

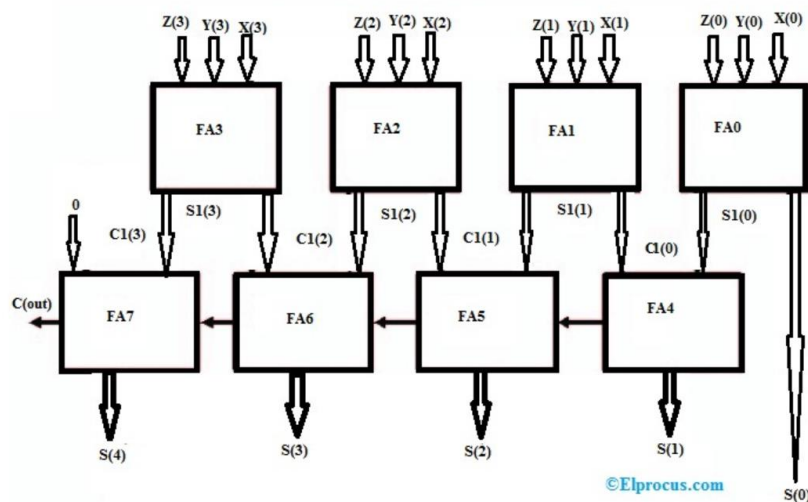


DAY-13

#100DAYSOFRTL

Aim:- Implementation of 4-Bit Carry Save Adder(CSA).

Block Diagram:-



RTL CODE:-

```
//////DATE:-13/01/2024
//////CARRY SAVE ADDER using FULL ADDERS
module FULLadder(input A,B,Cin,
output Sum,Carry);
○ assign Sum=A^B^Cin;
○ assign Carry=A&B|B&Cin|Cin&A;
endmodule

//////Carry Save Adder
module CSA(input [3:0] A,B,C,
output [5:0] Sum,
output Cout);
wire [3:0] S;
wire [3:0] C1;
wire [3:0] C2;
FULLadder M1(.A(A[0]),.B(B[0]),.Cin(C[0]),.Sum(S[0]),.Carry(C1[0]));
FULLadder M2(.A(A[1]),.B(B[1]),.Cin(C[1]),.Sum(S[1]),.Carry(C1[1]));
FULLadder M3(.A(A[2]),.B(B[2]),.Cin(C[2]),.Sum(S[2]),.Carry(C1[2]));
FULLadder M4(.A(A[3]),.B(B[3]),.Cin(C[3]),.Sum(S[3]),.Carry(C1[3]));
FULLadder M5(.A(C1[0]),.B(S[1]),.Cin(0),.Sum(Sum[1]),.Carry(C2[0]));
FULLadder M6(.A(C1[1]),.B(S[2]),.Cin(C2[0]),.Sum(Sum[2]),.Carry(C2[1]));
FULLadder M7(.A(C1[2]),.B(S[3]),.Cin(C2[1]),.Sum(Sum[3]),.Carry(C2[2]));
FULLadder M8(.A(C1[3]),.B(0),.Cin(C2[2]),.Sum(Sum[4]),.Carry(Cout));
○ assign Sum[0]=S[0];
○ assign Sum[5]=Cout;
endmodule
```

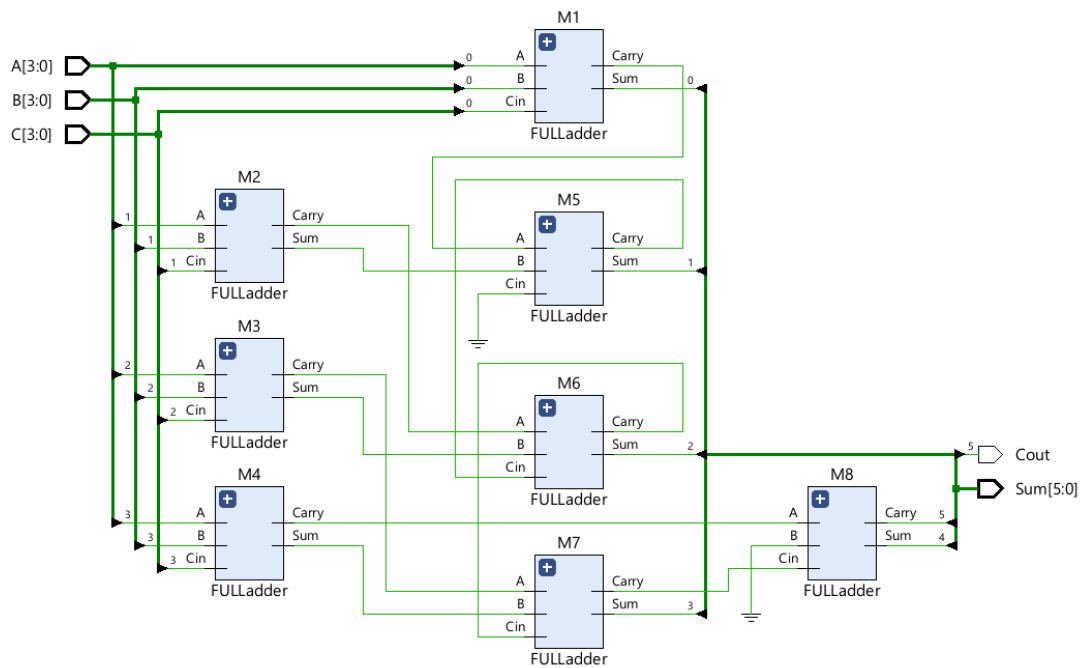
TESTBENCH:-

```
module CSA_tb();
reg [3:0] A,B,C;
wire [5:0] Sum;
wire Cout;
CSA dut (.A(A), .B(B), .C(C), .Sum(Sum), .Cout(Cout));
initial begin
  A=4'b0011; B=4'b0100;
  C=4'b1000;
  #10;
  $display("A=%d,B=%d,C=%d,Cout=%b,Sum=%d",A,B,C,Cout,Sum);
  A=4'b0001; B=4'b0010;
  C=4'b0010;
  #10;
  $display("A=%d,B=%d,C=%d,Cout=%b,Sum=%d",A,B,C,Cout,Sum);
  A=4'b0011; B=4'b1000;
  C=4'b0100;
  #10;
  $display("A=%d,B=%d,C=%d,Cout=%b,Sum=%d",A,B,C,Cout,Sum);
  A=4'b1010; B=4'b0101;
  C=4'b0110;
  #10;
  $display("A=%d,B=%d,C=%d,Cout=%b,Sum=%d",A,B,C,Cout,Sum);
  A=4'b0111; B=4'b0100;
  C=4'b1100;
  #10;
  $display("A=%d,B=%d,C=%d,Cout=%b,Sum=%d",A,B,C,Cout,Sum);
  A=4'b0110; B=4'b0110;
  C=4'b1000;
  #10;
  $display("A=%d,B=%d,C=%d,Cout=%b,Sum=%d",A,B,C,Cout,Sum);
  A=4'b1111; B=4'b1111;
  C=4'b1111;
  #10;
  $display("A=%d,B=%d,C=%d,Cout=%b,Sum=%d",A,B,C,Cout,Sum);
  $finish();
end
endmodule
```

OUTPUT:-

```
A= 3,B= 4,C= 8,Cout=0,Sum=15
A= 1,B= 2,C= 2,Cout=0,Sum= 5
A= 3,B= 8,C= 4,Cout=0,Sum=15
A=10,B= 5,C= 6,Cout=0,Sum=21
A= 7,B= 4,C=12,Cout=0,Sum=23
A= 6,B= 6,C= 8,Cout=0,Sum=20
A=15,B=15,C=15,Cout=1,Sum=45
```

SCHEMATIC:-



WAVEFORMS:-

