



DAY-19

#100DAYSOFRTL

Aim:- Implementation of 16-BIT ADDER AND SUBTRACTOR with Control input.

RTL CODE:-

```
//////DATE:-19/01/2024
//////Implementation of 16-BIT ADDER/SUBTRACTOR CIRCUIT
module Add_Sub(input [15:0] A,B,
input Ctrl, output reg [15:0] Result,
output reg overflow );
reg [15:0] Neg_b;
○ always @(*) begin
○ if(Ctrl) begin ///ADDITION
○ Result=A+B;
○ overflow=( (~A[15]) & (~B[15]) & (Result[15])) | (A[15]&B[15]&(~Result[15]));
end
else begin///SUBTRACTION
○ Neg_b=(~B)+1;
○ Result=A+Neg_b;
○ overflow=( (~A[15]) & (~Neg_b[15]) & (Result[15])) | (A[15]&Neg_b[15] & (~Result[15]));
end
end
endmodule
```

OUTPUT:-

```
A=63461,B=29303,Ctrl=0,Result=34158,Overflow=0
A=56207,B=27122,Ctrl=0,Result=29085,Overflow=1
A=31464,B=20165,Ctrl=0,Result=11299,Overflow=0
A=10429,B=22573,Ctrl=1,Result=33002,Overflow=1
A=25187,B=34570,Ctrl=0,Result=56153,Overflow=1
A= 8480,B=17834,Ctrl=1,Result=26314,Overflow=0
A=16022,B=47123,Ctrl=1,Result=63145,Overflow=0
A=54867,B=56683,Ctrl=1,Result=46014,Overflow=0
A=18946,B=16046,Ctrl=1,Result=34992,Overflow=1
A=29391,B=18723,Ctrl=0,Result=10668,Overflow=0
A= 2762,B=19516,Ctrl=0,Result=48782,Overflow=0
A=24970,B=45889,Ctrl=0,Result=44617,Overflow=1
A=62328,B= 4745,Ctrl=1,Result= 1537,Overflow=0
A=26038,B=63942,Ctrl=0,Result=27632,Overflow=0
A= 700,B=56618,Ctrl=1,Result=57318,Overflow=0
A=48753,B=16773,Ctrl=1,Result=65526,Overflow=0
A=24635,B=13114,Ctrl=0,Result=11521,Overflow=0
A=19221,B=39921,Ctrl=1,Result=59142,Overflow=0
A= 1890,B=64332,Ctrl=1,Result= 686,Overflow=0
A=41359,B=43512,Ctrl=1,Result=19335,Overflow=1
A=22175,B=37980,Ctrl=1,Result=60155,Overflow=0
A=14217,B=12873,Ctrl=0,Result= 1344,Overflow=0
```

TESTBENCH:-

```

module Add_Sub_tb();
reg [15:0] A,B;
reg Ctrl;
wire [15:0] Result;
wire Overflow;
Add_Sub UUT(A,B,Ctrl,Result,Overflow);
initial begin
  for(integer i=0; i<40; i=i+1) begin
    A=$random();
    B=$random();
    Ctrl=$random();
    #10;
    $display("A=%d,B=%d,Ctrl=%d,Result=%d,Overflow=%d",A,B,Ctrl,Result,Overflow);
    #10;
  end
end
endmodule

```

WAVEFORMS:-

Name	Value																												
		0.000 ns				50.000 ns				100.000 ns				150.000 ns				200.000 ns				250.000 ns				300.000 ns			
> A[15]	52493	13604	22115	33893	52493	22509	9414	63461	56207	31464	10429	25187	8480	16022	54867	18946	29391	2762											
> B[15]	61814	24193	31501	21010	61814	63372	33989	29303	27122	20165	22573	34570	17834	47123	56683	16046	18723	19516											
Ctrl	1																												
> Result	48771	37797	53616	54903	48771	20345	40961	34158	29085	11299	33002	56153	26314	63145	46014	34992	10668	48782											
Overflow	0																												

SCHEMATIC:-

