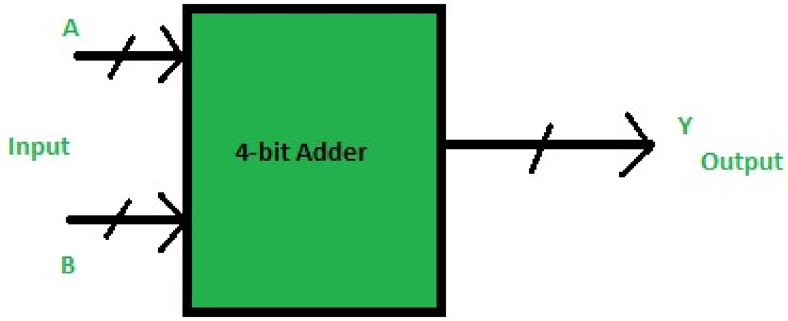
DAY #23

30 DAYS OF VERILOG

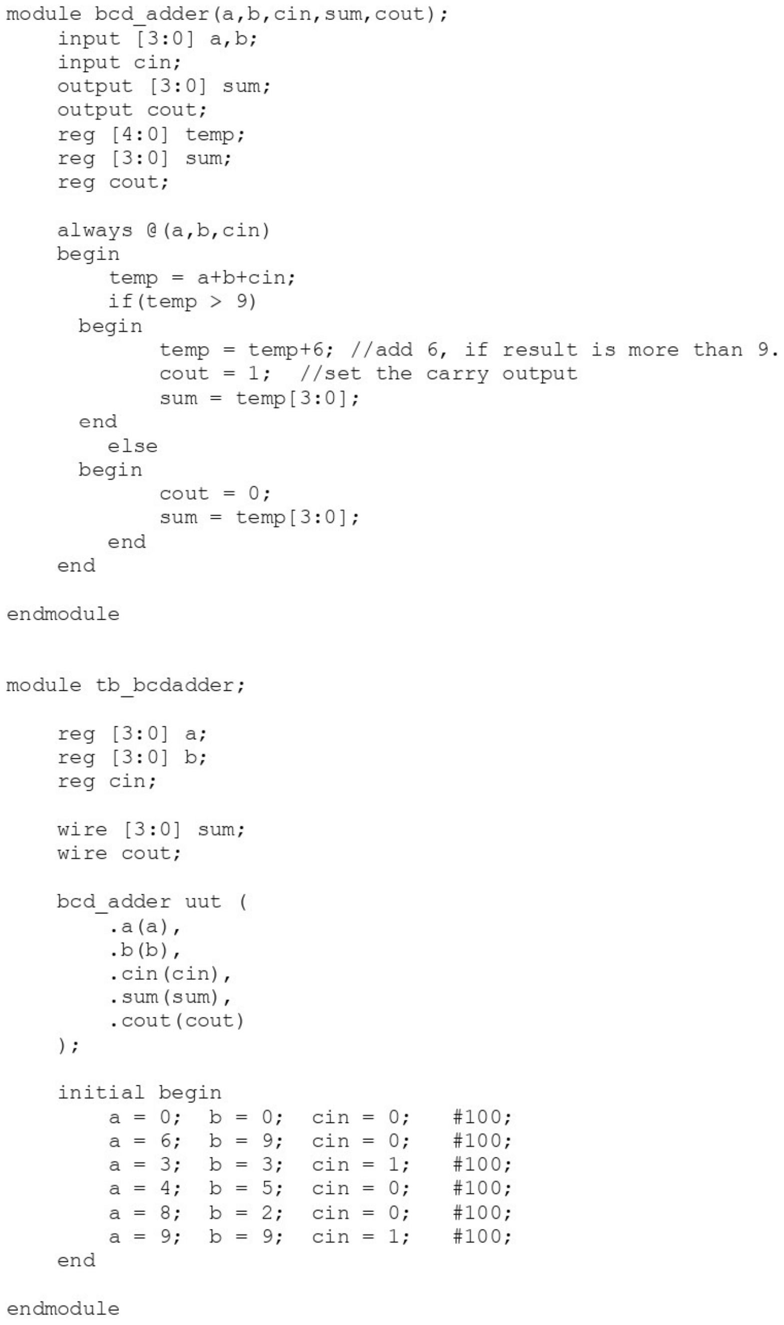
AIM – TO IMPLEMENT BCD ADDER

BCD stands for binary coded decimal. It is used to perform the addition of BCD numbers. A BCD digit can have any of ten possible four-bit representations. Suppose, we have two 4-bit numbers A and B. The value of A and B can vary from 0(0000 in binary) to 9(1001 in binary) because we are considering decimal numbers.

The output will vary from 0 to 18 if we are not considering the carry from the previous sum. But if we are considering the carry, then the maximum value of output will be 19 (i.e. 9+9+1 = 19). When we are simply adding A and B, then we get the binary sum. Here, to get the output in BCD form, we will use BCD Adder.

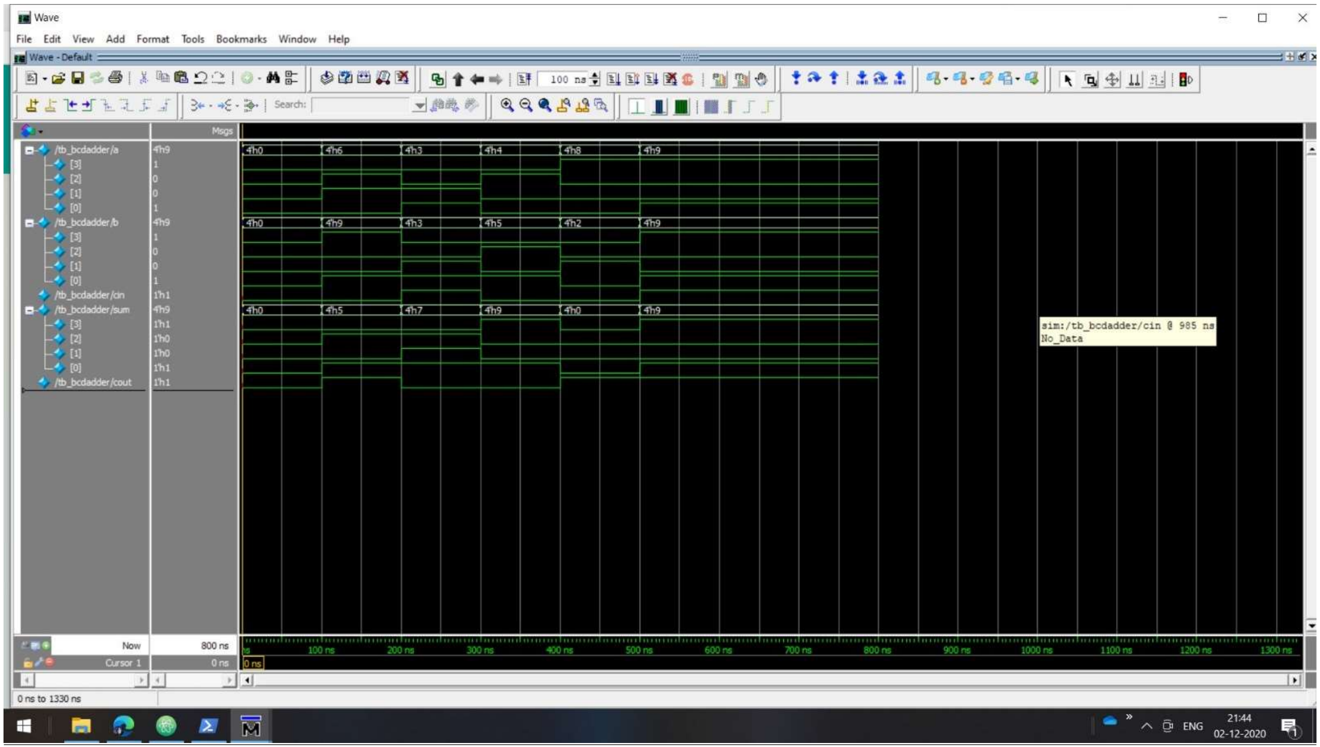


CODE –



```
module bcd_adder(a,b,cin,sum,cout);
    input [3:0] a,b;
    input cin;
    output [3:0] sum;
    output cout;
    reg [4:0] temp;
    reg [3:0] sum;
    reg cout;

    always @(a,b,cin)
    begin
        temp = a+b+cin;
        if(temp > 9)
      begin
            temp = temp+6; //add 6, if result is more than 9.
            cout = 1;  //set the carry output
            sum = temp[3:0];
      end
        else
      begin
            cout = 0;
            sum = temp[3:0];
        end
    end

endmodule


module tb_bcdadder;

    reg [3:0] a;
    reg [3:0] b;
    reg cin;

    wire [3:0] sum;
    wire cout;

    bcd_adder uut (
        .a(a),
        .b(b),
        .cin(cin),
        .sum(sum),
        .cout(cout)
    );

    initial begin
        a = 0;  b = 0;  cin = 0;   #100;
        a = 6;  b = 9;  cin = 0;   #100;
        a = 3;  b = 3;  cin = 1;   #100;
        a = 4;  b = 5;  cin = 0;   #100;
        a = 8;  b = 2;  cin = 0;   #100;
        a = 9;  b = 9;  cin = 1;   #100;
    end

endmodule
```

WAVEFORM-



	Msgs
/tb_bcdadder/a	4'h9
[3]	1
[2]	0
[1]	0
[0]	1
/tb_bcdadder/b	4'h9
[3]	1
[2]	0
[1]	0
[0]	1
/tb_bcdadder/cin	1'h1
/tb_bcdadder/sum	4'h9
[3]	1'h1
[2]	1'h0
[1]	1'h0
[0]	1'h1
/tb_bcdadder/cout	1'h1

Now	800 ns
Cursor 1	0 ns

```
sim:/tb_bcdadder/cin @ 985 ns
No_Data
```

0 ns to 1330 ns

Wave
File Edit View Add Format Tools Bookmarks Window Help
Wave - Default
100 ns
Search:
4'h0 4'h6 4'h3 4'h4 4'h8 4'h9
4'h0 4'h9 4'h3 4'h5 4'h2 4'h9
4'h0 4'h5 4'h7 4'h9 4'h0 4'h9
100 ns 200 ns 300 ns 400 ns 500 ns 600 ns 700 ns 800 ns 900 ns 1000 ns 1100 ns 1200 ns 1300 ns
0 ns
ENG
21:44
02-12-2020