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Professor Ogunfunmi

COEN 21L / 2:15 F

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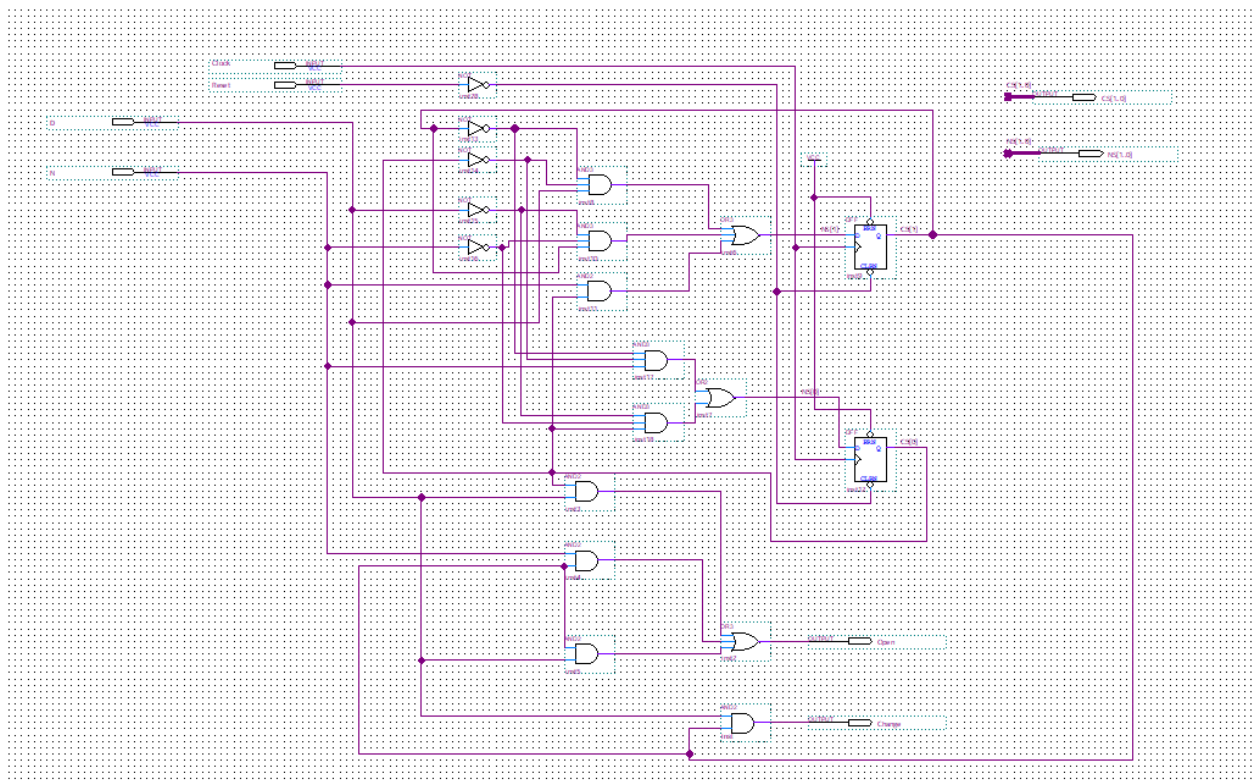
## Lab 8 Report

### Introduction

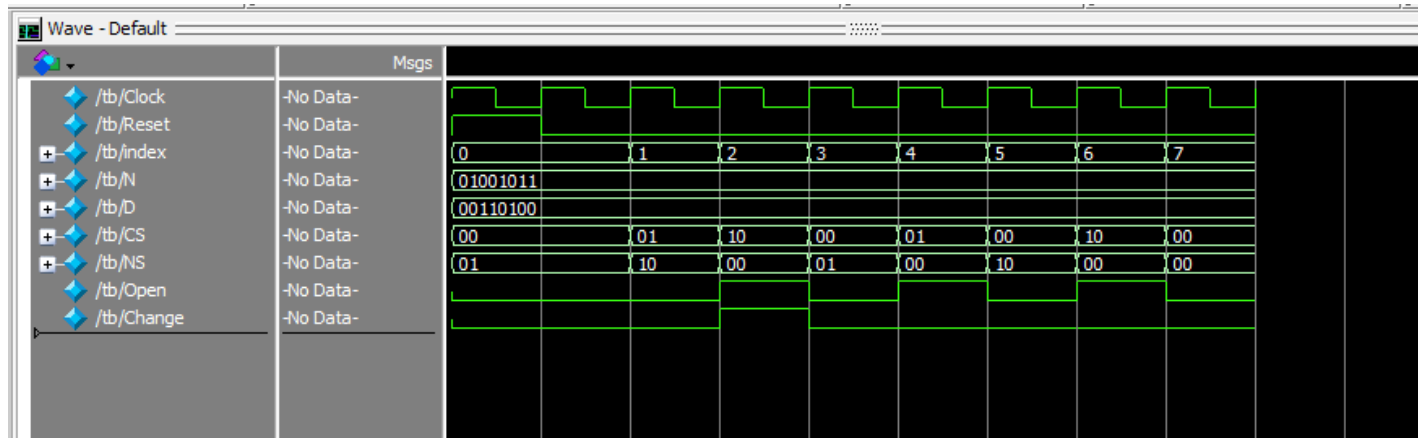
In this lab, we implemented a vending machine that dispenses coffee, and takes in only nickels and dimes as payment. It also offers change.

### Schematics/Waveforms/Verilog

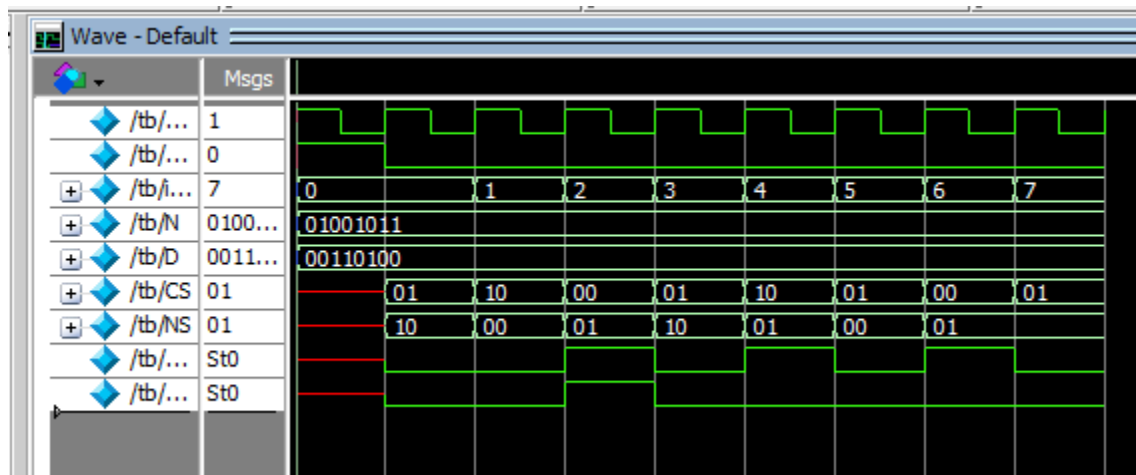
#### Schematic



## Schematic Waveform



## Verilog Waveform



## Verilog

```
module VendingMachineOneHotMealy(
```

```
    input Clock, Reset, D, N,
```

```
    output reg [2:0] CS, NS,
```

```
    output reg Open, Change);
```

```
    parameter s0cent = 3'b001, s5cent = 3'b010, s10cent = 3'b100;
```

```

always @(posedge Clock) begin
    if(Reset)
        CS <= s0cent;
else
    CS <= NS;
end

always @(*)
    case(CS)
        s0cent: begin
            Open = 1'b0;
            Change = 1'b0;
            if(N)
                NS = s5cent;
            else if(D)
                NS = s10cent;
        end
        s5cent: begin
            if(N) begin
                Open = 1'b0;
                Change = 1'b0;
                NS = s10cent;
            end
        end
    endcase

```

```
        else if(D) begin
            Open = 1'b1;
            Change = 1'b0;
            NS = s0cent;
        end
    end
s10cent: begin
    if(N) begin
        Open = 1'b1;
        Change = 1'b0;
        NS = s0cent;
    end
    else if(D) begin
        Open = 1'b1;
        Change = 1'b1;
        NS = s0cent;
    end
end
endcase
endmodule
```

## Questions

- Were the state diagrams/state tables you created in your pre-lab correct or not? If it was incorrect, in what way was it incorrect? What do you think led you to your incorrect diagram/table?

No errors in relation to the diagrams/state tables in the pre-lab.

- How difficult would it be to modify the design in the book to give back change?
  - It was not difficult, we just needed to make an extra bit for the change, and rewire the states.
- Compare the designs of the Schematic Based Design with the Verilog-based Design.
  - The difference is in One Hot encoding; there can't be the state of 11.
- How will your design change if you have to accept all types of coins (nickels, dimes, pennies and quarters). What about if you accept dollar bills?
  - If we were to accept all types of coins...
    - Our design would need to allow for more states as we are accepting a wider variety of coins and therefore we need more options for change.
    - We would need states from 1 to 25 cents.
    - For the change state we would need to add logic that determines if a Dime needs to be given as change as well.
  - If we were to accept dollar bills (only including nickels and dimes)...
    - This would simply require states that would allow for 1 dollar, and allow for having  $(1.00 - 0.15) = 85$  cents of change.