

B CD to Excess-3 Converter

Truth table

85
79
86
84
92

Binary	BCD Input				Excess-3 output			
	B ₃	B ₂	B ₁	B ₀	E ₃	E ₂	E ₁	E ₀
0	0	0	0	0	0	0	1	1
1	0	0	0	1	0	1	0	0
2	0	0	1	0	0	1	0	1
3	0	0	1	1	0	1	1	0
4	0	1	0	0	0	1	1	1
5	0	1	0	1	1	0	0	0
6	0	1	1	0	1	0	0	1
7	0	1	1	1	1	0	1	0
8	1	0	0	0	1	0	1	1
9	1	0	0	1	1	1	0	0

$G_2 = B_2 B_0$

B ₃ B ₂	B ₁ B ₀	00	01	11	10
00	0	0	0	0	0
01	0	1	1	1	1
11	X	X	X	X	X
10	1	1	X	X	X

$G_3 = B_1 B_2$

$G_1 = B_3$

$E_3 =$

$E_3 = B_0 + B_2 B_0 + B_2 B_1$

$E_3 = B_3 + B_2 (B_0 + B_1)$

B₃B₂
00
01
11
10

B ₃ B ₂	B ₁ B ₀	B ₀ B ₁	B ₀ B ₂	B ₀ B ₂	B ₀ B ₂
B ₃ B ₂					
B ₃ B ₂					
B ₃ B ₂					
B ₃ B ₂					

$\overline{A}B = \overline{A+B}$

$B_2(B_1 + B_0) + B_2 \overline{B_1} \overline{B_0}$

$B_2(B_1 + B_0) + B_2(\overline{B_1 + B_0})$

$= B_2 \oplus (B_1 + B_0)$

$E_2 =$

B ₃ B ₂	B ₁ B ₀	00	01	11	10
B ₃ B ₂	00	0	1	1	1
B ₃ B ₂	01	1	0	0	0
B ₃ B ₂	11	X	X	X	X

$G_1 = \overline{B_2} B_1$

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

$B_2 \overline{B_1} \overline{B_0}$

$= \overline{B_2} (B_1 + B_0) + B_2 \overline{B_1} \overline{B_0}$

$B_3 B_2$ $B_1 B_0$

	00	01	11	10
00	1	0	1	0
01	1	0	1	0
11	x	x	x	x
10	1	0	x	x

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

$$E_1 = B_1 \oplus B_0$$

$L_{G1} = 0$ L_{G2}

$$= \overline{B_1} \overline{B_0} \quad = B_1 B_0$$

$$E_0 =$$

$B_3 B_2$ $B_1 B_0$

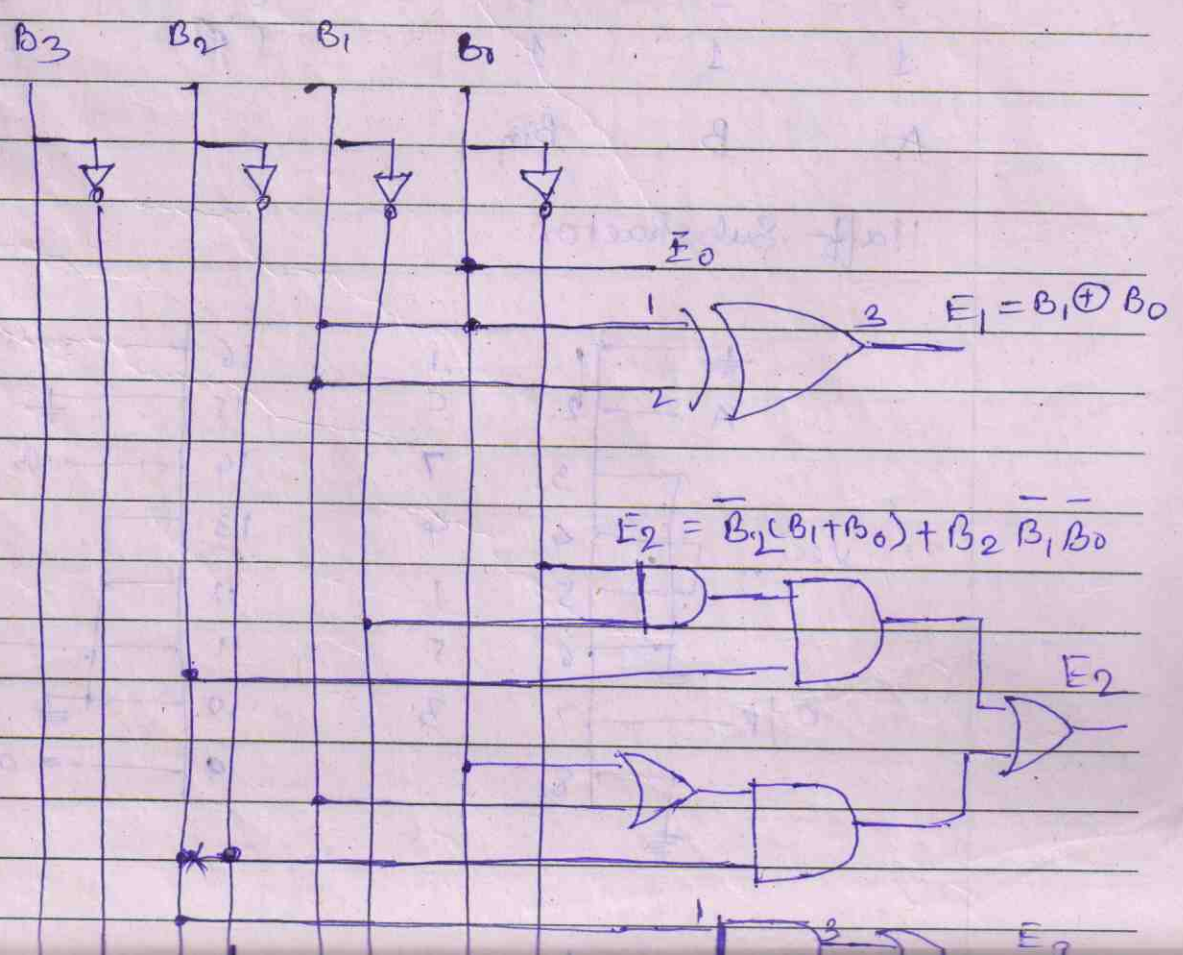
	00	01	11	10
00	1	0	0	1
01	1	0	0	1
11	x	x	x	x
10	1	0	x	x

L_{G1} $L_{G2} = B_0$

$$E_0 = B_1 B_0 + \overline{B_1} B_0$$

$$= B_0$$

$$E_0 = \overline{B_0}$$



Half Subtractor:

Input		Output	
A	B	Diff	Borrow
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

Full Subtractor:

(S₂) (S₁)

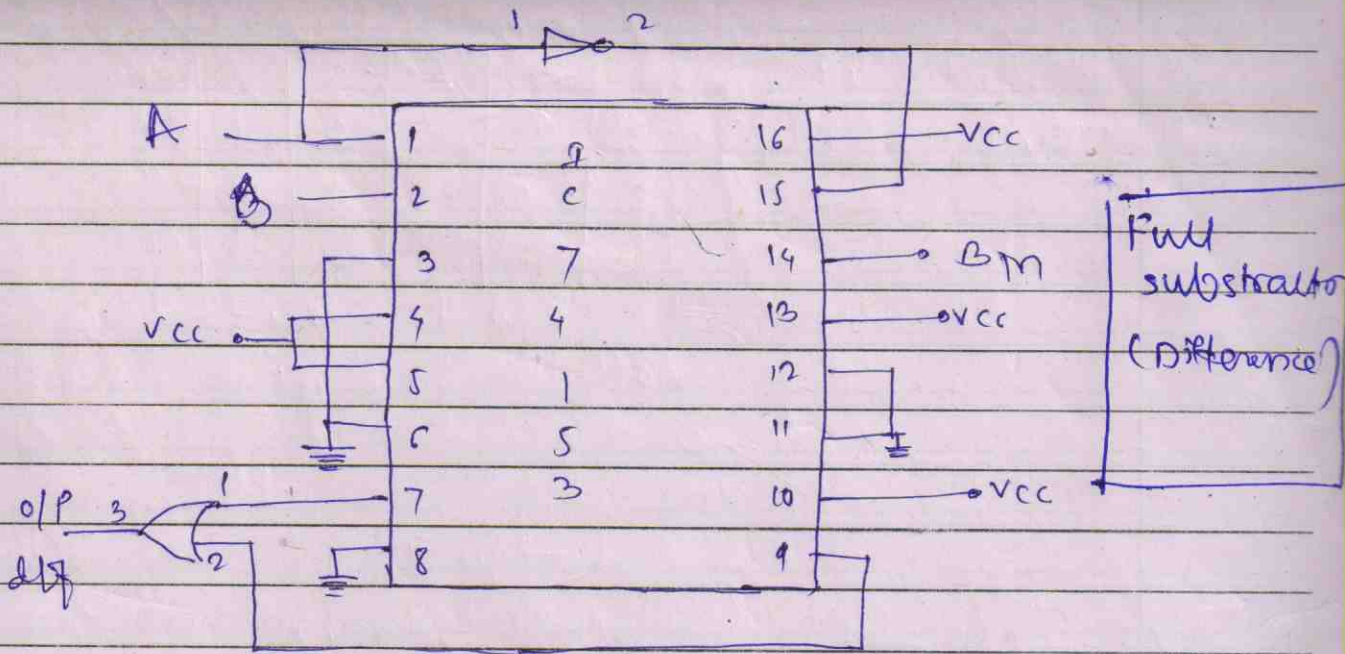
Input		Output	
A	B	Diff	Borrow
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	1

A B Bin
 0 0 0
 0 1 1
 1 0 0
 1 1 1

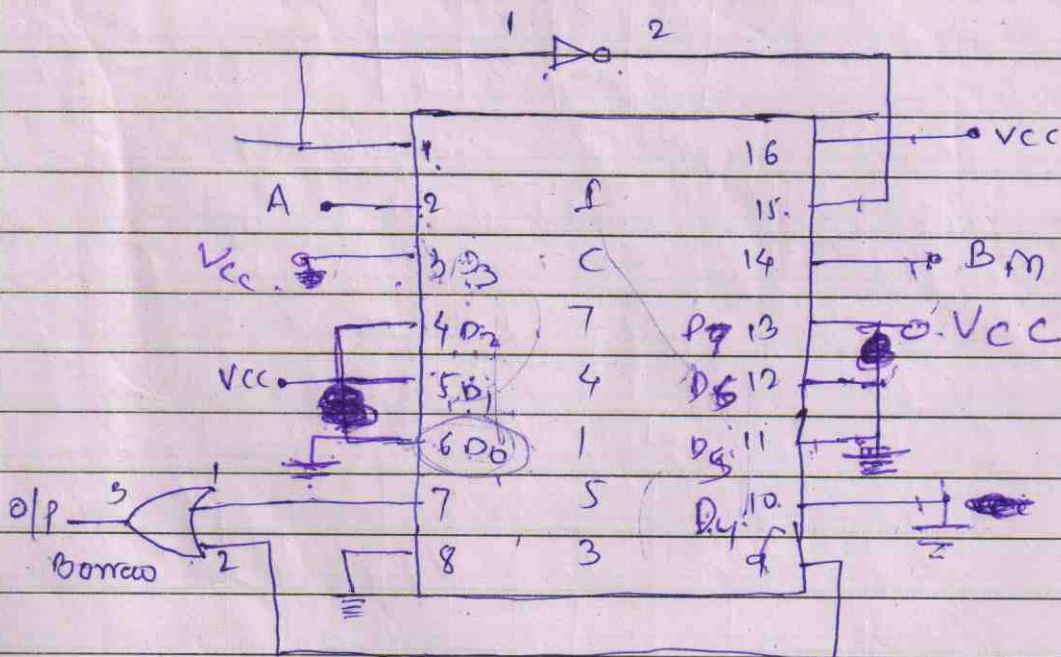
Half Subtractor



full Subtractor (Difference)



full Subtractor (Borrow)



BCD Adder:-

- BCD is less efficient than binary.
- BCD ~~Binary~~ needs more bits than binary to encode the same decimal no.
- BCD arithmetic is more complicated than binary arithmetic.
- The advantage of a BCD code is that the conversion from decimal to BCD or vice versa is simpler.

	Decimal	Binary	BCD
	0	0000	0000
	1	0001	0001
	2	0010	0010
BCD &	3	0011	0011
Binary are	4	0100	0100
different	5	0101	0101
same.	6	0110	0110
	7	0111	0111
	8	1000	1000
	9	1001	1001
	10	1010	0001 0000
	11	1011	0001 0001
BCD & binary	12	1100	0001 0010
are different	13	1101	0001 0011
	14	1110	0001 0100
	15	1111	0001 0101

Advantages of BCD codes.

- ① It is very similar to decimal system.
- ② we need to remember binary equivalent of decimal no. 0 to 9 only.

Disadvantages.

- ① The addition & subtraction of BCD have different rules.
- ② BCD arithmetic is more complicated.
- ③ BCD needs more no. of bits than binary to represent the same decimal no. so BCD is less efficient than binary.

