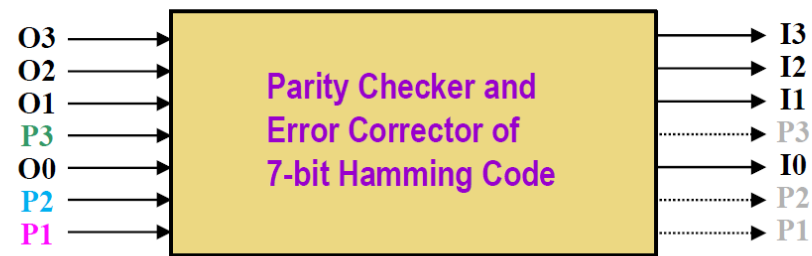


實驗內容：

**Exercise : Parity Checker and Error Corrector**

- Design and verify the Parity Checker and Error Corrector of 7-bit Hamming Code using FPGA board



7	6	5	4	3	2	1	Bit positions
1	0	1	0	1	0	1	correct code word
I3	I2	I1	P3	I0	P2	P1	

Test bench:

0	0	1	0	1	0	1
1	1	1	0	1	0	1
1	0	0	0	1	0	1
1	0	1	0	0	0	1

程式碼：

```

21 module corrector(I3,I2,I1,I0,O3,O2,O1,O0,P3,P2,P1);
22 output I3,I2,I1,I0;
23 wire [0:7]D;
24 wire A,B,C;
25 input O3,O2,O1,O0,P3,P2,P1;
26 _generate x1(C,B,A,O3,O2,O1,O0,P3,P2,P1);
27 assign D[0] = (~C) && (~B) && (~A),
28         D[1] = (~C) && (~B) && (A),
29         D[2] = (~C) && (B) && (~A),
30         D[3] = (~C) && (B) && (A),
31         D[4] = (C) && (~B) && (~A),
32         D[5] = (C) && (~B) && (A),
33         D[6] = (C) && (B) && (~A),
34         D[7] = (C) && (B) && (A);
35 assign I0 = O0 ^ D[3],
36         I1 = O1 ^ D[5],
37         I2 = O2 ^ D[6],
38         I3 = O3 ^ D[7];
39 endmodule
40
41 module _generate(C3,C2,C1,O3,O2,O1,O0,P3,P2,P1);
42 output C3,C2,C1;
43 input O3,O2,O1,O0,P3,P2,P1;
44
45 assign C1 = O3^O2^O1^P3,
46         C2 = O3^O2^O0^P2,
47         C3 = O3^O1^O0^P1;
48 endmodule

```

```

25 module hamming_tb;
26
27     // Inputs
28     reg O3;
29     reg O2;
30     reg O1;
31     reg O0;
32     reg P3;
33     reg P2;
34     reg P1;
35
36     // Outputs
37     wire I3;
38     wire I2;
39     wire I1;
40     wire I0;
41
42     // Instantiate the Unit Under Test (UUT)
43     corrector uut (
44         .I3(I3),
45         .I2(I2),
46         .I1(I1),
47         .I0(I0),
48         .O3(O3),
49         .O2(O2),
50         .O1(O1),
51         .O0(O0),
52         .P3(P3),
53         .P2(P2),
54         .P1(P1)
55     );
56
57     initial begin
58         // Initialize Inputs
59         O3 = 0;
60         O2 = 0;
61         O1 = 1;
62         P3 = 0;
63         O0 = 1;
64         P2 = 0;
65         P1 = 1;
66     end
67
68 endmodule

```

實驗分析：

利用 parity checker 加上 decoder 可以找出 Hamming Code 錯誤的位置並修正