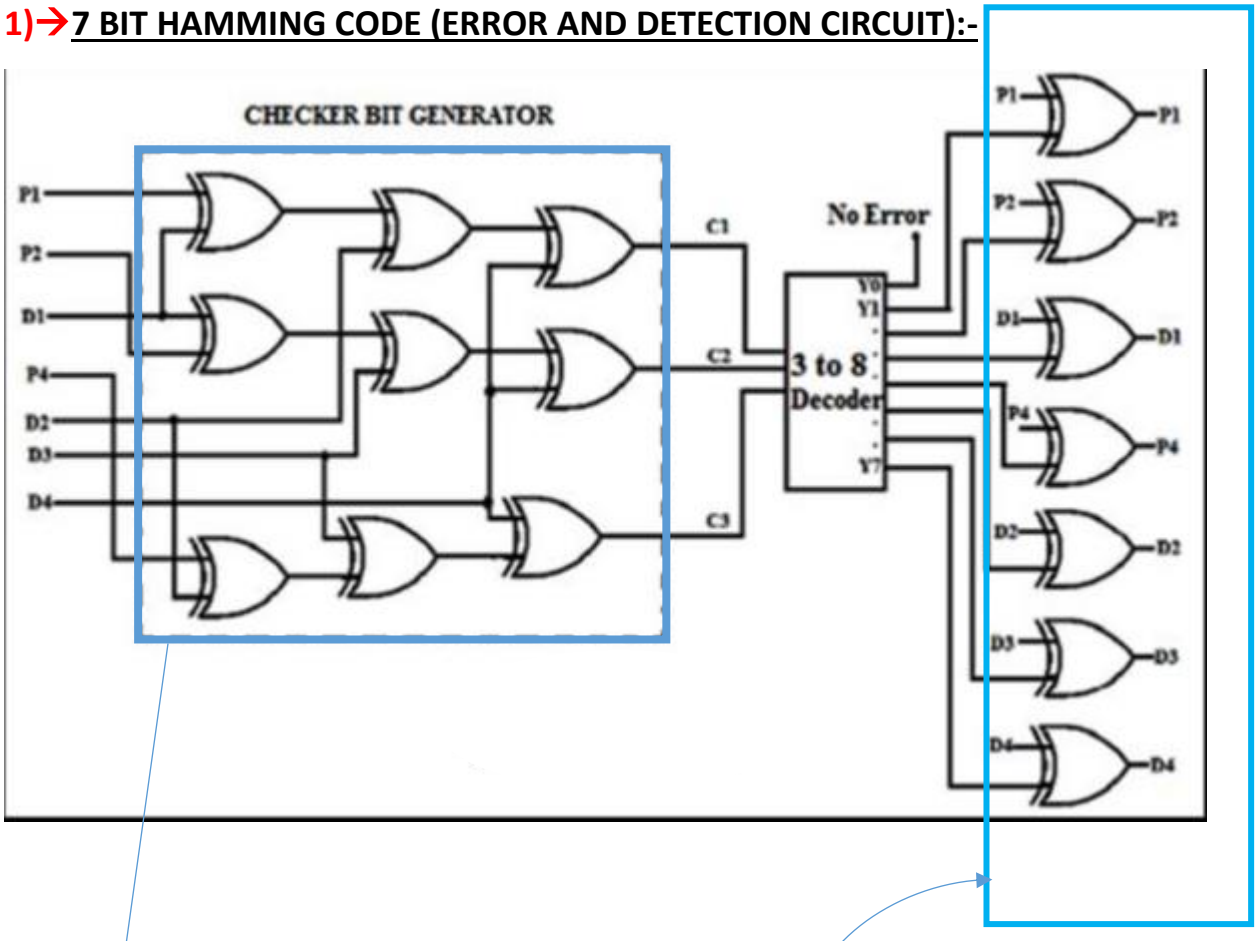
1)→7 BIT HAMMING CODE (ERROR AND DETECTION CIRCUIT):-



ERROR DETECTION

CIRCUIT

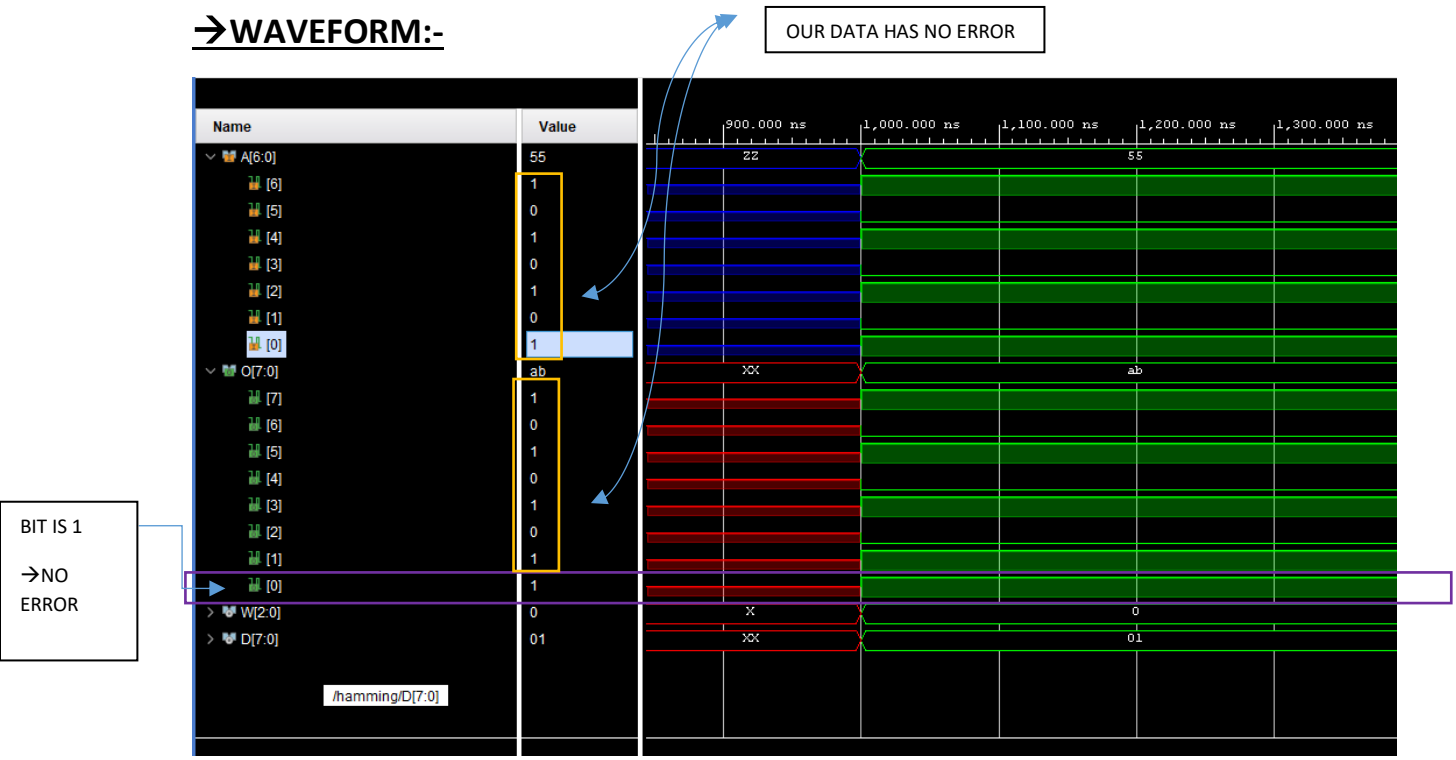
Correction circuit

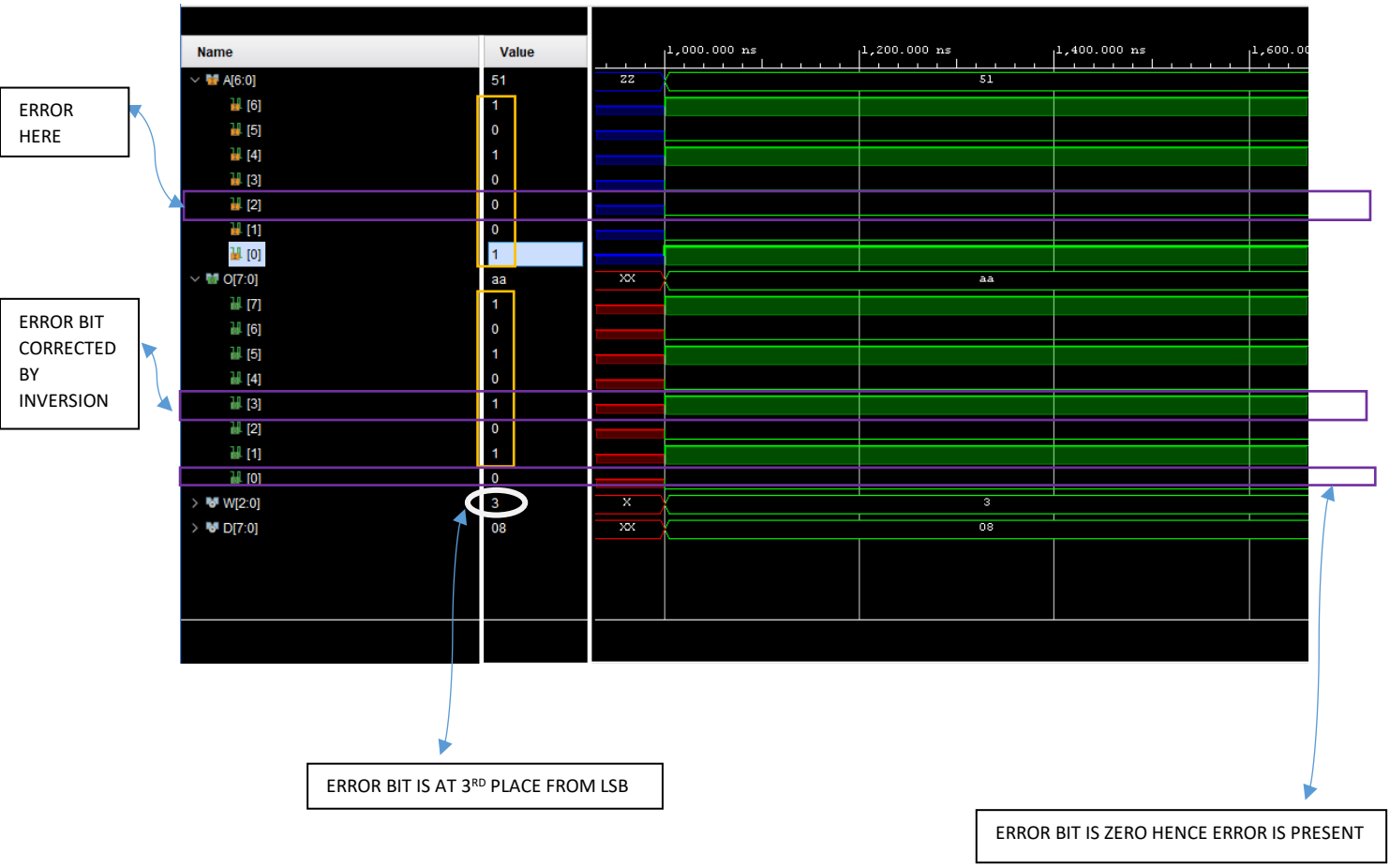
→**CODES:-**

```
`timescale 1ns / 1ps
//////////////////////////////////////////////////////////////////////////////////

//
//////////////////////////////////////////////////////////////////////////////////

module hamming(O,A);
input [6:0] A;
output [7:0] O;
wire[2:0] W;
wire [7:0]D;
xor(W[0],A[0],A[2],A[4],A[6]);
xor(W[1],A[1],A[2],A[5],A[6]);
xor(W[2],A[3],A[4],A[5],A[6]);
decoder dd(D,W);
buf(O[0],D[0]);
xor(O[1],D[1],A[0]);
xor(O[2],D[2],A[1]);
xor(O[3],D[3],A[2]);
xor(O[4],D[4],A[3]);
xor(O[5],D[5],A[4]);
xor(O[6],D[6],A[5]);
xor(O[7],D[7],A[6]);
endmodule

module decoder(O,I);
```

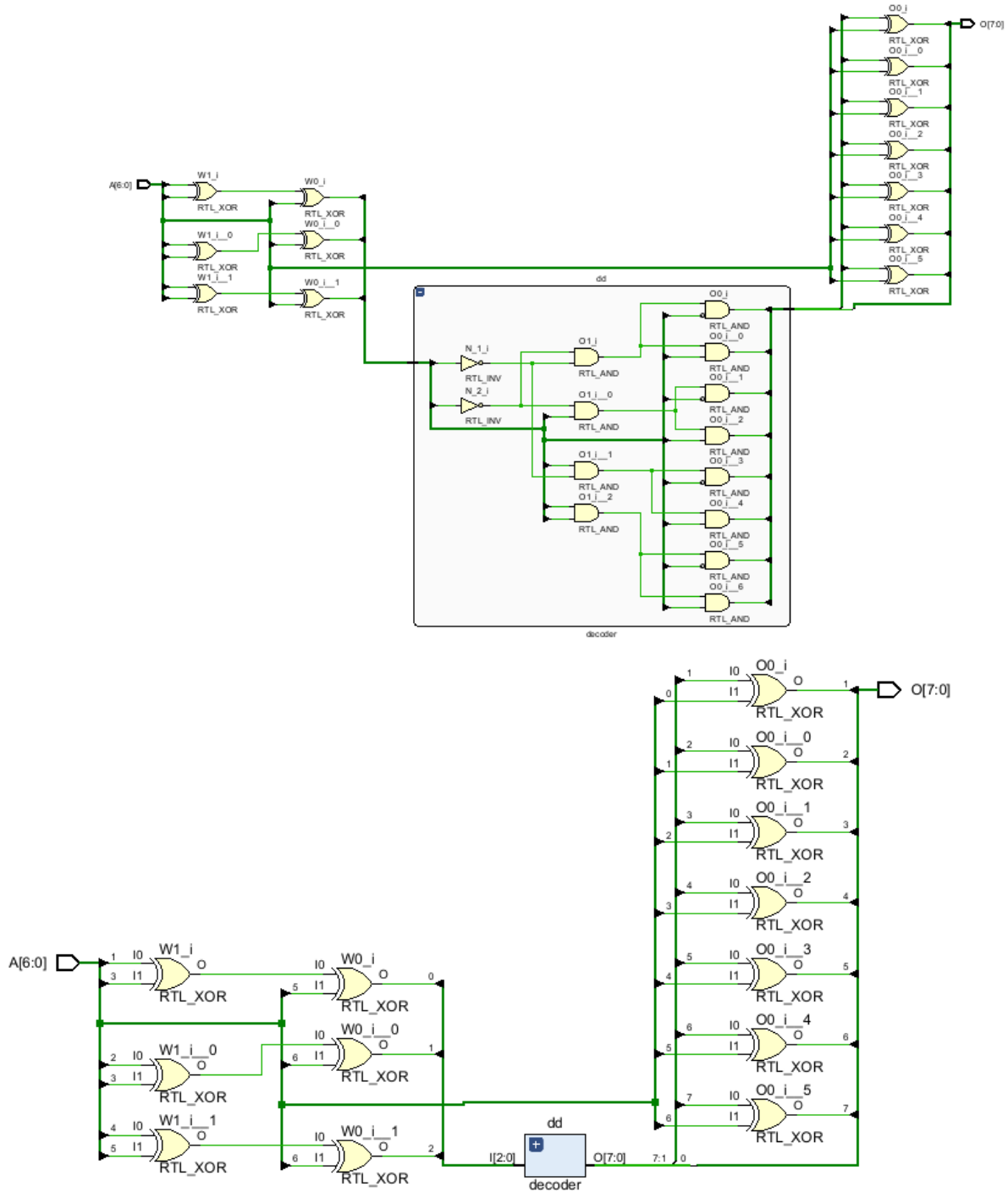
```
input [2:0] I;
output [7:0] O;
wire [3:0] N;
not(N[0],I[0]);
not(N[1],I[1]);
not(N[2],I[2]);
and(O[0],N[2],N[1],N[0]);
and(O[1],N[2],N[1],I[0]);
and(O[2],N[2],I[1],N[0]);
and(O[3],N[2],I[1],I[0]);
and(O[4],I[2],N[1],N[0]);
and(O[5],I[2],N[1],I[0]);
and(O[6],I[2],I[1],N[0]);
and(O[7],I[2],I[1],I[0]);

endmodule
```

→WAVEFORM:-




ERROR HERE
ERROR BIT CORRECTED BY INVERSION
Name
Value
A[6:0]
51
[6]
1
[5]
0
[4]
1
[3]
0
[2]
0
[1]
0
[0]
1
O[7:0]
aa
[7]
1
[6]
0
[5]
1
[4]
0
[3]
1
[2]
0
[1]
1
[0]
0
W[2:0]
3
D[7:0]
08
1,000.000 ns
1,200.000 ns
1,400.000 ns
ZZ
51
XX
aa
X
3
XX
08
ERROR BIT IS AT 3RD PLACE FROM LSB
ERROR BIT IS ZERO HENCE ERROR IS PRESENT

→CIRCUIT DIAGRAM:-



7 bit Hamming code testbench:-

module hamming_tb();

```
 reg [6:0] a;
 wire[7:0] o;
 hamming f1(.O(o),.A(a));
 initial
  begin
    $monitor($time,"a=%b,o=%b",a,o);
    a=7'b1001001;
    #10
    a=7'b1001011;
    #10
    a=7'b1101001;
  end
endmodule
```