CE 1911 Week 7 Lab: Advanced FSM HDL Design

Name:_____

Objectives
- Design a complex Finite State Machines using VHDL
- Develop a DE10 implementation using switches and seven segment displays

		student check off

Prelab
- Create a working directory and project in Quartus for W7Lab ☐
- Review HDL FSM class notes ☐
- Review CE1901 notes on using the seven segment displays ☐
- Create a state transition diagram for your design ☐

Assignment

This assignment involves the development of a vending machine. Our vending machine takes nickels, dimes and quarters and vends one of 5 items. Two of the items are chips and 3 are candy bars. The chips cost 50 cents and the candy bars cost 60 cents.

- The display (7-seg) indicates the total amount inserted into the machine.
- If an item is selected and insufficient funds have been entered the display will indicate dash dash, the required amount, and 2 more dashes, then return to displaying the amount already entered.
- If an item is selected and there is a sufficient amount entered the display will indicate the word 'vend' followed by a space and the appropriate number 1-5. In addition, an LED will light corresponding to the selected item. The machine will then return to the ready state.
- The machine does not give change, but a button will be assigned to cancel the sale. When this occurs the display indicates 'cancel' and all 5 product LEDs light up. The machine will then return to the ready state and all money is lost.

Inputs: rstb, clk, 4 switches(Nickle, Dime, Quarter, Cancel), 5 switches (chip1, chip2, candy1, candy2, candy3)
Outputs: 7 seg display, 5 LEDS (one for each item)

Part 1: Define your states and outputs. Create a state diagram for your finite state machine. No checkoff will be allowed without this.
*** Try to get your state machine to 5 or 6 states ***
Hint: Create a separate process for keeping track of the current cash value

Part 2: Create a VHDL implementation of your design. Simulate your design showing the following 4 scenarios:
1) 5 dimes and chip1 selected
2) 4 dimes, 5 nickels and candy 2 selected

3) 2 quarters and candy 1 selected, followed by 1 dime and candy 1 selected
4) 1 nickel, 1 dime, 1 quarter and chip 2 selected followed by 1 nickel and chip 2 selected followed by cancel

Part 3: Create a DE10 implementation of your design. Use the clock divider circuit to slow down the system to 1 clk/sec. Any combinations of inputs can be chosen by your instructor to test the design.

MAPPING:
rstb, Nickle, Dime, Quarter, Cancel, chip1, chip2, candy1, candy2, candy3 → SW
7 seg display
5 LEDS (one for each item)

Check Off
- Show your state diagram   10%
- Demo and document your simulations   40%
- Demo and document your DE10 implementation   50%

Lab Report (informal)
- Due at 4:00 pm, Monday after lab – in the box
- Include a properly documented informal lab report.