



Lab 2: BCD Adder in Verilog

T 2pm-5pm

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Introduction

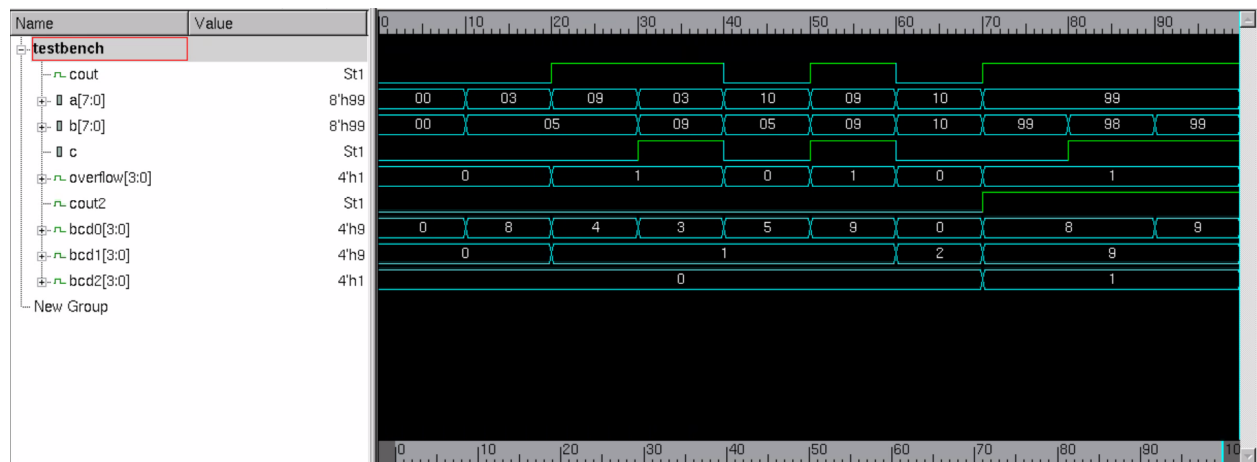
In this lab we were tasked with creating a 4 bit adder for Binary Coded Decimal values. With these modules we would then connect them to create an 8 bit adder for BCD values.

Procedure

For our 8 bit adder, we connected the sum out of our first adder to one of the inputs of our second adder and a constant of 6 to our second input. This would keep the binary values from exceeding 9 and shift the remainder to the next digits. Because of that we needed our carry in to be zero. We then used two 2 to 1 multiplexers to output our two BCD sums.

Results

[*Screenshot of gui waveforms after running tb*]



```

module BCDAdder (A, B, Cin, Cout, BCD1, BCD0);
    input [3:0]A;
    input [3:0]B;
    input Cin;
    output [3:0]BCD1;
    output [3:0]BCD0;
    output reg Cout;
    wire Cout1, Cout2;
    wire [3:0] Sum;
    reg [3:0] constant;
    wire [3:0] Sum2;
    reg [3:0] zero, one;

    adder4 adder1(A, B, Cin, Cout1, Sum);
    adder4 adder2(Sum, constant, 0, Cout2, Sum2);
    m21 m1(BCD0, Sum, Sum2, Cout);
    m21 m2(BCD1, zero, one, Cout);

    always@(*)begin
        constant = 4'b0110;
        zero = 4'b0000;
        one = 4'b0001;
        Cout = Cout1|Cout2;
    end
endmodule

module testbench();

    reg [7:0] a,b;
    reg c;
    wire [3:0] bcd0, bcd1, bcd2;
    wire cout, cout2;
    wire [3:0] overflow;

    BCDAdder dut(a[3:0], b[3:0], c, cout, overflow, bcd0);
    BCDAdder dut2(a[7:4], b[7:4], overflow[0], cout2, bcd2, bcd1);

```

Conclusion

We knew to reevaluate our handling of our binary outputs when we moved to the 8 bit adder and found that our BCD values were exceeding 9. We found the solution to this to be setting the constant to 6, because there are 6 values over 9 that cannot be represented in one bit of decimal, but can in 4 bits of binary.

What problems did you encounter while testing your steps yourself?

We couldn't figure out how to connect the two adders which was causing digits to represent the wrong BCD values.

Did any problems arise when demonstrating for the TA? What were they? Explain your thoughts on how/why these test cases escaped your own testing.

We had a problem with carry values that led to a digit overflowing and giving hexadecimal a.