Lab 10: Counters

Introduction

Flip-flops are memory devices that can be used to design counters. A counter is a device capable of incrementally or decrementally counting within a range of numbers. There are two basic forms of counters discussed within this course: ripple counters and synchronous counters. Ripple counters differ from synchronous counters in that the clock pulses are applied to all the inputs of all flip-flops as opposed to just one flip-flop in ripple counters. In order to design synchronous counters, we need to determine the range of the counter and the states it requires. From our defined states, we then create a state transition diagram to create state transition tables and excitation tables.

Objectives

Students will be introduced to synchronous counters and apply their theoretical knowledge to use build a synchronous circuit that counts from 0 to 7 indefinitely. Additionally, students will be more comfortable in dealing with state and state transitions.

[100 points] Procedure & Results

Design and Implementation of a synchronous counter

Design a sequential circuit that counts from 0 to 7 indefinitely. Include the following in your lab report:

- **State diagram.**
- **State transition table. K-maps.**
- **Simplified logical expression for flip-flop inputs.**
- **Design in Logisim**
- **Implement on the breadboard. Use 74174 (6xD flip-flop), 7408 (AND), 7486 (XOR).**