UCSD CSE140L Spring 2014

# LAB#3 Report

Demonstration Date : 5 / 20 /14 Student CID___________268_____________

Student Name: _______Kieth__________________________________Vo_________________
first M.I. Last

**TED Submission Date & Time :**

(FILLED BY Student BEFORE DEMO)

**Self-test Report**

(*** FILLED BY TUTOR/INSTRUCTOR ***)

Demo Reviewer
Name : ___________________________

| | Working | Not working | **Demo** score | **Report** score |
|---|---|---|---|---|
| **Part1**: | _________ | ________ | ________/**3** | a)________/**1** |
| **Part2**: | _________ | _________ | ________/**3** | b) ________/**1** |
| **Part3**: | _________ | _________ | _________/**3** | c) ________/**2** |
| **Part4**: | _________ | _________ | _________/**3** | d)________/**1** |
| **Part5**: | _________ | ________ | ________ /**3** | |
| | | | **Subtotal** | **Subtotal** |
| | | | _______/**15** | ____________/**5** |

**TOTAL Score:** _______________/**20**

**A)**

**1.**

For part 1 I created variables to hold deposit and change. Then I just incremented those and displayed them on the hex displays using the mod and divide operations and my task function. Switches 0-4 adds their respective values and modifies the deposit and change variables accordingly. Switch 8 resets the deposit and change values. All of this is in an always block that activates whenever I press the key[1] button.

**2.**

For part 2 I used if statements in an always block. If I get an error the state goes back to 1. Else normal operation continues. If Switch 9 is up then I display the number dispensed and when it is down it returns to displaying deposit and change again.

**3.**

For part 3 I used the clock variable in an always block so whenever the deposit was greater than or equal to 35 I made the green LEDs blink. When there is an error case and the state goes back to 0000 then I turn it off. They run at half second cycles with 50% duty.

**4.**

For part 4 I used if statements to check the conditions of multiple switches being in the up position when I push key[1]. For the consecutive dollars and credit cards I used a count variable in each section where I take care of incrementing the deposit and change for them respectively. The count variable will set an error when it gets to 2 because that would be consecutive inputs and count returns to 0 otherwise. Using the same method I set an if statement where if the deposit is 35 and the change is 0 and credit card input is used then it will display an error.

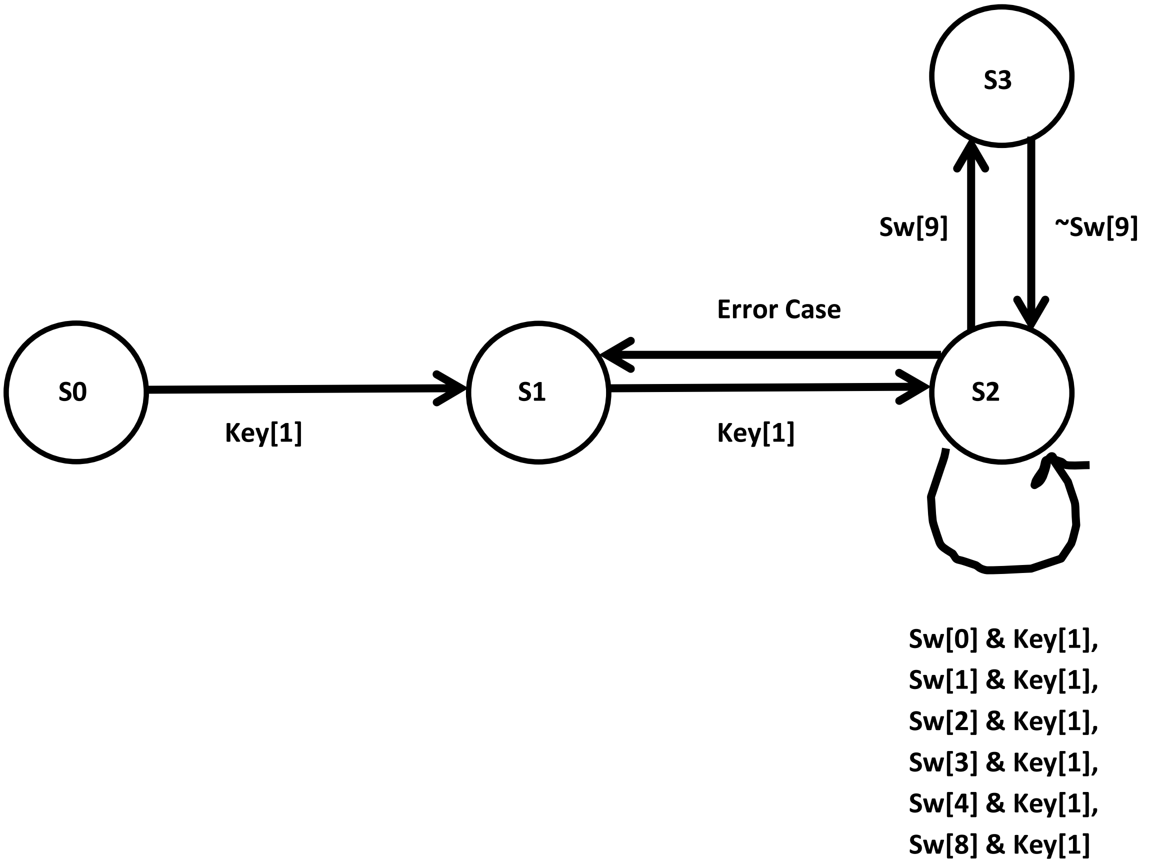
## B)

```
module L3C268( // where yyy=your CID. For example, L3C079 if your CID=079
 input [9:0] sw, // ten up-down switches, SW9 - SW0
 input [3:0] key, // four pushbutton switches, KEY3 - KEY0
 input clock, // 24MHz clock source on Altera DE1 board
 output [9:0] ledr, // ten Red LEDs, LEDR9 - LEDR0
 output [7:0] ledg, // eight Green LEDs, LEDG8 - LEDG0
 output reg [6:0] hex0, hex1, hex2, hex3 // four 7-segment, HEX3 - HEX0
);
// State controller
reg[6:0] deposit = 0;
reg[6:0] change = 0;
reg[1:0] state = 0;
reg[1:0] errorCase = 0;
always @ (*)
begin
    if (state == 0)
        begin hx3(0); hx2(2); hx1(6); hx0(8); end // CID/Initial State
    if (state == 1)
        begin hx3(0); hx2(0); hx1(0); hx0(0); end // Zero State
    else if (~sw[9] && state == 2)
        begin
            if (errorCase) // Error State
                begin hx3(14); hx2(19); hx1(19); hx0(18); end
            else // Normal Operation
                begin hx3(deposit/10); hx2(deposit%10); hx1(change/10); hx0(change%10); end
        end
    else if (sw[9]) // Report State
        begin hx3(18); hx2(18); hx1(18); hx0(totalDispensed); end
end

// Key Operations
reg[1:0] consecutiveCredit = 0;
reg[1:0] consecutiveDollar = 0;
reg[1:0] creditInput = 0;
reg[1:0] reset = 0;
reg[6:0] totalDispensed = 0;
assign switch = sw[0] | sw[1] | sw[2] | sw[3] | sw[4] | sw[8];
always @ (negedge key[1])
begin
    if (state == 1 && errorCase)
        begin state = 2; errorCase = 0; deposit = 0; change = 0; consecutiveDollar = 0; consecutiveCredit = 0; end
    if (state < 2)
        begin state = state + 1; end
    else if (errorCase)
        begin state = 1; end
    if (state == 2 & switch)
        begin
            if (((sw[0] & (sw[1] | sw[2] | sw[3] | sw[4] | sw[8])) |
                 (sw[1] & (sw[0] | sw[2] | sw[3] | sw[4] | sw[8])) |
                 (sw[2] & (sw[0] | sw[1] | sw[3] | sw[4] | sw[8])) |
                 (sw[3] & (sw[0] | sw[1] | sw[2] | sw[4] | sw[8])) |
                 (sw[4] & (sw[0] | sw[1] | sw[2] | sw[3] | sw[8])) |
                 (sw[8] & (sw[0] | sw[1] | sw[2] | sw[3] | sw[4]))))       // More than one input error
                begin errorCase = 1; end
            else
                begin
                    if (reset == 1)
                        begin
                            if (sw[4] & deposit == 35 & change == 0)    // Credit card error when HEX[3:0] == 3500
                                begin errorCase = 1; end
                            else
                                begin
                                    change = 0;
                                    deposit = 0;
                                    reset = 0;
                                end
                        end
                    if (sw[0])  // NICKEL
                        begin
                            deposit = deposit + 5;
                            consecutiveDollar = 0;
                            consecutiveCredit = 0;
                        end
                    else if (sw[1])     // DIME
                        begin
                            deposit = deposit + 10;
                            consecutiveDollar = 0;
                            consecutiveCredit = 0;
                        end
                    else if (sw[2])     // Quarter
                        begin
                            deposit = deposit + 25;
                            consecutiveDollar = 0;
                            consecutiveCredit = 0;
                        end
                    else if (sw[3]) // Dollar
                        begin
                            deposit  = deposit + 100;
                            consecutiveDollar = consecutiveDollar + 1;
                            if (consecutiveDollar == 2)     // Consecutive dollars error
                                begin errorCase = 1; end
                            consecutiveCredit = 0;
                        end
                    else if (sw[4]) // Credit Card
                        begin
                            deposit = deposit + 35;
                            consecutiveCredit = consecutiveCredit + 1;
                            if (consecutiveCredit == 2)     // Consecutive credit card error
                                begin errorCase = 1; end
                            consecutiveDollar = 0;
                        end
                    else if (sw[8])     // Reset. Does not clear # dispensed.
                        begin
                            deposit = 0;
                            change = 0;
                            consecutiveDollar = 0;
                            consecutiveCredit = 0;
                        end
                    if (deposit >= 35)
                        begin
                            if (reset == 0)
                                begin
                                    if (errorCase != 1)
                                    begin
                                    change = change + (deposit - 35);
                                    deposit = 35;
                                    end
                                    if (totalDispensed == 15)
                                        begin totalDispensed = 0; end
                                    else if (errorCase != 1)
                                        begin  totalDispensed  =  totalDispensed  +
1; end

                                    reset = 1;
                                end
                        end
                end
        end
end
```

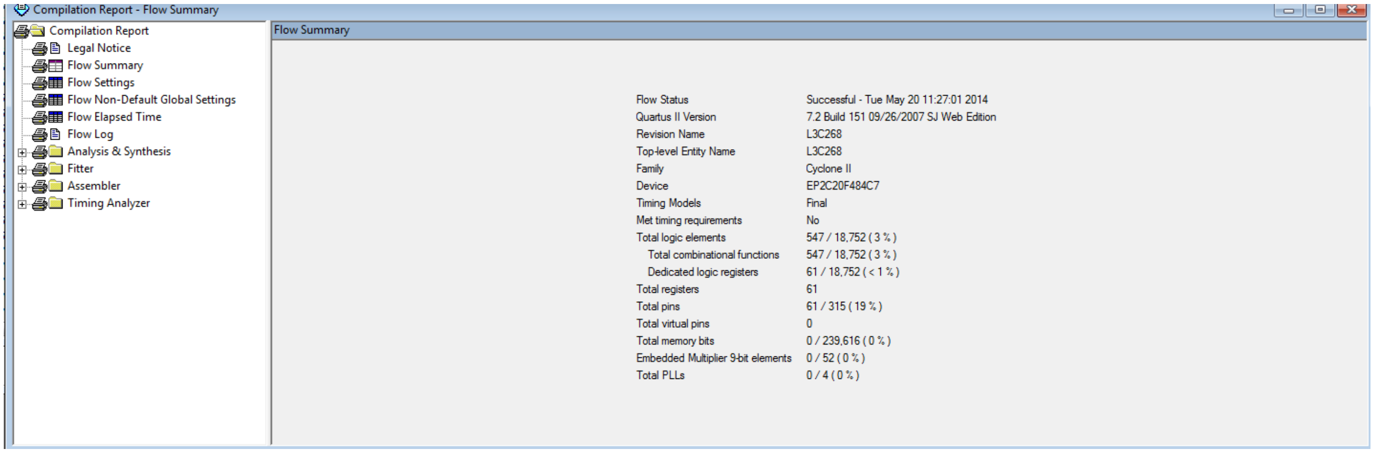
```
// Light Controller
reg[23:0] clockIndex;
reg [7:0] ledGreen;
reg [6:0] count;
assign ledg[7:0] = ledGreen;
always @(posedge clock)
begin
    if (deposit >= 35) // Flash at 50% duty for .5 second cycles
        begin
            clockIndex = clockIndex + 1;
            if (clockIndex == 6000000)
                begin
                    clockIndex = 0;
                    count = count + 1;
                    if (count == 1)
                        ledGreen = 8'b11111111;
                    if (count == 2)
                        begin ledGreen = 8'b00000000; count = 0; end
                    if (state == 1)
                        begin ledGreen = 8'b00000000; count = 0; end
                end
        end
    else
        begin
            ledGreen = 8'b00000000;
            count = 0;
            clockIndex = 0;
        end
end

// Controls HEX0 Display
task hx0;
input  [6:0] num;
begin
    case(num)
        0:  hex0 =  7'b1000000;  //0
        1:  hex0 =  7'b1111001;  //1
        2:  hex0 =  7'b0100100;  //2
        3:  hex0 =  7'b0110000;  //3
        4:  hex0 =  7'b0011001;  //4
        5:  hex0 =  7'b0010010;  //5
        6:  hex0 =  7'b0000010;  //6
        7:  hex0 =  7'b1111000;  //7
        8:  hex0 =  7'b0000000;  //8
        9:  hex0 =  7'b0011000;  //9
        10: hex0 =  7'b0001000;  //A
        11: hex0 =  7'b0000011;  //b
        12: hex0 =  7'b1000110;  //C
        13: hex0 =  7'b0100001;  //d
        14: hex0 =  7'b0000110;  //E
        15: hex0 =  7'b0001110;  //F
        16: hex0 =  7'b0001001;  //H
        17: hex0 =  7'b1000111;  //L
        18: hex0 =  7'b1111111;  //OFF
        19: hex0 =  7'b0101111;  //r
    endcase
end
endtask

task hx1;
input  [6:0] num;
begin
    case(num)
```

```
                0:  hex1 =  7'b1000000;  //0
                1:  hex1 =  7'b1111001;  //1
                2:  hex1 =  7'b0100100;  //2
                3:  hex1 =  7'b0110000;  //3
                4:  hex1 =  7'b0011001;  //4
                5:  hex1 =  7'b0010010;  //5
                6:  hex1 =  7'b0000010;  //6
                7:  hex1 =  7'b1111000;  //7
                8:  hex1 =  7'b0000000;  //8
                9:  hex1 =  7'b0011000;  //9
                10: hex1 =  7'b0001000;  //A
                11: hex1 =  7'b0000011;  //b
                12: hex1 =  7'b1000110;  //C
                13: hex1 =  7'b0100001;  //d
                14: hex1 =  7'b0000110;  //E
                15: hex1 =  7'b0001110;  //F
                16: hex1 =  7'b0001001;  //H
                17: hex1 =  7'b1000111;  //L
                18: hex1 =  7'b1111111;  //OFF
                19: hex1 =  7'b0101111;  //r
        endcase
end
endtask

task hx2;
input  [6:0] num;
begin
        case(num)
                0:  hex2 =  7'b1000000;  //0
                1:  hex2 =  7'b1111001;  //1
                2:  hex2 =  7'b0100100;  //2
                3:  hex2 =  7'b0110000;  //3
                4:  hex2 =  7'b0011001;  //4
                5:  hex2 =  7'b0010010;  //5
                6:  hex2 =  7'b0000010;  //6
                7:  hex2 =  7'b1111000;  //7
                8:  hex2 =  7'b0000000;  //8
                9:  hex2 =  7'b0011000;  //9
                10: hex2 =  7'b0001000;  //A
                11: hex2 =  7'b0000011;  //b
                12: hex2 =  7'b1000110;  //C
                13: hex2 =  7'b0100001;  //d
                14: hex2 =  7'b0000110;  //E
                15: hex2 =  7'b0001110;  //F
                16: hex2 =  7'b0001001;  //H
                17: hex2 =  7'b1000111;  //L
                18: hex2 =  7'b1111111;  //OFF
                19: hex2 =  7'b0101111;  //r
        endcase
end
endtask

task hx3;
input  [6:0] num;
begin
        case(num)
                0:  hex3 =  7'b1000000;  //0
                1:  hex3 =  7'b1111001;  //1
                2:  hex3 =  7'b0100100;  //2
                3:  hex3 =  7'b0110000;  //3
                4:  hex3 =  7'b0011001;  //4
                5:  hex3 =  7'b0010010;  //5
                6:  hex3 =  7'b0000010;  //6
                7:  hex3 =  7'b1111000;  //7
                8:  hex3 =  7'b0000000;  //8
                9:  hex3 =  7'b0011000;  //9
                10: hex3 =  7'b0001000;  //A
                11: hex3 =  7'b0000011;  //b
                12: hex3 =  7'b1000110;  //C
                13: hex3 =  7'b0100001;  //d
                14: hex3 =  7'b0000110;  //E
                15: hex3 =  7'b0001110;  //F
                16: hex3 =  7'b0001001;  //H
                17: hex3 =  7'b1000111;  //L
                18: hex3 =  7'b1111111;  //OFF
                19: hex3 =  7'b0101111;  //r
        endcase
end
endtask

endmodule
```

**C)**



**D)**



```
Flow Status                          Successful - Tue May 20 11:27:01 2014
Quartus II Version                   7.2 Build 151 09/26/2007 SJ Web Edition
Revision Name                        L3C268
Top-level Entity Name                L3C268
Family                               Cyclone II
Device                               EP2C20F484C7
Timing Models                        Final
Met timing requirements              No
Total logic elements                 547 / 18,752 ( 3 % )
   Total combinational functions     547 / 18,752 ( 3 % )
   Dedicated logic registers         61 / 18,752 ( < 1 % )
Total registers                      61
Total pins                           61 / 315 ( 19 % )
Total virtual pins                   0
Total memory bits                    0 / 239,616 ( 0 % )
Embedded Multiplier 9-bit elements   0 / 52 ( 0 % )
Total PLLs                           0 / 4 ( 0 % )
```