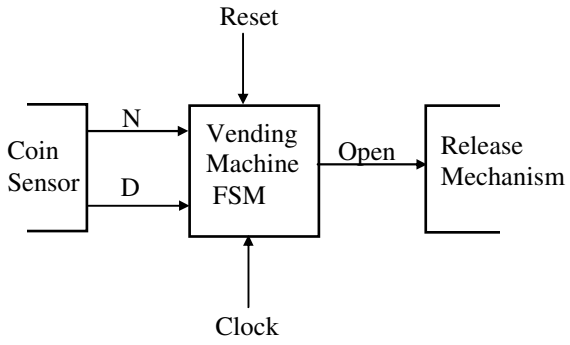
Computer Engineering 315L
Digital System Design Lab
Lab 6
Option A
Finite State Machine
Vending Machine Controller

A finite state machine, so names because the sequential logic or flip-flops that implements them can be in one of a finite number of possible states. In lab 6 option A. you will implement a simple vending machine to dispense after dinner at a restaurant Snickers Ice Cream Bar, a perfect combination of soft, creamy ice cream, milk chocolate, some caramel, and just enough peanuts.

Original Vending Machine
The vending machine delivers an ice cream bar after it has received 15 cents in coins. The machine has a single coin slot that accepts only nickels and dimes, one coin at a time. A mechanical sensor indicates whether a dime or a nickel has been inserted into the coin slot. The controller's output causes one ice cream bar to be released down a chute to the charitable donor. The donor may insert three nickels, a dime and a nickel, or two nickels and a dime or two dimes. If the donor inserts a total of 20 cents, the machine keeps the extra 5 cents as an additional charitable donation.



Suitable Abstract Representation
I. Tabulate typical input sequences:
- 3 nickels
- nickel, dime
- dime, nickel
- two dimes

II. Draw state diagram:
- Inputs: N, D, reset
- Output: open chute

III. Assumptions:
- Assume N and D asserted for one cycle.
- Each state has a self loop for N = D = 0 (no coin)

Revised Vending Machine
After demonstrating the logic of this machine to the instructor, it was deemed impractical to keep the extra nickel of change for the Dime-Dime-Nickel and Nickel-Nickel-Dime scenario listed above. Too many users were annoyed that the extra nickel was kept as an extra donation. Therefore, a second output called Change is to return one Nickel in the above two scenarios. Add a state called *TwentyCents* that dispenses the ice cream bar and returns a nickels change.

Final Report, using the same format of previous lab reports, is to include at a minimum the following:

- Original Vending Machine State Diagram
- Original Vending Machine Transition Table
- Original Vending Machine K-Maps
- Original Vending Machine Circuit Diagram
- Revised Vending Machine State Diagram
- Revised Vending Machine Transition Table
- Revised Vending Machine K-Maps
- Revised Vending Machine Circuit Diagram

In addition to completing the final report, you need to demonstrate the correct operation of the breadboarded (original version) vending machine controller to the instructor.