Experiment No. 03 21118

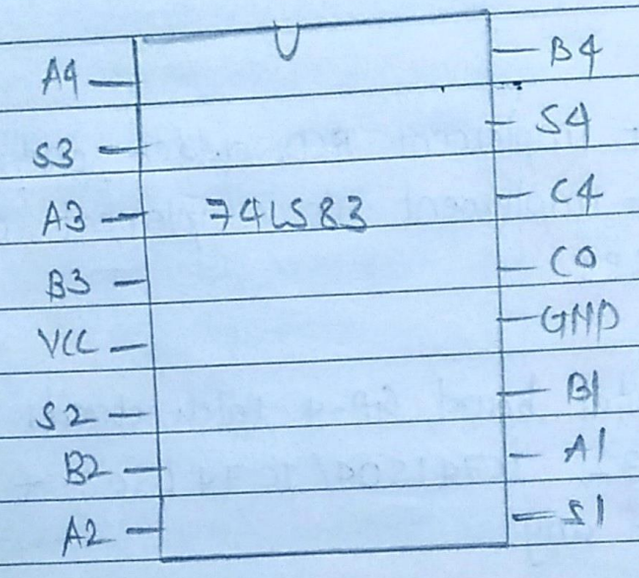
Title: BCD Adder/ 9's complement circuit

Objective:
1) Design & implement BCD adder circuit using IC74LS83
2) Design & implement 9's complement circuit using IC74LS83.

Apparatus: Digital board, GP-4 Patch chords, IC74LS83, IC74LS32, IC74LS04/ IC74LS08 & required logic gates if any.

Theory:
1) IC74LS83 is a 4-bit binary parallel adder. By using it we can implement BCD adder.
2) BCD means Binary coded decimals. BCD numbers are valid from 0 to 9.
For BCD adder when addition is below 9, carry is 0 result is valid BCD.
When addition is more than 9 & carry is 0 as well as when addition is more than 15 & carry is 1 the result of binary adder IC is invalid BCD
3) We can convert invalid BCD to valid BCD by adding 6.
Max addition (9+9) result is 18 if carry input 0 & 19 if carry input is 1.
Thus for binary result greater than 9 six should be added to the result as a correction factor using a combinational circuit.
4) 74LS83 can also be used to implement the BCD substractor. for BCD substraction first we have to find 9's complements. To find 9's complements using IC74LS83, first find 1's complement of a given number then add to 1010.

PIN diagram:



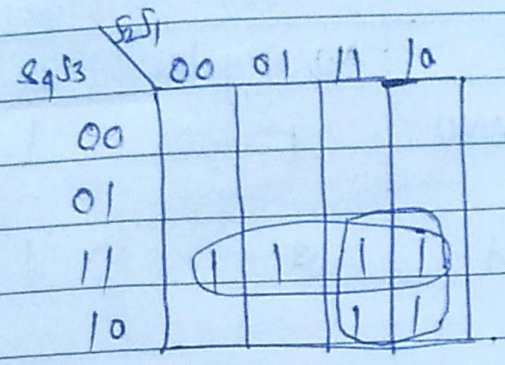
Procedure:

1) Make connections as per logic circuit of 1 digit BCD adder using IC74LS83 & verify its TT.
2) Make the connections as per the logic of 9's complement circuits using IC74LS83 & verify its TT.

Design of BCD Adder using IC74LS83.

Dec. Eqn	S4	S3	S2	S1	Tens place o/p
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

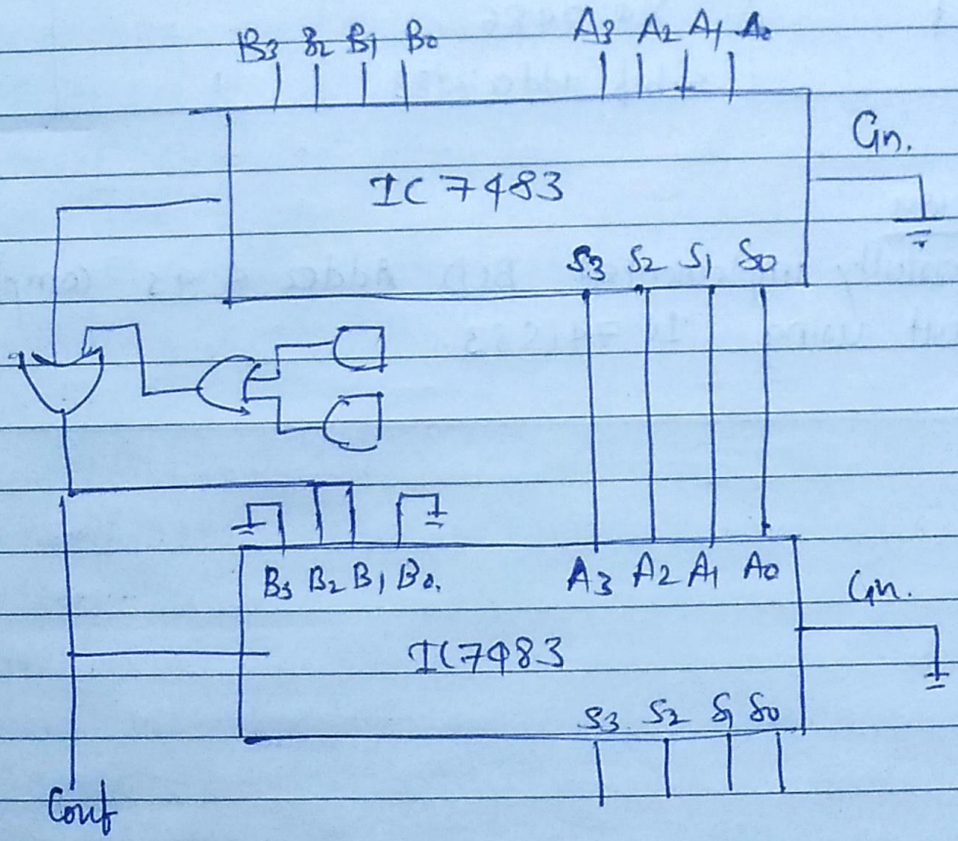
k-map simplification



$f = S_4S_2 + S_4S_3$

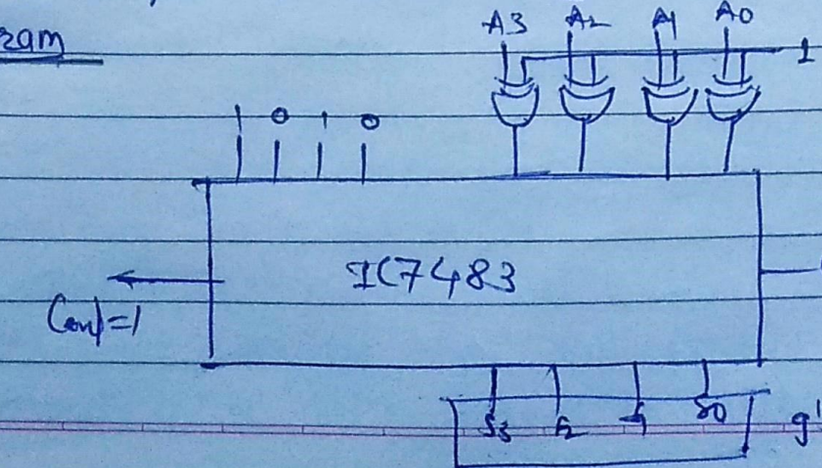
$= S_4(S_2 + S_3)$

logic diagram



Design of g's complement circuit using IC74LS83:

logic diagram



Logic gates / MSI device required to implementation:

S.No.	Title	Name of IC	No. of gates	IC req.
1	BCD Adder Circuit	Quad. 2-input AND 7408	1	1
		Quad. 2 input OR-7432	3	1
		4-bit. adder 7483	2	2
2	9's complement ckt	Quad. 2-input XOR 7486	4	1
		4bit adder 7483	1	1

Conclusion

Successfully implemented BCD Adder & 9's complement circuit using IC 74LS83.