CEG2136 Lab 2

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Introduction

The purpose of this lab was to experiment with the creation of two synchronous counters and the use of a oscilloscope. The problem of the lab was to create two circuits, one circuit with 3 bits and one circuit with 4 bits. Problems provided in this lab were the introduction of the oscilloscope and the introduction of manual simulation. Since this was the first lab where students created circuits with a register, the concept of storing a state and using flip flops was also new to students.

Design

This lab required the use of an oscilloscope and the appropriate cables to connect the oscilloscope to the board in order to synchronize the clocks and a ribbon cable to extend the outputs of the Altera board. The following state diagrams were used to design the circuits created in this lab

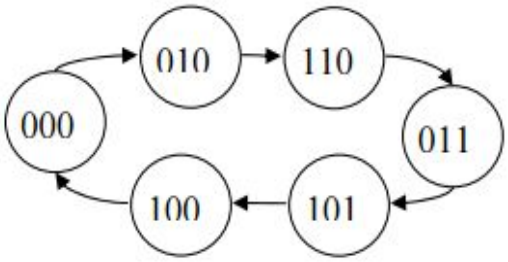

Fig 1. State diagram of 3 bit counter

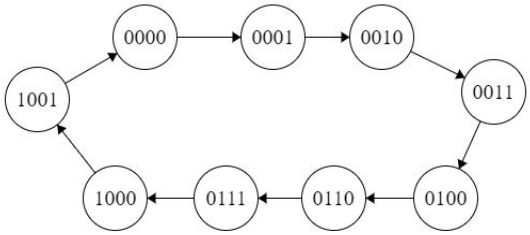

Fig 2. State diagram of 3 bit counter

Since these diagrams were the only provided material for the lab, creation of the circuit diagram and schematic was required. The counters utilized D flip flops as a register to keep track of the current state of the circuit.

Solution

The solution to this lab involved 2 sections, a section for next state logic and a section for the registers. The next state logic was used to calculate the next state using the current state and specific boolean gates. The two circuits are arranged as pictured below, with the 3 and 4 bit circuits having their respective amount of D flip flops.

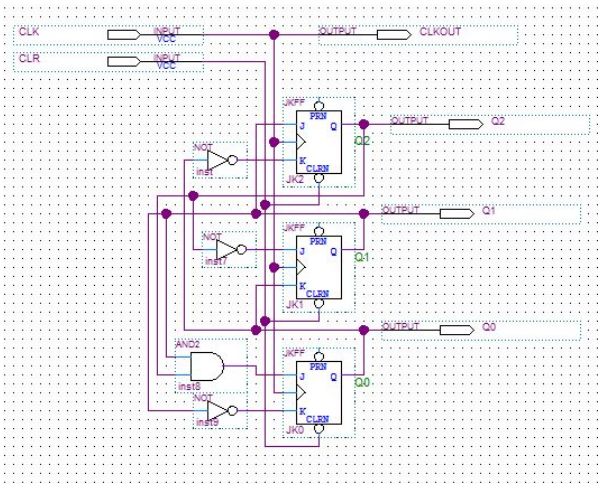

Fig 3. 3 Bit counter schematic

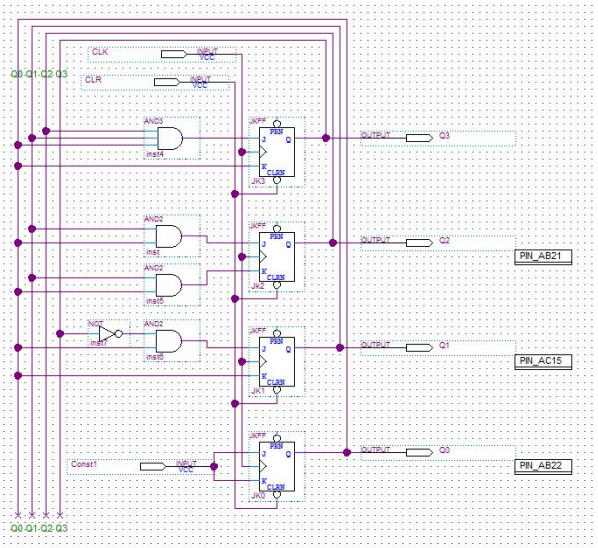

Fig 4. 4 Bit counter schematic

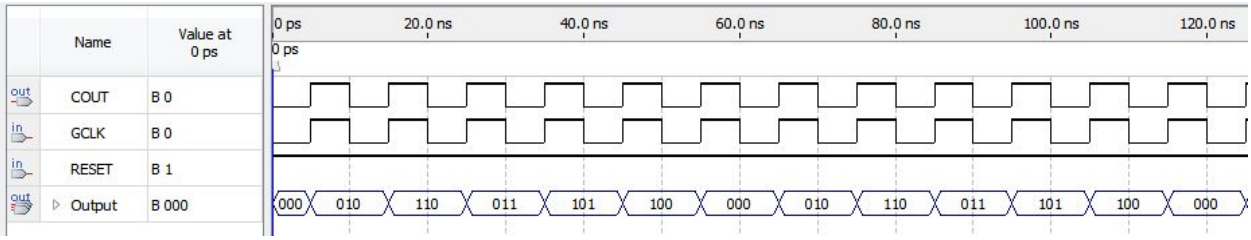

Fig 5. 3 Bit counter waveform

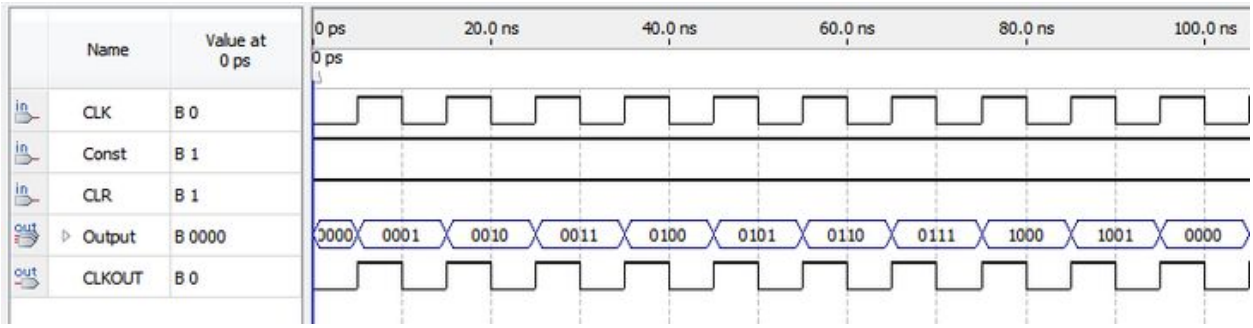

Fig 6. 4 Bit counter waveform

Discussion

This lab provided a few challenges which I had to overcome such as the proper use of an oscilloscope and the physical wiring from the board to the oscilloscope. These challenges were overcome by help from the teaching assistants. I had no errors in my design and was able to maintain a clean and easy to read design. All of the output was correct and my oscilloscope and manual simulations were both valid.