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
```

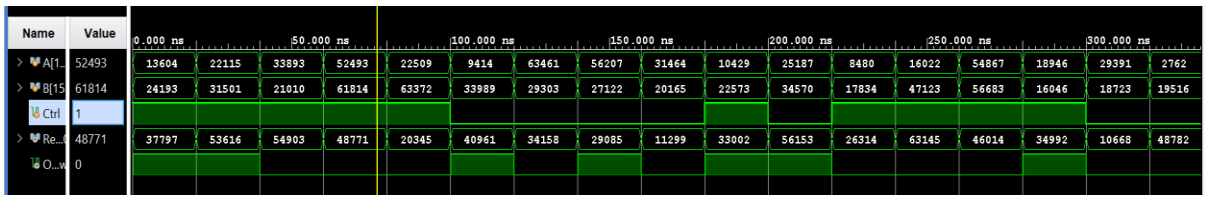
OUTPUT:-

```
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:-



SCHEMATIC:-