Pre-Lab 3
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Problem 1. Adder IC (74LS283)

The mathematical equation computed by the 4-bit adder is
$C_{in}+ 2^0(A_0+B_0) + 2^1(A_1+B_1) + 2^2(A_2+B_2) + 2^3(A_3+B_3) = 2^0S_0 + 2^1S_1 +2^2S_2 + 2^3S_3 + 2^4C_{out}$.

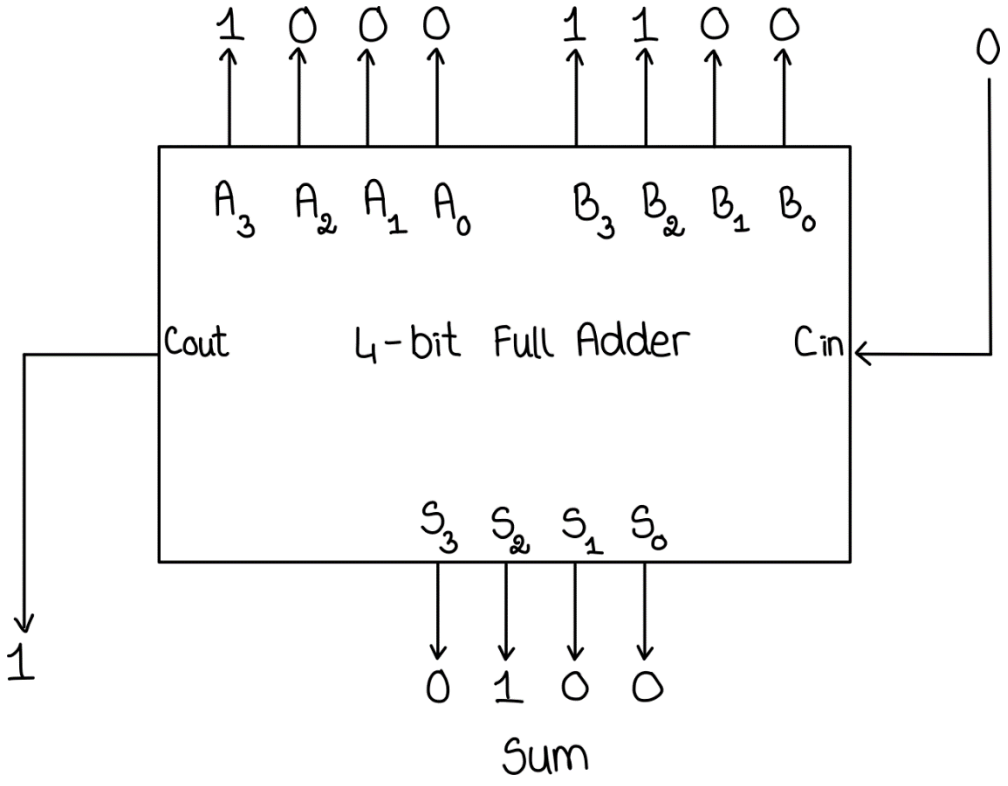
1.1 Pin 16 is VCC.

1.2 Pin 8 is GND.

1.3 For input A (same for B and output S), A3 is the more significant bit.

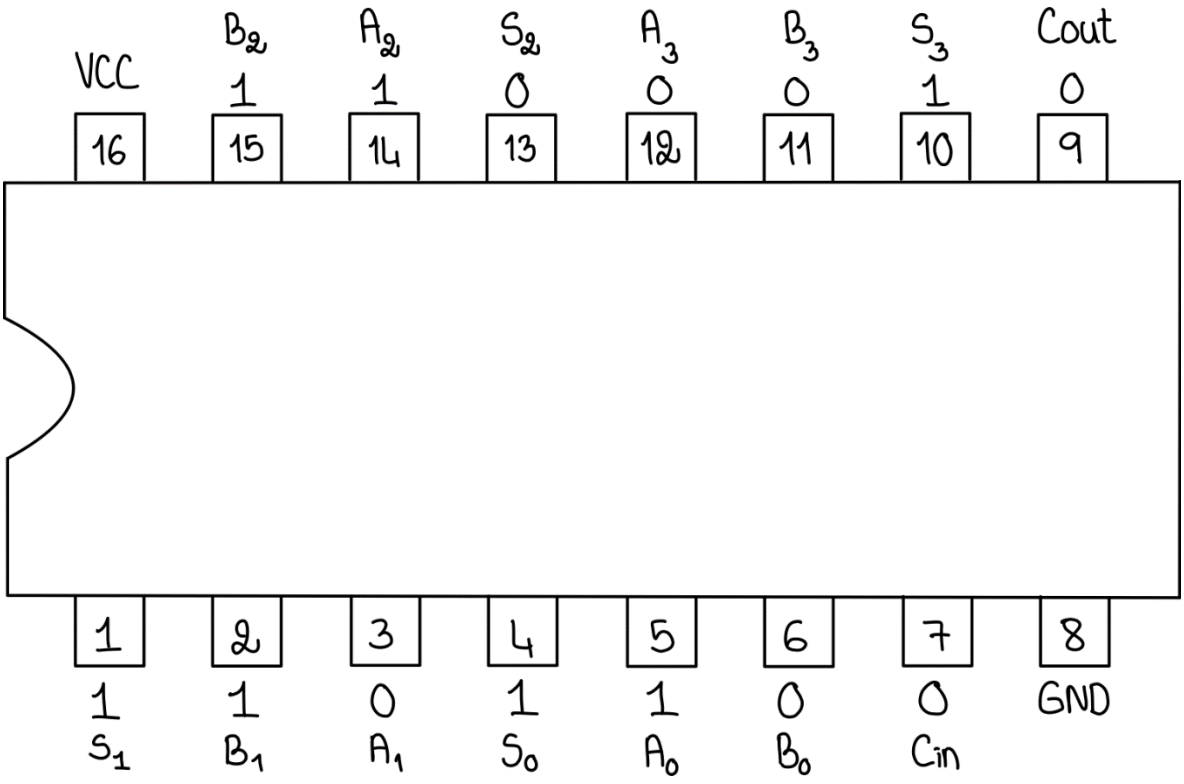
1.4 Compute 8 + 12 using the binary adder using the binary adder logic symbol. Draw an image of the logic symbol and label the appropriate inputs and outputs with a 1 or a 0.

Cin = 0
$A = 8 = 1000_2$
$B = 12 = 1100_2$
$S = 0100_2$
Cout = 1 (Overflow)



1.5 Compute 5 + 6 using the binary adder IC pinout. Draw an image of the IC chip and label the appropriate pins with a 1 and 0. Include VCC and GND.

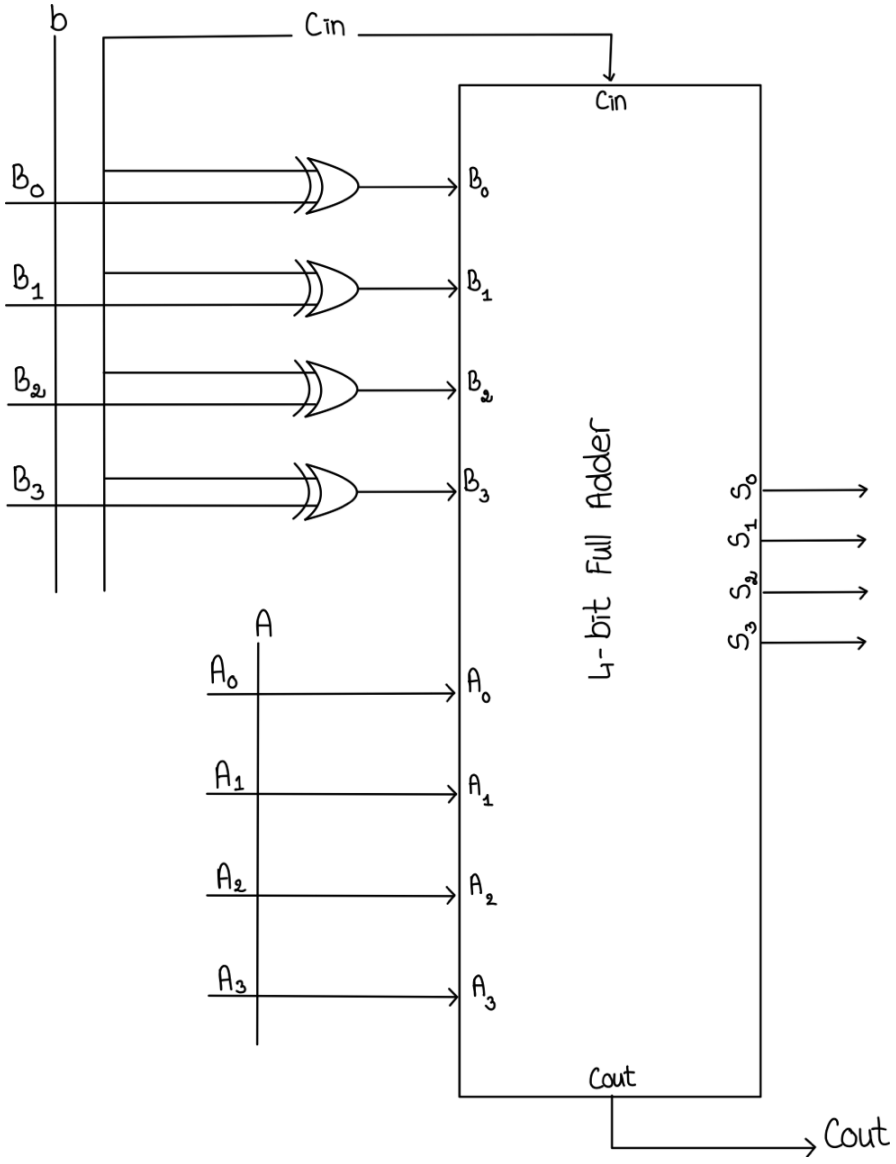
Cin = 0
A = 5 = 0101_2
B = 6 = 0110_2
S = 1011_2
Cout = 0 (No Overflow)



Problem 2. Subtraction with Two's Complement

2.1. To manipulate the bits of B to do both add and subtract is by using XOR gate between Cin and B. If Cin=0 or the remain is the same, then it does addition. If Cin=1 or all B's bits are flipped, then it does subtraction.

2.2. Draw the logic diagram (not circuit diagram) of the 4-bit adder/subtractor. For the Full Adder, use the logic symbol in the first page. A logical diagram should contain block notations (such as Full Adder, D Flip-Flop, Decoder, Multiplexer) and gate symbols (such as AND, OR, and NOT).



Problem 3. 1-Digit BCD Full Adder

Learn about Binary Coded Decimal. Check the logic behind a 1-digit BCD full adder. Come up with a truth table and logic diagram for the BCD full adder. (Note : You have to implement the same question in the lab). A logical diagram should contain block notations (such as Full Adder, D Flip-Flop, Decoder, Multiplexer) and gate symbols (such as AND, OR, and NOT).

Truth Table

Decimal	Binary Sum					BCD Sum				
	K	Z_8	Z_4	Z_2	Z_1	C	S_8	S_4	S_2	S_1
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	1	0	1	0
11	0	1	0	1	1	1	1	0	1	1
12	0	1	1	0	0	1	1	1	0	0
13	0	1	1	0	1	1	1	1	0	1
14	0	1	1	1	0	1	1	1	1	0
15	0	1	1	1	1	1	1	1	1	1
16	1	0	0	0	0	1	0	0	0	0
17	1	0	0	0	1	1	0	0	0	1
18	1	0	0	1	0	1	0	0	1	0
19	1	0	0	1	1	1	0	0	1	1

Logic Diagram