

University of Victoria
Department of Computer Science
CSC 355 Digital Logic and Computer Design
Lab 1: Introduction to Logic Gates and Design Works

Introduction

Welcome to the 355 Labs. The labs have been designed to give you a rewarding learning experience. This lab gives you an orientation to the lab hardware.

The objectives of this lab are to be able to:

- Submit the pre-lab worksheet on time, as specified below
- Explain the functionality of the Digital Design Lab (DDL) equipment.
- Insert chips into the breadboard of the DDL and add wires to create a complete and functional circuit.
- Practice techniques for troubleshooting circuit wiring errors.
- Learning to use the logic simulator *Design Works*¹.

NOTE: Your completed pre-lab worksheet is to be submitted in class on Friday, September 9, 2016.

Part 1: Pre-Lab Exercises: Complete Before the Lab

1. [3] Simplify the following equation and show your work²: $F = (\overline{P}\overline{R} + R)(PR + \overline{P}Q + QR)$

You will need to provide your work that shows how you simplified F on the Pre-Lab #1 Worksheet, which is attached to the end of this document.

2. Draw two circuits; either manually or using Design Works or Visio (available in the lab, ECS room 249):
 - a) Circuit 1 represents the original equation F (ie, without simplification) from point #1 above.
 - b) Circuit 2 represents the simplified equation F .

Draw your two circuits on the Pre-Lab Worksheet 1. There is an electronic copy of the worksheet on the course connex site, in case you wish to draw the circuit with Visio or Design Works and copy into the worksheet and print for class.

NOTE: You can and should check your solutions to the pre-lab exercises with your course instructor who will have a solution set available at all office hours and classes. (She will, however, want to see that yours is complete before you can check!)

Part 2: Procedures for the In-Lab Exercises

1. Get your graded Pre-Lab Exercise from your instructor.
2. Use the datasheets for the 7408 (Quad 2-Input AND gates) and 7432 (Quad 2-input OR gates) that are on the course web site (in the Lab 1 folder) to determine the pin numbers for the gate inputs and outputs.

¹ http://www.capilano.com/dww_overview

² You should show ALL the steps and indicate which Boolean Algebra rule was used at each step.

3. Your lab instructor will present a tutorial to guide you through wiring your circuit on the Digital Design board.
4. Build your (simplified) circuit and test it to ensure it functions.
5. Your instructor will present some troubleshooting techniques.
6. If your circuit functioned perfectly on the previous step, ask a classmate to create some wiring errors. Use the techniques to find error(s) in your circuit.
7. Demonstrate your correctly functioning circuit to your instructor.
8. In the remaining lab time, work with *Design Works* and/or *Visio*, two applications that will be used throughout the course and are installed on the lab computers.
 - The drawing package *Visio* has a digital logic library that can be used to draw circuits.
 - The simulator *Design Works* can be used for experimentation, similar to our digital design boards, and is especially useful with large circuits. Also, there is a DesignWorks tutorial on the course web site.

Pre-Lab Worksheet **NAME:** _____ **LAB Section: B0**__

Your work to simplify: $F = (\overline{P}\overline{R} + R)(PR + \overline{P}Q + QR)$	Boolean Algebra Rule Used

Circuit #1: Unsimplified $F = (P\overline{R} + R)(PR + \overline{P}Q + QR)$

Circuit #2: Simplified F

Finally, write a list of things that you learned in doing this pre-lab: