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Class : SYBCS Roll No. : Batch :

Experiment No. : Performed Date : / /20

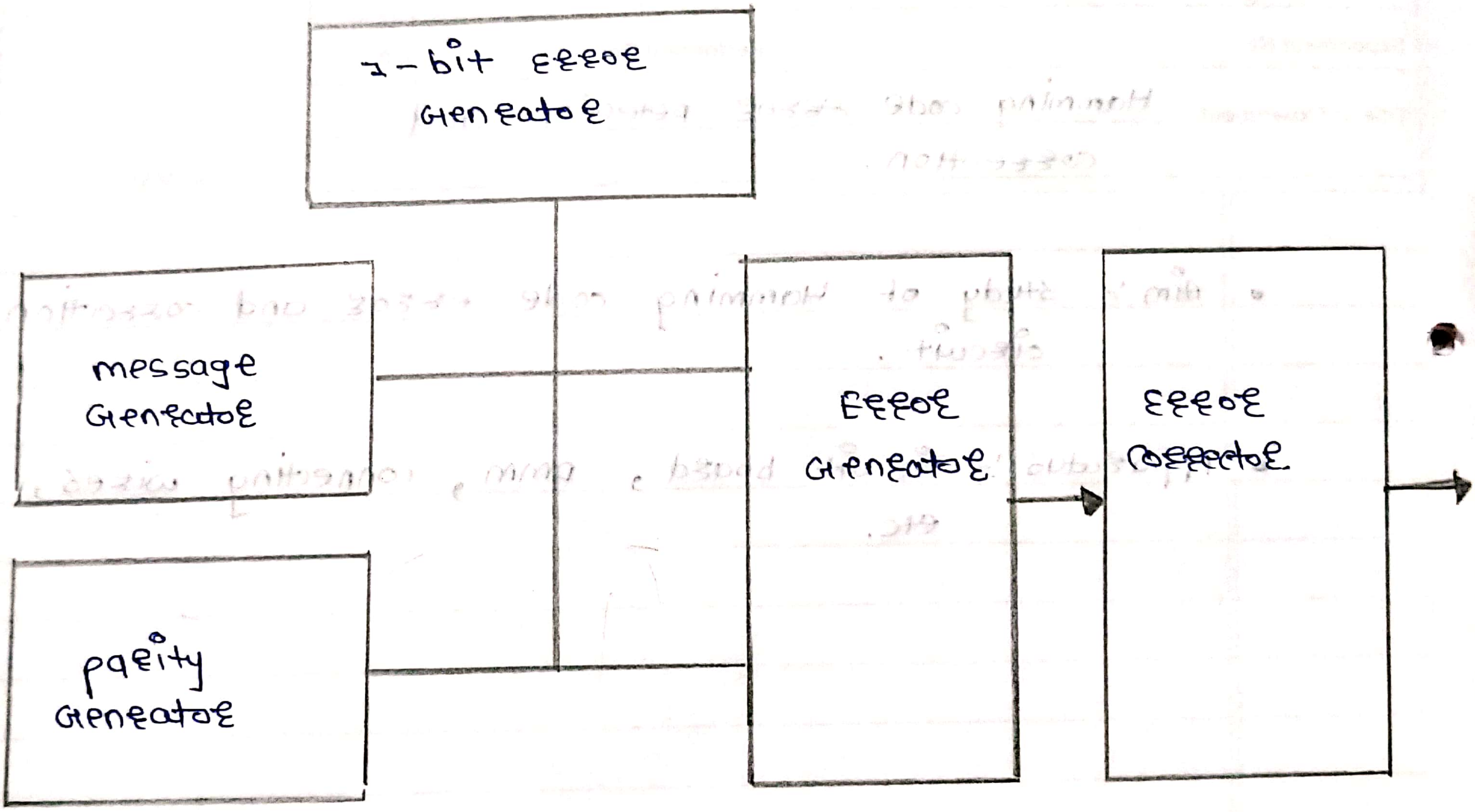
Title of Experiment : Hamming code error Detection and correction.

REMARKS

- Aim :- Study of Hamming code error and correction circuit.

- Apparatus :- circuit board, DMM, connecting wires, etc.

Circuit Diagram :-



* Procedure :-

1. Take any 4 bit binary number information bits.
2. Find out the Hamming code for that 4 bit no. for either even pariety or odd pariety.
3. Show that Hamming code (H.C) to the examiner / Teacher.
4. Construct the H.C. as input to the circuit by using switches provided on Hamming code generator block.
5. Set parity even or odd.
6. Note down 7- bit Hamming code.
7. Apply the current H.C. as input to the circuit by using switches provided on error detector block.
8. Set the pariety even or odd.
9. Set the o/p of error detector and error corrector notes down the o/p in observation table.
10. Generate 1-bit error in 7-bit hamming code by switches
11. The error generate in this is found on the o/p of error detector in binary code.
12. The o/p of error detector is given as i/p of decoder in binary code.
13. See the o/p of correction ckt. note these reading in observation table.
14. again take new 4 bit information signal for odd pariety and repeat the step 3 to 10.

• Note :-

The onboard arrangement can detect and correct the one bit error in 4 bit information in even / odd pariety Hamming code.

Theory :-
When digital code are transferred from one point to another point, within a digital systems error can occure these errors due to component malfunction or electrical noise can result in 1 changing to 0 or zero changing to 1.

Although the probability of even a single bit error occureance in digital system is very small a parity bit may be the means of single bit error detection a pariety bit is attached to the group of information bits (word) to make the total no. of '1s' always odd the periority bit cannot detect error at more than one bit position.

Hamming code not only provides for dection of a bit error but also identifies which bits is in error so that it can be corrected. This code uses a number of pariety bits (depends on the no of information bits) located at certain positions in the group. error detection and correction are provided for all bits.

observation table :-

Sr. No	Set 4-bit input				Set Parity	Set fault Hamming code							7-bit hamming code or 1-bit error							error detected binary code			corrected op.						
	P1	P2	P3	P4		1	2	3	4	5	6	7	1	2	3	4	5	6	7	01	02	03	1	2	3	4	5	6	7
1]	1	0	1	1	Even	0	1	1	0	0	1	1	0	1	1	0	0	1	0	1	1	1	0	1	1	0	0	1	1
2]	1	0	1	1	odd	1	0	1	1	0	1	1	1	1	1	0	0	1	1	0	1	0	1	0	1	1	0	1	1
3]	1	1	0	1	Even	1	0	1	0	1	0	1	0	0	1	0	1	0	1	0	0	1	1	0	1	0	1	0	1
4]	1	1	0	1	odd	0	1	1	1	1	0	1	0	1	1	1	0	0	1	1	0	1	0	1	1	1	1	0	1
5]	0	1	0	1	Even	0	1	0	0	1	0	1	0	1	1	0	1	0	1	0	1	1	0	1	0	0	1	0	1
6]	0	1	0	1	odd	1	0	0	1	1	0	1	1	0	0	0	1	0	1	1	0	0	1	0	0	1	1	0	1

- calculation :-

(1) message code = 1011

→ $2^n \geq m+p+1$

$2^1 \geq 4+1+1$ ∴ Hamming Rule not satisfied

$2^2 \geq 4+2+1$ ∴ Hamming Rule not satisfied

$2^3 \geq 4+3+1$

$8 \geq 8$ ∴ Hamming Rule satisfied

∴ $L = m+p$

$= 4+3$

$= 7$

we need length of Hamming code is 7.

	1	2	3	4	5	6	7
	P_1	P_2	m_1	P_3	m_2	m_3	m_4
even →	0	1	1	0	0	1	1
odd →	1	0	1	1	0	1	1

P_1 =	1	3	5	7
	0	1	0	1
	1	1	0	1

even = 0

odd = 1

P_2 =	2	3	5	7
even	1	1	1	1
odd	0	1	1	1

P_3	4	5	6	7
even	0	0	1	1
odd.	1	0	1	1

(2) 1101

	P_1	P_2	m_1	P_3	m_2	m_3	m_4
	1	2	3	4	5	6	7
even →	1	0	1	0	1	0	1
odd →	0	1	1	1	1	0	1

P1 =	1	3	5	7		P2 =	2	3	6	7
even =	1	1	1	1		even =	0	1	0	1
odd =	0	1	1	1		odd =	1	1	0	1

P3 =	4	5	6	7
even =	0	1	0	1
odd =	1	1	0	1

(3) 0 1 0 1

→	P1	P2	m1	P3	m2	m3	m4
even =	0	1	0	0	1	0	1
odd =	1	0	0	1	1	0	1

P3 =	4	5	6	7
even =	0	1	0	1
odd =	1	1	0	1

Result :-

(1) Data = 1 0 11

Hamming code

	P1	P2	m1	P3	m2	m3	m4
Even =	0	1	1	0	0	1	1
odd =	1	0	0	1	0	1	1

(2) data = 1 1 0 1

Hamming code

	P1	P2	m1	P3	m2	m3	m4
even =	1	0	1	0	1	0	1
odd =	1	1	1	1	1	0	1

③ Data : 0 1 01

	P_1	P_2	m_1	P_3	m_2	m_3	m_4
even =	0	1	0	0	1	0	1
odd =	1	0	0	1	1	0	1

• conclusion :-

1] we have studied Hamming code error detection and correction code.

2] It is one of the most common error detection and correction code.

3] Hamming code can be use for error detection and correction by adding extra parity bit.

4] The no. of parity bits are dependent on length of data information.

5] no. of parity bits are given by formula are :-

$2^n \geq m+p+1$ $\quad\quad$ $L = m+p$

$2^3 \geq 4+3+1$ $\quad\quad$ $= 4+3$

$\therefore 8 \geq 8$ $\quad\quad$ $= 7$