Name: KEY Id#

COE 405, Term 152

 Design & Modeling of Digital Systems

Quiz# 4

Date: Sunday, April 14, 2016

#  It is required to design a circuit that receives two **4-bit** signed numbers in 2's complement representation **A=A3A2A1A0, B=B3B2B1B0** and produces a **6-bit output** **C= C5C4C3C2C1C0**. The circuit implements the following functions based on the values of the three selection inputs: S1, S1 and S0.

|  |  |
| --- | --- |
| S2 S1 S0 | Function  |
| 0 0 0  | C = A + B |
| 0 0 1 | C = A - B |
| 0 1 0 | C = A + 1 |
| 0 1 1 | C = A - 1 |
| 1 0 0  | C = 2\*A+B  |
| 1 0 1 | C = 2\*A-B |
| 1 1 0 | C = 2\*A+1 |
| 1 1 1 | C = 2\*A-1 |

# Show the block diagram design of your circuit using MSI components like Adder, Multiplexor, as needed. Use only one adder in your solution.



# Model your design in Verilog by modeling each component separately i.e. adder, MUX, etc. and then instantiate these components to model your circuit.

module Mux2x1 (output [5:0] y, input [5:0] a, b, input s);

assign y = (s ? b : a);

endmodule

module Mux4x1(output reg [5:0] z, input [5:0] a, b, c, d, input s1, s0);

always@(s1, s0, a, b, c, d) begin

case ({s1, s0})

2'b00: z=a;

2'b01: z=b;

2'b10: z=c;

2'b11: z=d;

endcase

end

endmodule

module Adder (output [5:0] sum, input [5:0] a, b, input cin);

assign sum = a + b + cin;

endmodule

module Quiz4 (output [5:0] C, input [3:0] A, B, input [2:0] S);

wire [5:0] Y, Z;

assign cin = S[0]^S[1];

Mux2x1 M1 (Y, {A[3],A[3],A}, {A[3],A,1'b0}, S[2]);

Mux4x1 M2 (Z , {B[3],B[3],B}, ~{B[3],B[3],B}, 6'b000000 , 6'b111111, S[1],S[0]);

Adder M3 (C, Y, Z, cin);

endmodule

# Write a Behavioral Verilog model to model the given circuit.

module Quiz4Behav (input [3:0] A, B, input s2, s1, s0, output reg[5:0]C);

wire [4:0] A5;

wire [5:0] A6, B6;

assign A5={ A[3], A};

assign A6={ A[3], A[3], A};

assign B6={ B[3], B[3], B};

always @\* begin

case ({s2,s1,s0})

3'b000: C = A6 + B6;

3'b001: C = A6 – B6;

3'b010: C = A6 + 1;

3'b011: C = A6 - 1;

3'b100: C = 2\*A5 + B6;

3'b101: C = 2\*A5 – B6;

3'b110: C = 2\*A5 + 1;

3'b111: C = 2\*A5 – 1;

endcase

end

endmodule