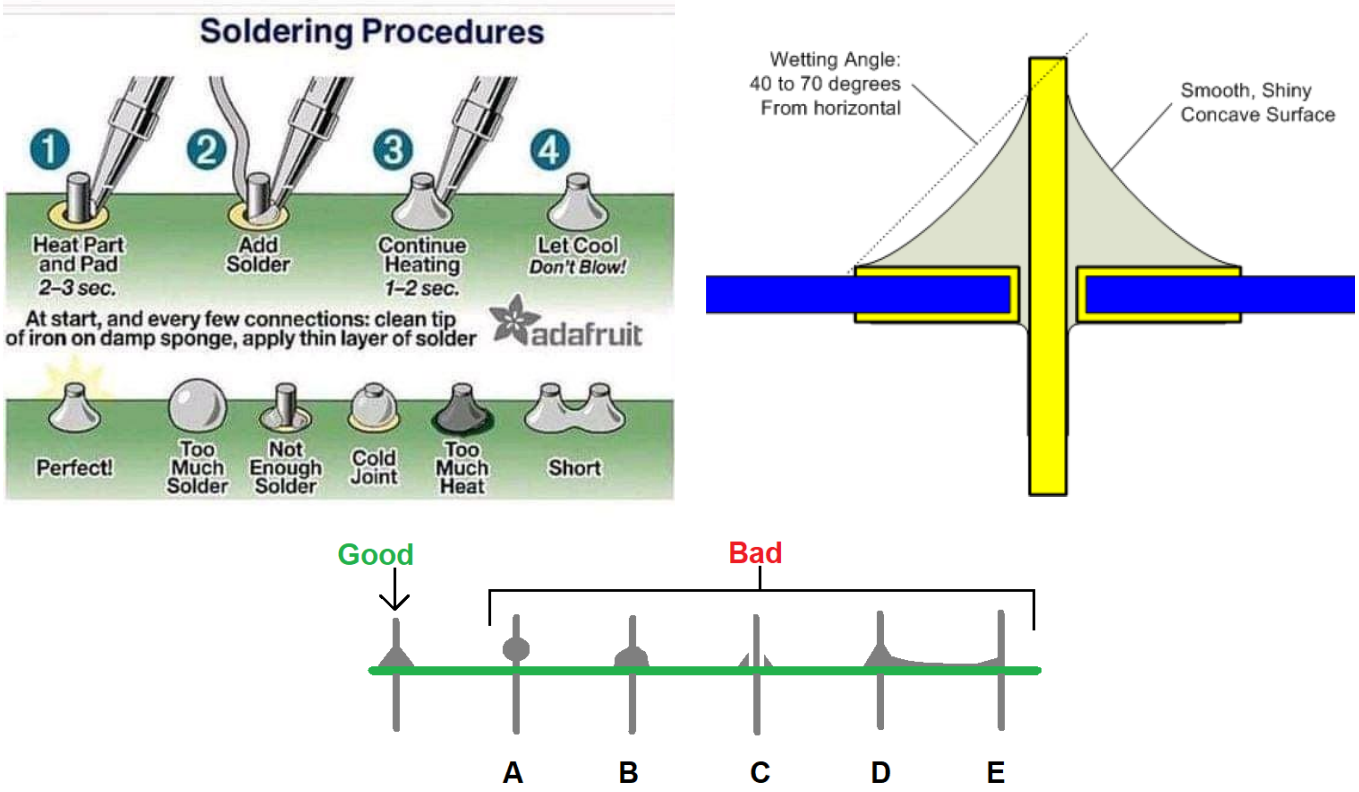

Figure 3: Good and bad soldering examples.

A good solder should have the shape of a *Hershey's Kiss* (without the wrinkles). By the way, the first Hershey's Kiss was manufatured in 1907!

Figure 4: Ideal solder joint.