

VALPARAISO UNIVERSITY
ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT

ECE 221

Design Project #6 - Vending Machine Controller

FALL 2003

Introduction: This design project is a culmination of most of the topics covered this fall. It involves the design and verification of a vending machine controller. The vending machine controller is a Finite State Machine (sequential circuit) that controls the operation of a vending machine (coins inserted, latches released and change returned).

SECTION I. SPECIFICATION

You are to design a newspaper vending machine controller. The machine takes only dimes and quarters and outputs a paper whenever 50 cents is entered. The machine can give at most 15 cents change (1 dime and 1 nickel). Your design should be implemented as a Moore Machine.

SECTION II. CONCEPTUAL DESIGN

1. Understand the problem!!! What are your inputs and outputs? If it helps, write out possible input/output sequences.
2. Create a minimized state diagram for your design. Include a key that describes the input and output labels in your diagram. Any unused states will NEVER occur, and a dime and quarter cannot be dropped into the machine at the same time. Therefore, you can treat the next states and outputs of those cases as don't cares. Make sure you show all valid input transitions and label what each state represents.
3. Create a state transition table from your state diagram. You can use don't cares where ever possible to shorten the table.
4. Choose a flip flop type and determine the minimized boolean equations for the flip flop inputs and outputs. You can use either K-maps or Espresso to minimize your equations.

SECTION III. MENTOR IMPLEMENTATION

1. Implement your minimized design in Design Architect. You can use parts from either the GEN_LIB or the board process libraries. If you use the board process libraries, select the more common symbol for the simple gates. Make sure you include a clear or reset input in your design so that you can reset your states at the beginning of the simulation.
2. Verify that your design is working correctly using Quicksim. Your waveforms should include testing enough combinations of dimes and quarters so that all states are visited at least once. When the design is working, print out the waveforms. Your printout should include all inputs and outputs AND your state variables. On your waveforms show (in pencil) the different test cases.

SECTION IV. WHAT TO TURN IN

1. The design project header page. If you worked with another person, on the bottom of the page describe how the two of you split up the project (who did what).
2. All parts of your conceptual design including any Espresso input and output files (if used).
3. A copy of design schematic showing your final implementation and the output waveforms verifying the implementation is working properly.

**ECE 221 Digital Logic Design
Design Project #6: Vending Machine Controller**

December 12, 2003, Noon

Name: _____

Name: _____

Honor Code Pledge:

Signature: _____

Signature: _____

Describe how the project was split up between the two of you:

Please staple this sheet to the front of your assignment