

Design and Synthesis of Finite State Machines

PURPOSE: In this lab you will learn how to design and synthesize finite state machines. You will be designing a vending machine controller.

1. Designing a vending machine controller

In this lab you will design a vending machine that sells candy bars for 25 cents. The machine takes nickels, dimes and quarters and dispenses candy bars and returns nickels and dimes as change.

The inputs to the machine come from 4 push button switches. Three switches correspond to a nickel, dime or quarter inserted into the machine. The fourth is used to reset the machine. You will be using 3 7-segment displays as outputs to demonstrate the working of the machine.

When the machine is reset, it is ready to accept the coins. This is indicated by displaying an 'E' on one of the displays. When coins are entered, the total value of the coins entered is displayed on two 7-seg displays. Note that when a push button switch corresponding to any coin is pressed, the machine should read in only 1 coin irrespective of how long the switch is pressed. When the total value of the coins exceeds 25 cents, the machine dispenses a candy bar. This is indicated by displaying a 'C' on one of the displays. Any excess change is dispensed as one coin per clock cycle. The value of coins returned as change is also indicated on the displays. 'C' is displayed as long as the machine keeps dispensing coins as change. Then it displays an 'A' indicating it needs to be reset to get the next candy bar. For e.g., If the sequence on coins you enter is 5, 10, 25. The displays read E 05, E15, C 10, C 05, A.

When the total value of coins inserted is less than 25 cents, the state machine changes states only when a coin is inserted. After enough money has been inserted, the machine dispenses candy bars and change at the rate of 1 per clock cycle.

As deliverables for this lab, you will turn in your state machine design as a state diagram with description of the states and transitions, and verilog code. You should also design test benches and attach simulation waveforms verifying your design.