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ASSIGNMENT:- 03.

AIM:-

Design and implement code which converts a) Binary to gray code and b) BCD to excess 3.

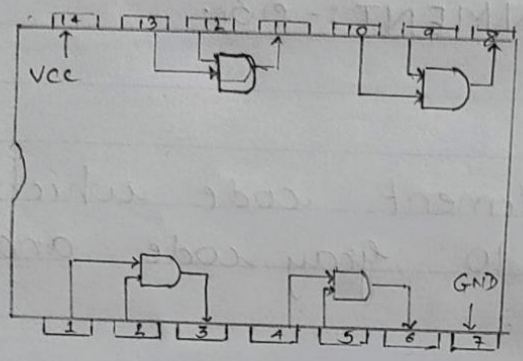
I.C REQUIRED:-

I.C 7486 (XOR), IC 7408 (AND)
I.C 7432 (OR), IC 7404 (NOT) and toolkit.

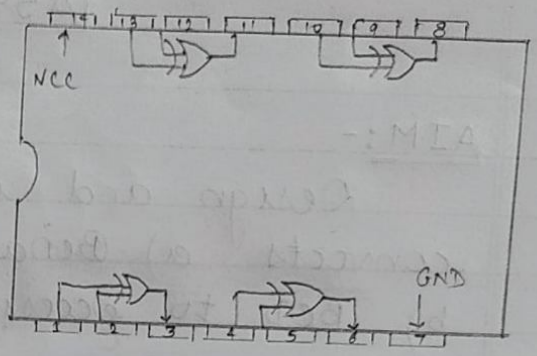
THEORY:-

① Binary coded decimal (BCD), in this each decimal digit is represented by 4-bit binary numbers.
② The 4-bit representation of decimals is done of numbers (0000 to 1111)
③ This representation is done for only first ten decimals i.e (0-9).
④ Excess-3 binary code is an unweighted self-complementary BCD code.
⑤ Self-complementary property means that the 1's complement of an excess-3 number is the excess-3 code of nines' complement of corresponding decimal number.
⑥ This property is useful since a decimal number can be 9's complemented (for subtraction) as easily as binary ones can be ones' complementing, just by inverting all the bits.

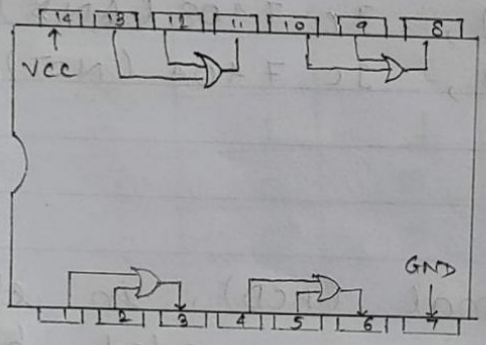
PIN DIAGRAM:-



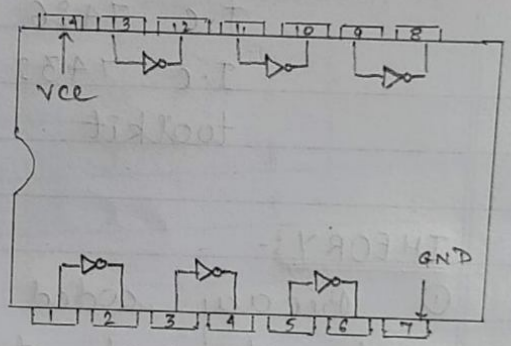
IC 7408 (AND GATE)



IC 7486 (XOR GATE)



IC 7432 (OR GATE)



IC 7404 (NOT GATE)

a) Binary to gray conversion:-

BINARY CODE				GRAY CODE			
B_3	B_2	B_1	B_0	G_3	G_2	G_1	G_0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1
0	0	1	0	0	0	1	1
0	0	1	1	0	0	1	0
0	1	0	0	0	1	1	0
0	1	0	1	0	1	1	1
0	1	1	0	0	1	0	1
0	1	1	1	0	1	0	0
1	0	0	0	1	1	0	0
1	0	0	1	1	1	0	1
1	0	1	0	1	1	1	1
1	0	1	1	1	1	1	0
1	1	0	0	1	0	1	0
1	1	0	1	1	0	1	1
1	1	1	0	1	0	0	1
1	1	1	1	1	0	0	0

① FOR G_3 :-

G_3 : B_1B_0 \ B_3B_2	00	01	11	10
00	0	0	1	1
01	0	0	1	1
11	0	0	1	1
10	0	0	1	1

expression : $G_3 = B_3\bar{B}_2 + B_3B_2$

$G_3 = B_3(\bar{B}_2 + B_2)$

$G_3 = B_3$.

Binary to gray code :

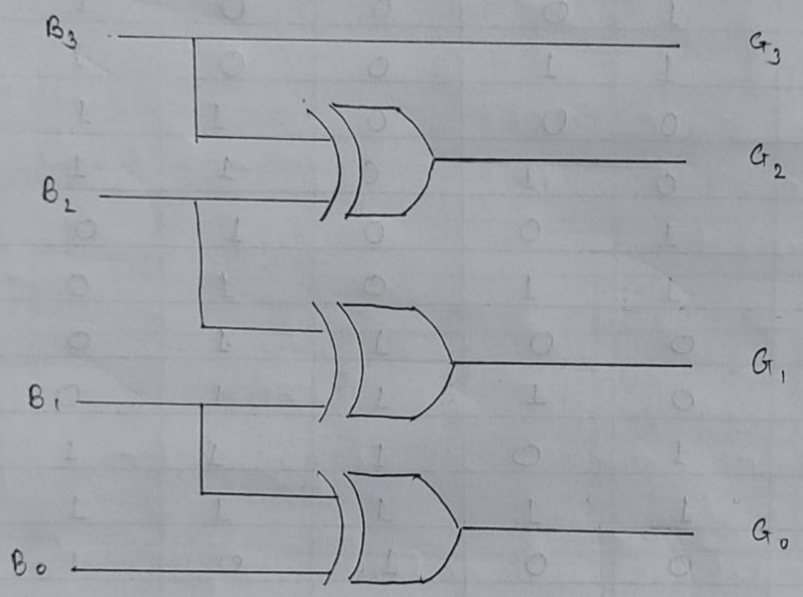
expressions :

① $G_3 = B_3$

② $G_2 = B_3 \oplus B_2$

③ $G_1 = B_1 \oplus B_2$

④ $G_0 = B_1 \oplus B_0$



② FOR G_2 :-

G_2 : B_3B_2 / B_1B_0	00	01	11	10
00	0	1	0	1
01	0	1	0	1
11	0	1	0	1
10	0	1	0	1

expression : $G_2 = \bar{B}_3 B_2 + B_3 \bar{B}_2$

$G_2 = B_3 \oplus B_2$.

③ FOR G_1 :-

G_1 : B_3B_2 / B_1B_0	00	01	11	10
00	0	1	1	0
01	0	1	1	0
11	1	0	0	1
10	1	0	0	1

expression :- $G_1 = B_1 \bar{B}_2 + \bar{B}_1 B_2$

$G_1 = B_1 \oplus B_2$

④ FOR G_0 :-

G_0 : B_3B_2 / B_1B_0	00	01	11	10
00	0	0	0	0
01	1	1	1	1
11	0	0	0	0
10	1	1	1	1

expression :- $G_0 = \bar{B}_1 B_0 + B_1 \bar{B}_0$

$G_0 = B_1 \oplus B_0$

BCD to Excess-3 :-

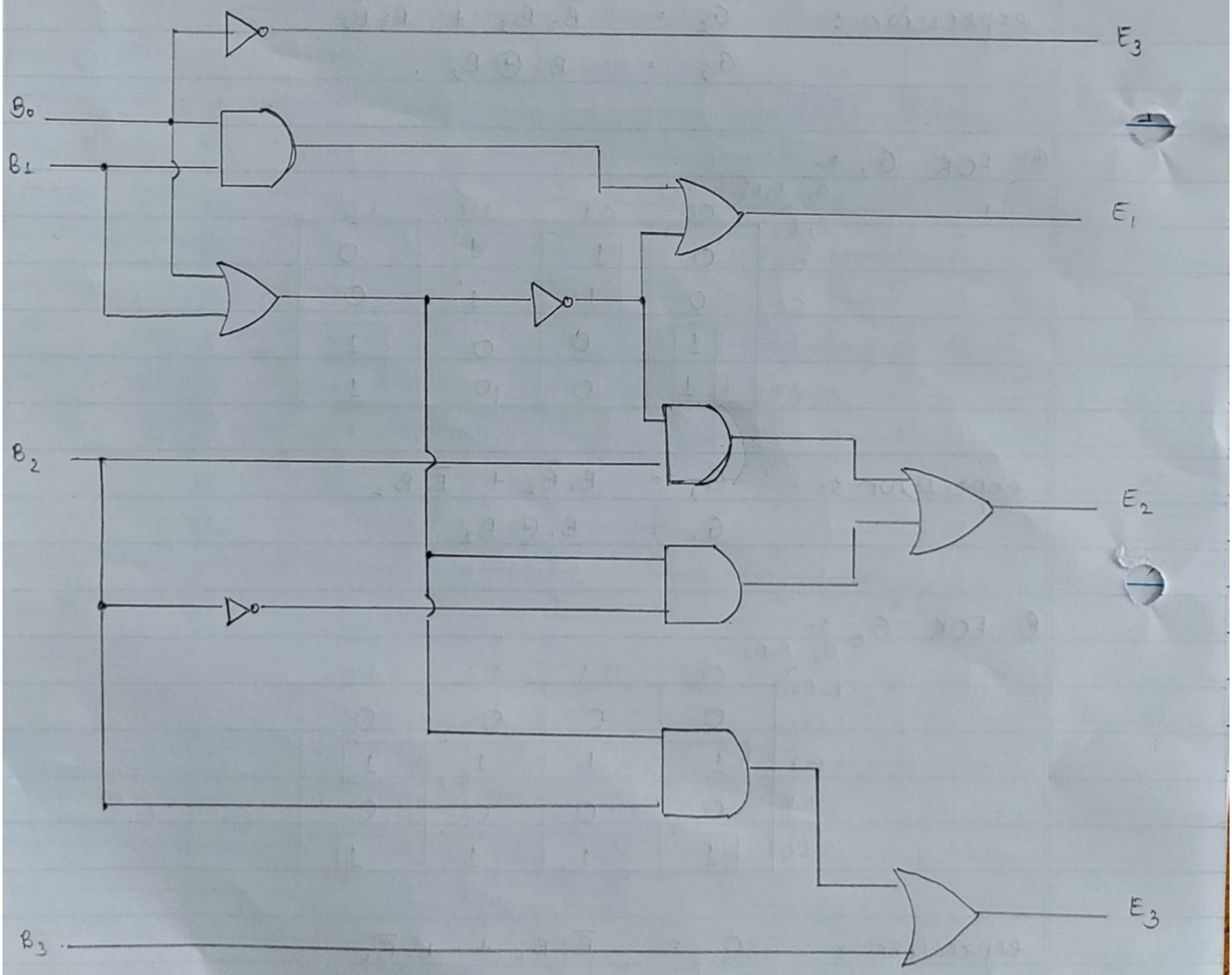
expression :-

① $E_3 = \overline{B_0}$

② $E_2 = \overline{B_2} B_1 + \overline{B_2} B_0 + B_2 \overline{B_1} \overline{B_0}$

③ $E_1 = B_1 B_0 + \overline{B_1} \overline{B_0}$

④ $E_0 = B_3 + B_2 B_1 + B_2 B_0$



b) BCD to Excess-3 :-

BINARY CODE				EXCESS-3 CODE			
B_3	B_2	B_1	B_0	E_3	E_2	E_1	E_0
0	0	0	0	0	0	1	1
0	0	0	1	0	1	0	0
0	0	1	0	0	1	0	1
0	0	1	1	0	1	1	0
0	1	0	0	0	1	1	1
0	1	0	1	1	0	0	0
0	1	1	0	1	0	0	1
0	1	1	1	1	0	1	0
1	0	0	0	1	0	1	1
1	0	0	1	1	1	0	0
1	0	1	0	x	x	x	x
1	0	1	1	x	x	x	x
1	1	0	0	x	x	x	x
1	1	0	1	x	x	x	x
1	1	1	0	x	x	x	x
1	1	1	1	x	x	x	x

① FOR E_3 :-

E_3 B_1B_0 / B_3B_2	00	01	11	10
00	1	0	0	1
01	1	0	0	1
11	x	x	x	x
10	1	0	x	x

expression : $E_3 = \overline{B_0}$

② FOR E_2 :-

E_2 \ B_1B_0 / B_3B_2	00	01	11	10
00	0	1	1	1
01	1	0	0	0
11	x	x	x	x
10	0	1	x	x

expression :- $E_2 = \bar{B}_2 B_1 + \bar{B}_2 B_0 + B_2 \bar{B}_1 \bar{B}_0$

③ FOR E_1 :-

E_1 \ B_1B_0 / B_3B_2	00	01	11	10
00	1	0	1	0
01	1	0	1	0
11	x	x	x	x
10	1	0	x	x

expression :- $E_1 = B_1 B_0 + \bar{B}_1 \bar{B}_0$

④ FOR E_0 :-

E_0 \ B_1B_0 / B_3B_2	00	01	11	10
00	0	0	0	0
01	0	1	1	1
11	x	x	x	x
10	1	1	x	x

expression :- $E_0 = B_3 + B_2 B_1 + B_2 B_0$

CONCLUSION :-

The circuit of above conversion was successfully executed, and by going through the above truth table, K-maps and expressions.