ENGR-354
Notes about HW#16

To get started on this problem first pay attention to the block diagram that was provided and the functional parts of the system: coin receiver, mask dispenser, coin return, clock source, and the state machine based controller. Note that state machine parts are also shown, i.e. a block representing next state logic, the two outputs from next state logic to the D inputs of the flip-flops, and a block representing the output logic. .

The major steps needed to design the system are listed in the homework handout. The first step you need to do is create a state diagram. Here are more particulars regarding operation and creation of the state diagram.

Only quarters and half-dollars can be inserted into the coin receiver. When a person inserts a coin either the 25c signal or the 50c signal is asserted high.

To dispense a mask, the dispense signal needs to be asserted for one clock cycle.

If 25 cents is first inserted, then 50 cents, and then a second 50 cents the total is greater than $1.00. A mask certainly should be dispensed but 25 cents change needs to be dispensed as well by asserting the return25 signal for one clock cycle.

To start creating the state diagram draw a circle at the top of your page. This can represent a "starting" state where you wait for a coin to be inserted. This state will have a holding branch and two other outgoing branches, three outgoing branches total. When in this state, each time a rising edge of the clock occurs a transition will occur along one of the outgoing branches. Which branch will be taken depends on if a coin has been inserted or not and if a coin was inserted what its value is. With two input signals (25c and 50c) there are four combinations: (I will use an exclamation to indicate negation):

!25c • !50c
!25c • 50c
25c • !50c
25c • 50c

where the dot represents a logical AND of the two. With three branches out of the first state, the branching condition for two branches will have one of these product terms (minterms) and the third branch will have two of these minterms ORed together there by obeying the SUM rule and also the UNIQUEness rule.

If 25 cents was entered, the destination state will represent 25 cents total. It will have a holding branch for waiting until another coin is inserted. When the next coin is inserted the branch taken will depend on if 25 cents was inserted or 50 cents. Note that the user can insert coins in any order and your sequence of states needs to accommodate any order of insertion. Once $1.00 total is reached the dispense signal will be asserted in some state. If the total becomes more than $1.00 than change must be given using quarters. After dispensing product go back to the first state to await another customer. More than 4 states will likely be required.

The time spend in a state that does not have a holding branch is one clock cycle. One clock cycle is likely fast, like 0.01 seconds. Thus multiple clock cycles will go by before the next coin is inserted and holding branches are needed in states while waiting for coins to be inserted.