Digital Logic Design Lab #1

Objectives

Learn to use Understanding of Computer Aided Design (CAD) tool TinkerCAD and associated instruments to implement digital logic circuit and test.

Preparation

Complete the following steps before starting to work on the experiments in this lab:

1) Complete lecture and assignment in Binary Number and Algebra Chapters
2) Watch the following Introductory Videos:
   a) Introduction to TinkerCAD Electronics at "https://youtu.be/38ur1kyFYxc"
   b) Introduction to TinkerCAD Digital Logic at "https://youtu.be/LHfqgct69bs"
   c) TinkerCAD Oscilloscope & Function Generator at "https://youtu.be/wfvYz1L0Qkk"
3) Create an account at w*ww.TinkerCAD.com* if you do not have an account

Experiment 1. Introduction to Instruments

For each of the following instruments in TinkerCAD describe the parmeters that you can change and its associated range:

- Resistor
- LED
- Prototype (Bread) Board
- Power Supply
- Multimeter
- Function Generator
- Oscilloscope

Experiment 2. Proto board Connectivity

Circuit proto boards are used for building experimental circuits for evaluation purposes. Electronic components such as resistors, IC's (integrated circuits which perform logic functions), switches, LED's, etc. are placed on the prototype board. The board makes electrical connection between these devices to enable them to operate as designed. You may use the Multimeter's ohmmeter capability to determine connectivity. To show connections, draw a lines between the connected holes on the diagram below.
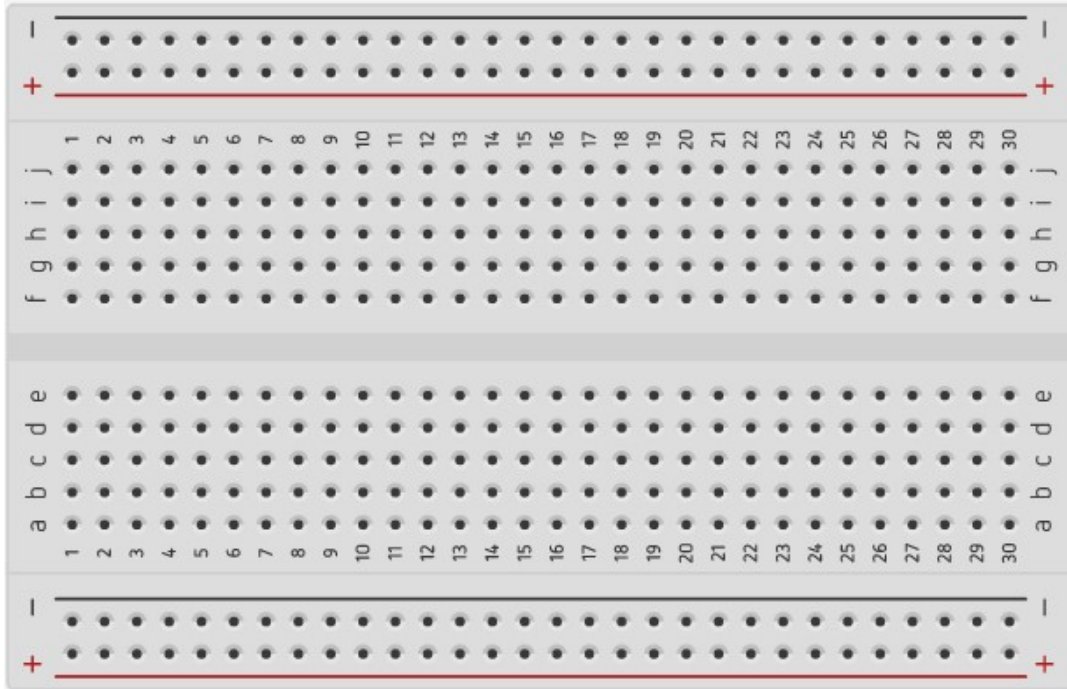
Experiment 3. Introduction to Square Wave (Clock)

Set the Function Generator to Square wave with frequency of 1 kHz, 50% duty cycle, amplitude to 5 V peak-to-peak and DC Bias of 2.5 V. Set the Oscilloscope time division such that you are able to view one whole cycle. Include the resulting diagram in your report.

Notes:
- *DC Bias or DC offset refers to DC voltages added to the AC signal.*
- *Duty Cycle refers to the percent of cycle time that the square wave signal is not zero.*

Repeat the experiment with frequency of 20 Hz, 50% duty cycle, amplitude of 3 V peak-to-peak and DC Bias of 0 V.

Repeat the experiment with frequency of 50 kHz, 50% duty cycle, amplitude of 4 V peak-to-peak and DC Bias of 2 V.

Experiment 4. System Specifications

A three way intersection needs a traffic signal control system. Each direction has only one lane and one signal control light (green and red) each Lane. Identify the Input variables into the traffic control system and Output variables to control the signals. Sketch the intersection with identified variables and their values. Also Develop a Truth Table for the Signal Control System at this intersection.

The traffic light system should adhere to the right-of-way laws of the state of Washington for a 3-way intersection.

Report Requirements

This lab and associated report must be completed individually. All reports must be computer printed (formulas and diagrams may be hand drawn) and at minimum:

For each experiment include:
- Clear problem statement; specify items given and to be found.
- Answer experiment questions
- Resulting circuit schematics, simulation results, and other relevant information from the experiment.

For the whole report include:
- A Cover sheet with your name, class, lab and completion date.
- A Lessons Learned section which summarizes your learning from this lab.
- A New Experiment section that has description of a new experiment and the experiment's results. Experiment should be related to material covered in class but not similar to one of the experiments in this lab.