Problem

make3 instances of Full adder to create a 3-bit binary ripple-carry adder.

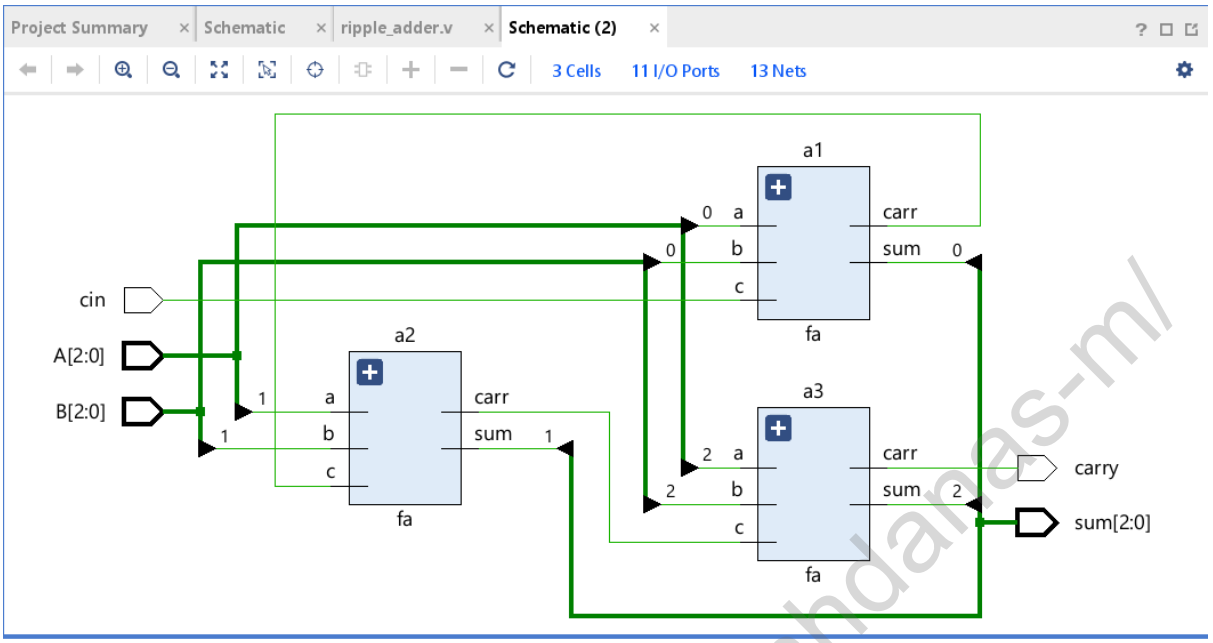
Design

```
module fa( input a,b,c,
output sum,carr
 );
// assign {carr,sum}=a+b+c;
wire w1,w2,w3;
xor a1(sum,a,b,c);
and a2(w1,a,b),
a4 (w2,a,c),
a3 (w3,b,c);
or a5(carr,w1,w2,w3);


endmodule

module ripple_adder( input [2:0] A,B,
                     input cin,
                    output[2:0] sum,
                    output carry );
    wire c0,c1;
    fa a1(A[0],B[0],cin,sum[0],c0),
       a2(A[1],B[1],c0,sum[1],c1),
       a3(A[2],B[2],c1,sum[2],carry);
endmodule
```

Circuit



Testbench

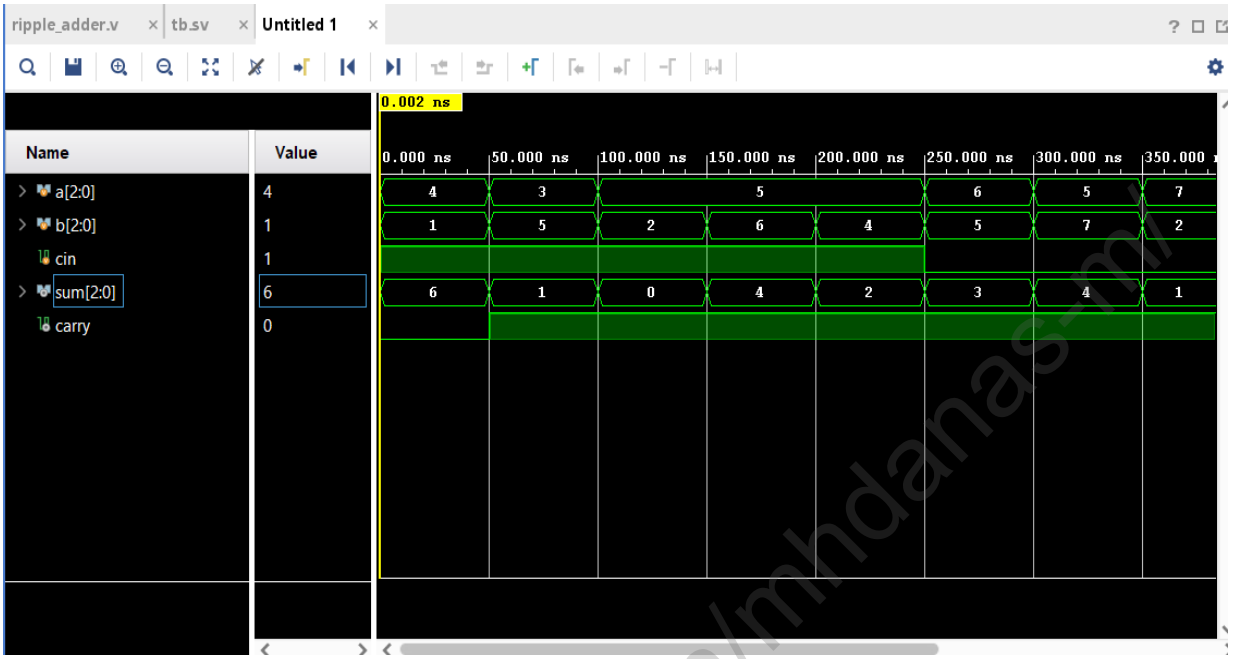
```
module tb();

reg [2:0] a,b;
reg cin;
wire [2:0] sum;
wire carry;

ripple_adder a3(a,b,cin,sum,carry);

initial begin
repeat(10) begin
a=$random;
b=$random;
cin={$random}%2;
#50;
end
$finish;
end
endmodule
```

Waveform



Consider carry as 8 : example a=3 , b=5 & cin=1 there for result =3+5+1=9.

{ Carry,sum} =4'b1001=9