

Experiment - 4

Aim: To design a circuit for BCD adder.

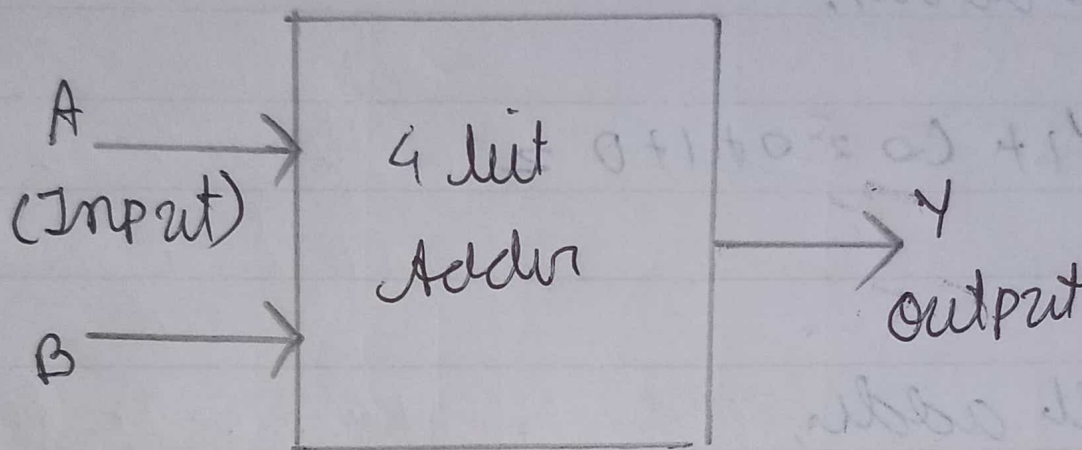
Theory: In computing and electronic systems, binary-coded decimal (BCD) is a class of binary encodings of decimal numbers where each decimal digit is represented by a fixed number of bits.

A BCD adder is a circuit that adds two BCD digits in parallel and produces a sum digit which is also in BCD. This circuit includes correction logic.

For sums > 9 , the circuit needs to add 2's complement of $(1010)_2 = (0110)_2$ to the uncorrected result ($S_4' S_3' S_2' S_1'$). Correction is also needed when a carry out (C_4) is generated (for numbers 16-19).

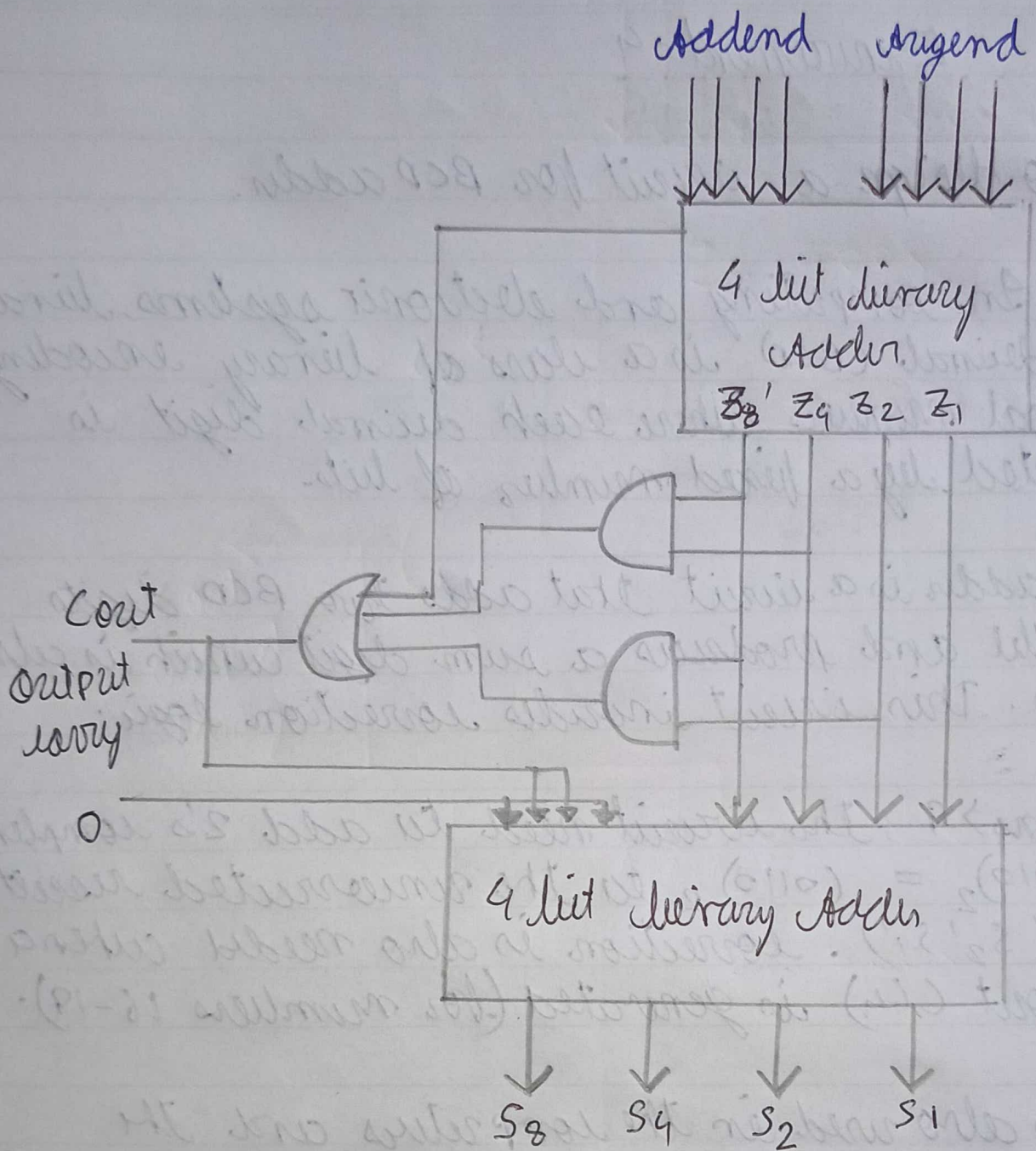
BCD was also used in the computers and the calculators that perform arithmetic operation directly in the decimal number system.

Truth Table:

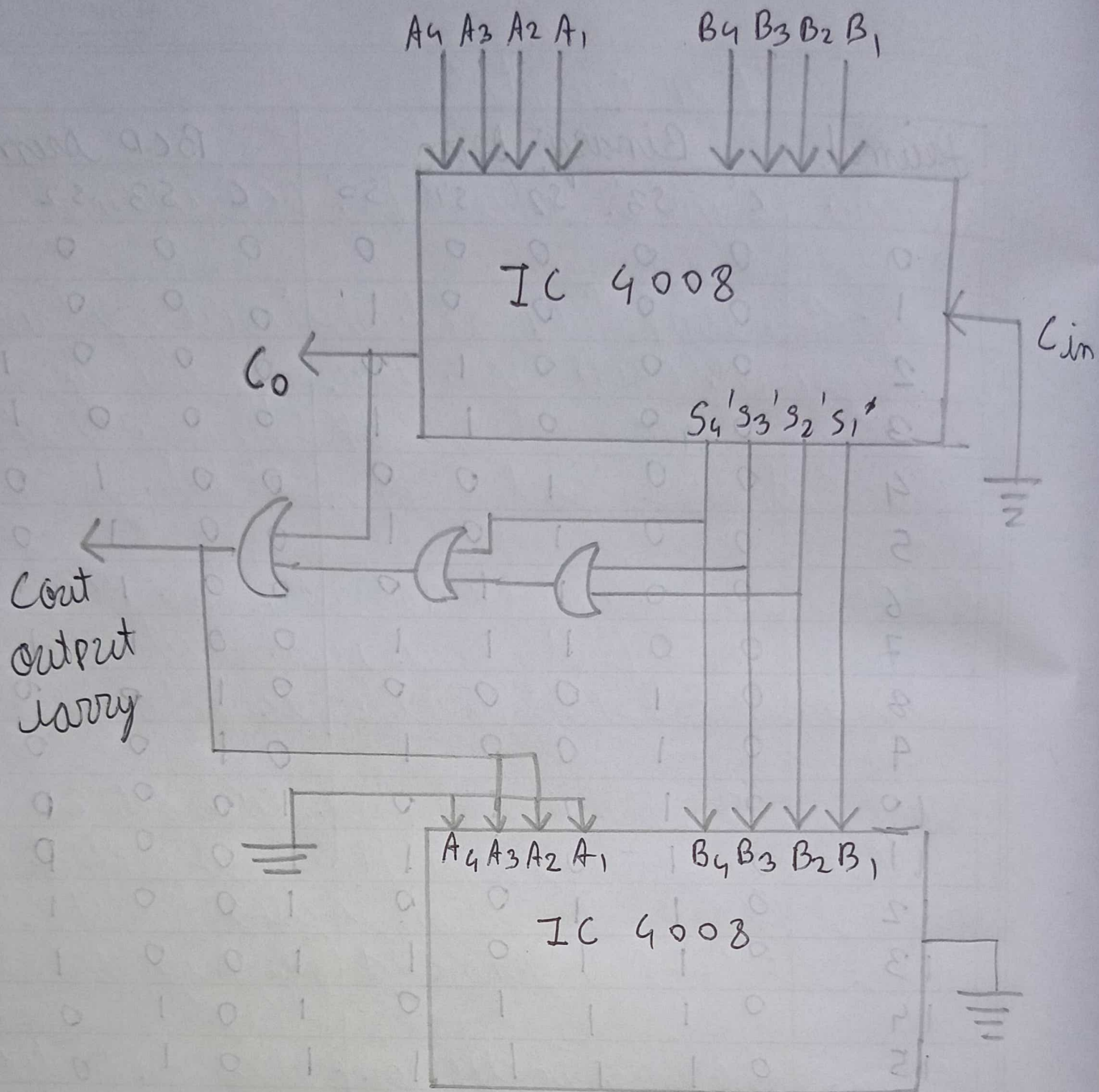


BCD Adder

Decimal	Binary Sum					BCD Sum				
	C'	S3'	S2'	S1'	S0'	C	S3	S2	S1	S0
0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	1
2	0	0	0	1	0	0	0	0	1	0
3	0	0	0	1	1	0	0	0	1	1
4	0	0	1	0	0	0	0	1	0	0
5	0	0	1	0	1	0	0	1	0	1
6	0	0	1	1	0	0	0	1	1	0
7	0	0	1	1	1	0	0	1	1	1
8	0	1	0	0	0	0	1	0	0	0
9	0	1	0	0	1	0	1	0	0	1
10	0	1	0	1	0	1	0	0	0	0
11	0	1	0	1	1	1	0	0	0	1
12	0	1	1	0	0	1	0	0	1	0
13	0	1	1	0	1	1	0	0	1	1
14	0	1	1	1	0	1	0	1	0	0
15	0	1	1	1	1	1	0	1	0	1
16	1	0	0	0	0	1	0	1	1	0
17	1	0	0	0	1	1	0	1	1	1
18	1	0	0	1	0	1	1	0	0	0
19	1	0	0	1	1	1	1	0	0	1



Block diagram of a BCP adder



IC diagram of BCD adder

2) The sum of two numbers is less than or equal to 9, then the value of BCD sum and binary sum will be same otherwise they will differ by 6 (5 in binary). Now, let's move to the table and find out the logic when we are going to add 0110.

Conclusion

Input: $A = (7)_{10} = (0111)_2$ and $B = 8_{10} = (1000)_2$
Output: $1(0101)_2$

The value of binary sum will be $(1111)_2$ but the BCD sum will be 10101 where 1 is 5001 in binary and 5 in 0101 in binary