DAY-10

#100DAYSOFRTL

Aim:- Implementation of 4-Bit Carry Select Adder using Full Adders and Multiplexers.

RTL CODE:-

```
////DATE:-10/01/2024
////CARRY SELECT ADDER
module FullAdder(input A,B,C,
output Sum,Carry);
assign Sum=A^B^C;
assign Carry=A&B|B&C|C&A;
endmodule

module mux(input  A,B,sel,
output reg y);
always @(A,B,sel)
begin
if(sel==0)
y=A;
else
y=B;
end
endmodule
module CarrySelectAdder(input [3:0] A,B,
input Cin,output Cout,
output [4:0] Sum);
wire [3:0] w0,w1,c0,c1;
///FOR CARRY=0;
FullAdder M1(.A(A[0]),.B(B[0]),.C(0),.Sum(w0[0]),.Carry(c0[0]));
FullAdder M2(.A(A[1]),.B(B[1]),.C(c0[0]),.Sum(w0[1]),.Carry(c0[1]));
FullAdder M3(.A(A[2]),.B(B[2]),.C(c0[1]),.Sum(w0[2]),.Carry(c0[2]));
FullAdder M4(.A(A[3]),.B(B[3]),.C(c0[2]),.Sum(w0[3]),.Carry(c0[3]));
///FOR CARRY=1;
FullAdder M5(.A(A[0]),.B(B[0]),.C(1),.Sum(w1[0]),.Carry(c1[0]));
FullAdder M6(.A(A[1]),.B(B[1]),.C(c1[0]),.Sum(w1[1]),.Carry(c1[1]));
FullAdder M7(.A(A[2]),.B(B[2]),.C(c1[1]),.Sum(w1[2]),.Carry(c1[2]));
FullAdder M8(.A(A[3]),.B(B[3]),.C(c1[2]),.Sum(w1[3]),.Carry(c1[3]));

 ///To select the carry
 mux m5(.A(c0[3]),.B(c1[3]),.sel(Cin),.y(Cout));
 mux m1(.A(w0[0]),.B(w1[0]),.sel(Cin),.y(Sum[0]));
 mux m2(.A(w0[1]),.B(w1[1]),.sel(Cin),.y(Sum[1]));
 mux m3(.A(w0[2]),.B(w1[2]),.sel(Cin),.y(Sum[2]));
 mux m4(.A(w0[3]),.B(w1[3]),.sel(Cin),.y(Sum[3]));

 assign Sum[4]=Cout;
endmodule
```

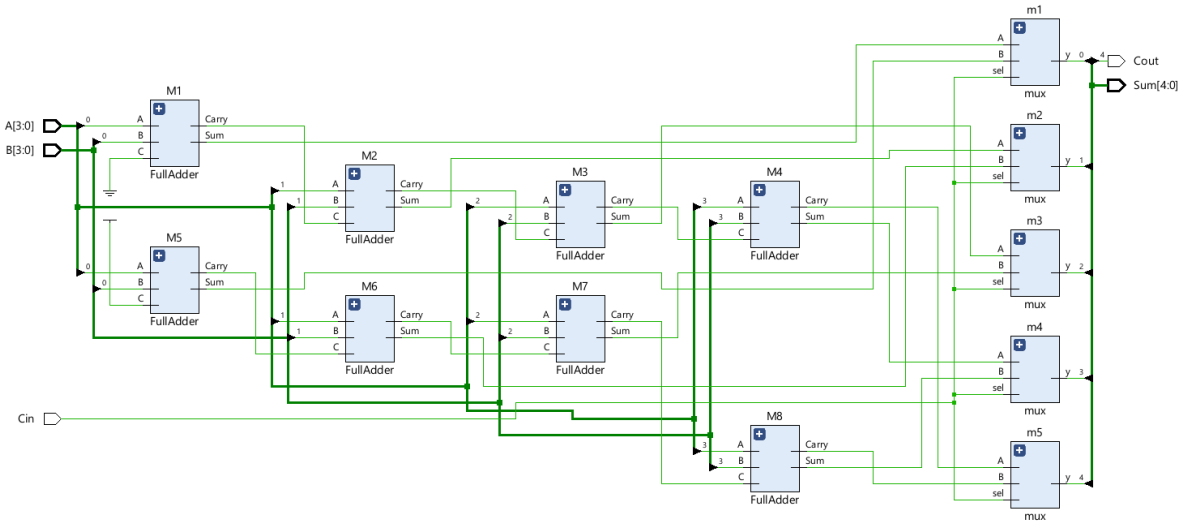
TESTBENCH:-

```
module CarrySelectAdder_tb();
reg [3:0] A,B;
reg Cin;
wire Cout;
wire [4:0] Sum;
CarrySelectAdder dut(.A(A),.B(B),.Cin(Cin),.Cout(Cout),.Sum(Sum));
initial begin
A=4'b0000; B=4'b0000;
Cin=1;
#10;
$display("A=%d,B=%d,Cin=%b,Cout=%b,Sum=%d",A,B,Cin,Cout,Sum);
A=4'b0001; B=4'b0100;
Cin=0;
#10;
$display("A=%d,B=%d,Cin=%b,Cout=%b,Sum=%d",A,B,Cin,Cout,Sum);
A=4'b0011; B=4'b0000;
Cin=1;
#10;
$display("A=%d,B=%d,Cin=%b,Cout=%b,Sum=%d",A,B,Cin,Cout,Sum);
A=4'b0110; B=4'b1110;
Cin=0;
#10;
$display("A=%d,B=%d,Cin=%b,Cout=%b,Sum=%d",A,B,Cin,Cout,Sum);
A=4'b1111; B=4'b1111;
Cin=1;
#10;
$display("A=%d,B=%d,Cin=%b,Cout=%b,Sum=%d",A,B,Cin,Cout,Sum);
A=4'b1000; B=4'b0110;
Cin=0;
#10;
$display("A=%d,B=%d,Cin=%b,Cout=%b,Sum=%d",A,B,Cin,Cout,Sum);
A=4'b0110; B=4'b1101;
Cin=1;
#10;
$display("A=%d,B=%d,Cin=%b,Cout=%b,Sum=%d",A,B,Cin,Cout,Sum);
#10;
$finish();
end
endmodule
```

OUTPUT:-

```
A= 0,B= 0,Cin=1,Cout=0,Sum= 1
A= 1,B= 4,Cin=0,Cout=0,Sum= 5
A= 3,B= 0,Cin=1,Cout=0,Sum= 4
A= 6,B=14,Cin=0,Cout=1,Sum=20
A=15,B=15,Cin=1,Cout=1,Sum=31
A= 8,B= 6,Cin=0,Cout=0,Sum=14
A= 6,B=13,Cin=1,Cout=1,Sum=20
```

SCHEMATIC:-



WAVEFORMS:-