# Homework 4
Problem 1 (Solution)

You are to design a state machine to control an old fashioned vending machine that would drop a token for a price of 20 cents. There are two possible inputs at any state: N (for nickel) and D (for dime). Based on the input, the machine is to transition to a new state. When any sequence of coins worth 20 cents or more is input, the machine transitions to the start state and outputs a 1 to indicate that the vending machine is to drop the token. All other transitions are accompanied with an output of 0. If the value of the coins is higher than 20 cents, the extra money is lost.
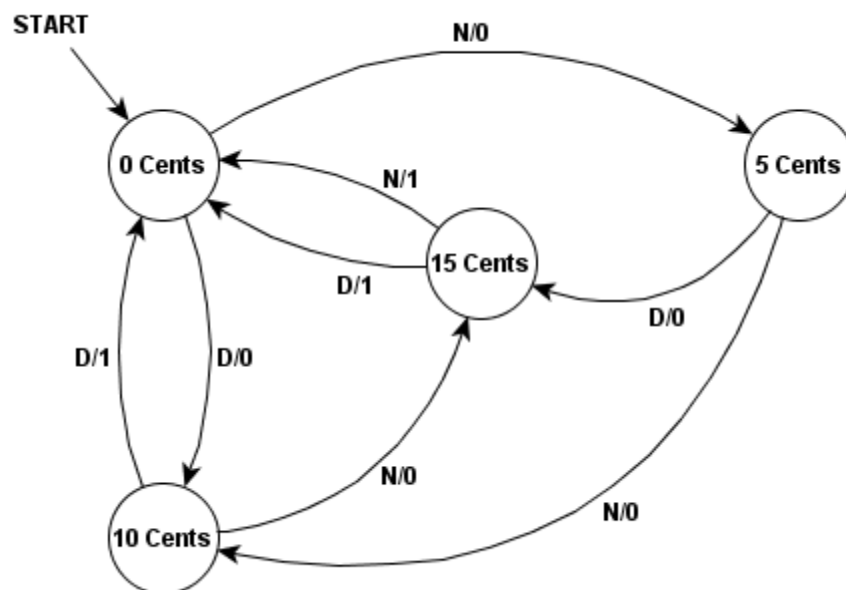
Explanation:

We chose the states so that they "memorize" how much money has been inserted so far. The machine starts with 0¢. When a nickel is inserted, the machine transitions to the *5 Cents* state to indicate that 5¢ have been currently inserted. Notice that for this transition, the input is N (nickel) and the output is 0. The output is 0 because no token should be dropped yet (we haven't reached 20¢). The interesting transitions occur at the *10 Cents* and the *15 Cents* states. When the machine is at state *10 Cents* and a dime (D) is inserted, we will have accumulated 20¢. At this point, we can drop the token (so the output is 1 when we insert a dime at this state). Notice, however, that there is no *20 Cents* state. Instead, as specified in the problem, we must transition back to the start state. This is to get ready for the next customer. Notice that if we insert a dime at state *15 Cents*, we will have accumulated 25¢. However, we still transition to the start state because the problem specified that the extra money is lost.