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# ASSIGNMENT :- 04

## AIM :-

To design and realise BCD adder using 4-bit binary adder.

## I.C REQUIRED :-

I.C. 7483 (4-bit binary full adder)

## THEORY :-

① A BCD adder adds two BCD digits and produces a BCD digit number which cannot be greater than 9.

② Two given BCD numbers are to be added using rules of binary addition, if sum is less than or equals to 9 and carry is equal to 0, then correction is not necessary and the sum is in true BCD form.

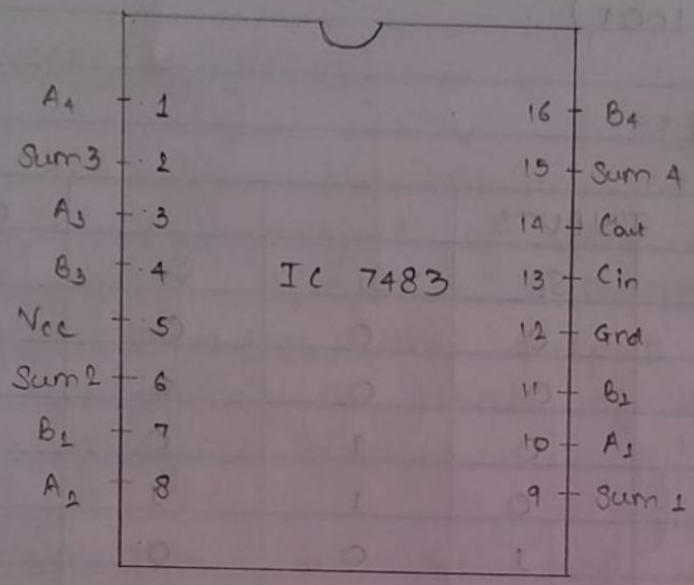
③ But if sum is invalid BCD or carry is generated then the result requires correction.

④ The result can be corrected by adding 6 (0110) to it.

⑤ The 4 bit binary adder IC 7483 can be used to perform addition of BCD numbers

⑥ In this if 4-bit output is not valid, then the BCD adder is cascaded to add the numbers several digits long by connecting carry-in of a stage to carry-out of another stage.

## PIN DIAGRAM :-


A4 1
Sum3 2
A3 3
B3 4
Vcc 5
Sum2 6
B2 7
A2 8
IC 7483
16 B4
15 Sum 4
14 Cout
13 Cin
12 Grd
11 B1
10 A1
9 Sum 1

⑦ The output of combinational circuit should be 1 if sum produced by adder is greater than 9 (1001).

a) TRUTH TABLE:-

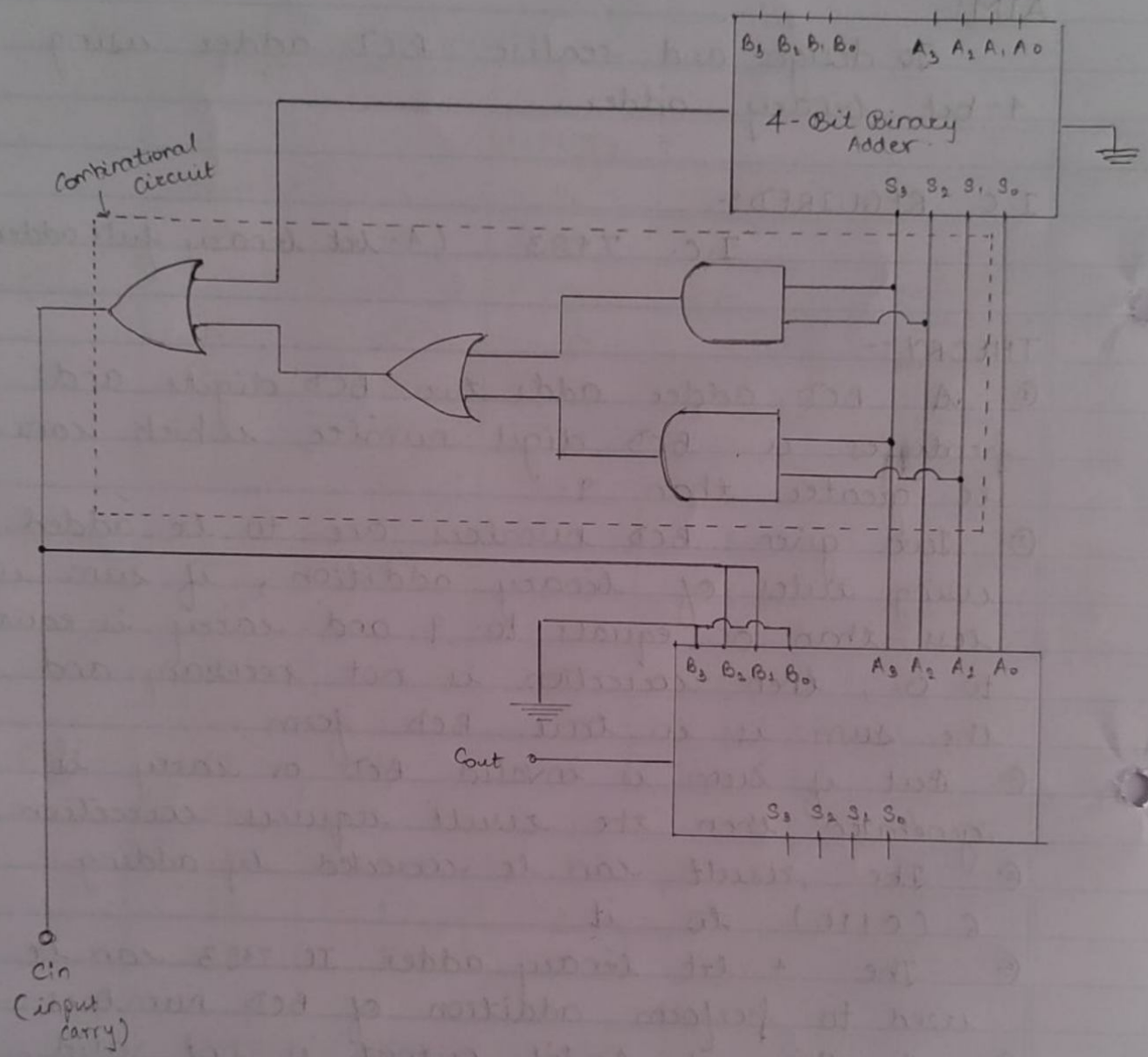
| | INPUTS | | | | OUTPUT |
|---|---|---|---|---|---|
| Decimal | $S_3$ | $S_2$ | $S_1$ | $S_0$ | Y |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 |
| 2 | 0 | 0 | 1 | 0 | 0 |
| 3 | 0 | 0 | 1 | 1 | 0 |
| 4 | 0 | 1 | 0 | 0 | 0 |
| 5 | 0 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 | 0 |
| 7 | 0 | 1 | 1 | 1 | 0 |
| 8 | 1 | 0 | 0 | 0 | 0 |
| 9 | 1 | 0 | 0 | 1 | 0 |
| 10 | 1 | 0 | 1 | 0 | 1 |
| 11 | 1 | 0 | 1 | 1 | 1 |
| 12 | 1 | 1 | 0 | 0 | 1 |
| 13 | 1 | 1 | 0 | 1 | 1 |
| 14 | 1 | 1 | 1 | 0 | 1 |
| 15 | 1 | 1 | 1 | 1 | 1 |

b) K- MAPS :-

Y

| $S_3S_2$ \ $S_1S_0$ | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 0 | 0 | 0 |
| 01 | 0 | 0 | 0 | 0 |
| 11 | 1 | 1 | 1 | 1 |
| 10 | 0 | 0 | 1 | 1 |

## CIRCUIT DIAGRAM



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$Y = S_3S_2 + S_3S_1$

$Y = S_3(S_2 + S_1)$.

c) SPECIAL CASES :-

CASE I :- sum <= 9 and carry = 0

① The output of combinational circuit Y = 0 hence $B_3B_2B_1B_0$ = 0000 for binary adder

② Therefore the output of adder circuit - 2 is same as that of adder - 1 i.e sum of first circuit.

CASE II :- sum > 9 and carry = 0

① If $S_3S_2S_1S_0$ of adder - 1 (sum - 1) is greater than 9 then output of combinational circuit becomes 1.

② $B_3B_2B_1B_0$ will be equal to 0110 (of adder 2) hence six will be added to sum output of adder 1

CASE III :- sum > 9 and carry = 1

① carry output of adder 1 is high and Y = 1 $B_3B_2B_1B_0$ = 0110 (of adder 2). Six will be added to sum of output of adder 2

CONCLUSION :-

The 4 bit BCD adder has been verified by using IC 7483. This is done with the help of simplified equations and K-maps.