DAY-9

#100DAYSOFRTL

Aim:- Implementation of 4-Bit Ripple Carry Adder using Full Adder.

Ripple carry adder is Obtained by instantiating 4 Full adders.

RTL CODE:-

```
1   ////DATE:-09/01/2024
2   ////4-BIT RIPPLE CARRY ADDER
3   module FA(input A,B,Cin,
4   output Sum,Carry);
5   assign Sum=A^B^Cin;
6   assign Carry=A&B|B&Cin|Cin&A;
7   endmodule
8
9   module Ripplecarry_Adder(input [3:0] A,
10  input [3:0] B,
11  input Cin, output [4:0] Sum);
12  wire w1,w2,w3;
13  FA M1(.A(A[0]),.B(B[0]),.Cin(Cin),.Carry(w1),.Sum(Sum[0]));
14  FA M2(.A(A[1]),.B(B[1]),.Cin(w1),.Carry(w2),.Sum(Sum[1]));
15  FA M3(.A(A[2]),.B(B[2]),.Cin(w2),.Carry(w3),.Sum(Sum[2]));
16  FA M4(.A(A[3]),.B(B[3]),.Cin(w3),.Carry(Sum[4]),.Sum(Sum[3]));
17  endmodule
```
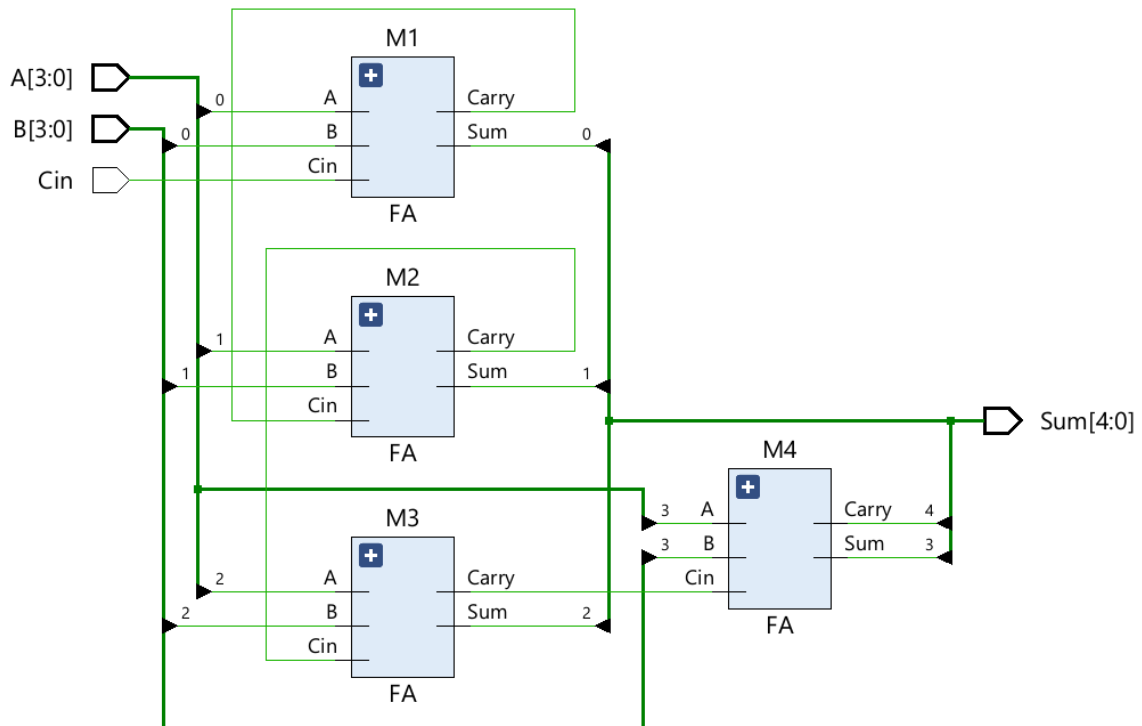
TESTBENCH:-

```verilog
1  module Ripplecarry_tb();
2  reg [3:0]A,B;
3  reg Cin;
4  wire [4:0] Sum;
5  Ripplecarry_Adder dut (.A(A), .B(B), .Cin(Cin), .Sum(Sum));
6  initial begin
7  A=4'b0000; B=4'b0000; Cin=0;
8  #10;
9  $display("A=%d,B=%d,Cin=%b,Sum=%d",A,B,Cin,Sum);
10 A=4'b0001; B=4'b1000; Cin=1;
11 #10;
12 $display("A=%d,B=%d,Cin=%b,Sum=%d",A,B,Cin,Sum);
13 A=4'b0010; B=4'b0010; Cin=1;
14 #10;
15 $display("A=%d,B=%d,Cin=%b,Sum=%d",A,B,Cin,Sum);
16 A=4'b0111; B=4'b0111; Cin=0;
17 #10;
18 $display("A=%d,B=%d,Cin=%b,Sum=%d",A,B,Cin,Sum);

19 A=4'b0111; B=4'b1000; Cin=1;
20 #10;
21 $display("A=%d,B=%d,Cin=%b,Sum=%d",A,B,Cin,Sum);
22 A=4'b0001; B=4'b1000; Cin=0;
23 #10;
24 $display("A=%d,B=%d,Cin=%b,Sum=%d",A,B,Cin,Sum);
25 A=4'b0011; B=4'b1100; Cin=1;
26 #10;
27 $display("A=%d,B=%d,Cin=%b,Sum=%d",A,B,Cin,Sum);
28 A=4'b1111; B=4'b1111; Cin=0;
29 #10;
30 $display("A=%d,B=%d,Cin=%b,Sum=%d",A,B,Cin,Sum);
31 A=4'b0111; B=4'b0011; Cin=1;
32 #10;
33 $display("A=%d,B=%d,Cin=%b,Sum=%d",A,B,Cin,Sum);
34 $finish();
35 end
36 endmodule
```

OUTPUT:-

```
A= 0,B= 0,Cin=0,Sum= 0
A= 1,B= 8,Cin=1,Sum=10
A= 2,B= 2,Cin=1,Sum= 5
A= 7,B= 7,Cin=0,Sum=14
A= 7,B= 8,Cin=1,Sum=16
A= 1,B= 8,Cin=0,Sum= 9
A= 3,B=12,Cin=1,Sum=16
A=15,B=15,Cin=0,Sum=30
A= 7,B= 3,Cin=1,Sum=11
```

SCHEMATIC:-

WAVEFORMS:-

Name	Value	0.000 ns	10.000 ns	20.000 ns	30.000 ns	40.000 ns	50.000 ns	60.000 ns	70.000 ns	80.000 ns
A[3:0]	1111	0000	0001	0010	0111		0001	0011	1111	0111
B[3:0]	1111	0000	1000	0010	0111	1000		1100	1111	0011
Cin	0									
Su...	11110	00000	01010	00101	01110	10000	01001	10000	11110	01011

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