Digital System Design
EE 245
Project Description

1 Overview

Your assignment is to design, describe, and build a vending machine similar to that of the in-class example discussed in class the first week of April. Your machine should accept nickels, dimes, and quarters. It should dispense a product once 65 cents has been received. Unlike my example in class, your machine *must* **give change** and *must* be a **Moore-type machine**. You may make reasonable assumptions, but will be penalized for unreasonable assumptions.

You may work with a single partner (teams of no more than two). Choose your partner wisely. You would be better off working alone than with a person who has yet to show up on lab-day with a schematic and/or a design. This person is probably not going to metamorphose into the ideal project partner overnight. I would prefer for students to work in groups of two (due to limited lab resources and the learning experience of working on a team). If you cannot find a partner, you will be allowed to work alone but we may have issues in scheduling you some extra lab time to work on your project.

2 Deliverables and Deadlines

Item	Due Date
Preliminary Design Document	5:00 pm Thursday April 13th
Project Demonstration	Be ready by May 2
Final Design Report	5:00 pm Friday May 5th

2.1 Preliminary Design Report (PDR)

Each team will hand in a preliminary design document by Thursday, April 13th. This document will include an overview of the approach that you plan to take in solving this problem. This report will include any required state diagrams and transition tables (if you are choosing to use the schematic capture toy or if your Verilog approach requires them), or flowcharts (if you plan on using Verilog). You do not need to include excitation information, but you should have read and understood the information on 5- and 6-variable Karnough maps (Section Min.2 on OneKey) if you are using schematic capture. You should be aware of any constraints imposed by this approach and outline the steps that you have taken to ensure that your design will be successful.

You should discuss any assumptions that you are making, and attempt to justify them. For example, if you want to assume that two coins will not be present (on the inputs) at the same time, you need to justify that assumption in your PDR.

You should also include a *schedule* indicating when you plan to meet with your team, when and when you plan to meet significant milestones. (Hint: there are more than the three milestones listed in the table above).

2.2 Project Demonstration

You will actually implement your project using the Xilinx FPGA proto-boards in HH 319. You may use a push-button to simulate a clock signal and three switches to simulate your inputs (nickel, dime, quarter). Use an LED to indicate when a product is to be dispensed, and other LEDs to indicate when each type of change should be returned. Additionally, you must use the 4-digit seven-segment display to indicate both amount of money received (since the last pop was dispensed *and* the amount of change due once the purchase price has been reached. You should preface the "change" display with the letter "c" in order to differentiate between the two displays. You should take a modular approach to your design, and since you will probably not fully understand how to drive the seven-segment displays until after class on Wednesday (April 12th) the details do not need to be as fully specified in your PDR.

You are to have your project working and tested *before* Tuesday, May 2nd. I may ask you to demonstrate the project at any time during your lab section on Tuesday, May 2nd. **Do not assume that you will be able to demonstrate at the end of the week. I will schedule the demonstrations**. Notice that I said "tested". You will label your switches and LEDs and I will test that your project works. It should obviously work for multiple purchases (not just the first time). It *must not* require a "reset" between purchases. It should work for all reasonable inputs (e.g. all reasonable assumptions made and stated in your preliminary design report and final documentation).

2.3 Final Report

Each team will hand in a written final report, no later than 5:00 pm on Friday May 5th. This report should include everything I might want to know about your project and the steps you took in designing and building it. Include all of the stuff from the design document, and more. State tables, state diagrams, excitation logic, flow charts, circuit drawings – whatever you needed to complete your design using your chosen approach. Include lessons learned (both EE 245 and life variety). Include a section on how you could improve your project if you had another week to work on it. This is your chance to sell me on your project, so mention any extra features, or anything you feel is extraordinary about your project.