

Group 36

Dipam Sen (24CS10059)
Mitali Laddha (24CS10111)

To design a 4-bit adder/subtractor using IC 7483 (TTL 4-bit adder).

- Breadboard
- IC 7483 (TTL 4-bit adder)
- IC 7486 (TTL Quad 2-input XOR gate)
- Wires, wire cutter, tweezers

IC 7483 provides a 4-bit adder. So, we can add two 4-bit numbers using it. (We can assume the inputs to be encoded in 2's complement form, then the output will be in 2's complement form as well.)

To perform subtraction of two 4-bit numbers ($A - B$), we need to take the 2's complement of B and add it to A . The 2's complement of a number can be obtained by inverting the bits and adding 1. So, we need to conditionally invert the bits of B (if we want to perform a subtraction). Also in order to add 1 to the output, we will use the carry-in input of the adder.

Thus, to realise an adder/subtractor, we can use an external input S which indicates subtraction. Then, we can use XOR gates to conditionally invert the bits of B if $S = 1$, and we can connect S to the carry-in input of the adder to add 1 when $S = 1$.

	A_3	A_2	A_1	A_0
$+B_3$	B_2	B_1	B_0	
C_{out}	O_3	O_2	O_1	O_0

Figure 1: Using IC 7483 (4-bit adder) to add two 4-bit numbers

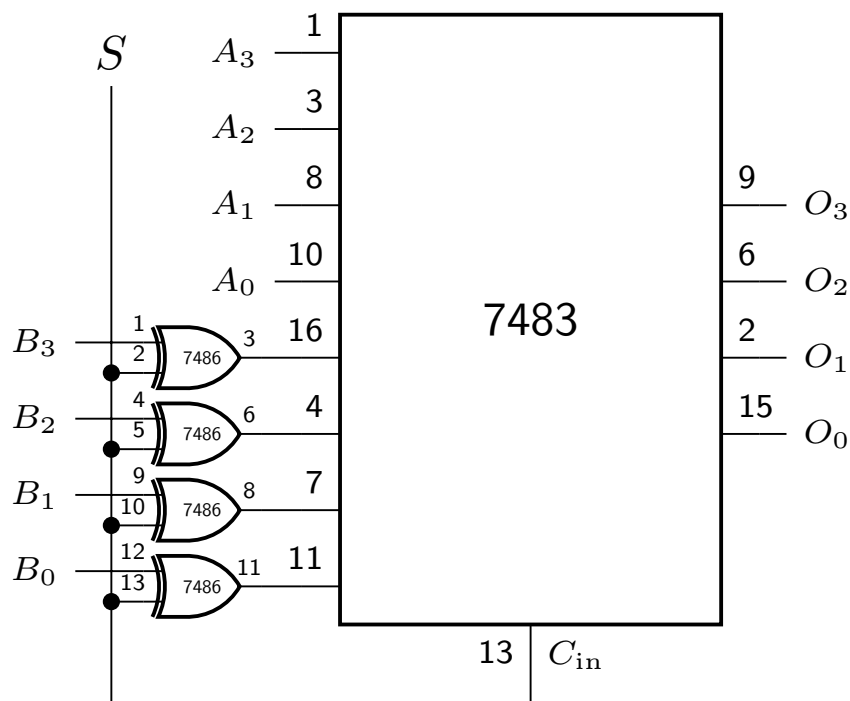


Figure 2: Using IC 7483 (4-bit adder) to design an adder/subtractor

Procedure

1. Connect the circuit as shown in the diagram using IC 7483. Connect the two 4-bit inputs and the S input to the circuit.
2. Connect the 4-bit output to the output displays.
3. Verify the working of the circuit by checking if it correctly adds or subtracts the two 4-bit numbers based on the value of S .

Observations

A	B	S	A_3	A_2	A_1	A_0	B_3	B_2	B_1	B_0	O_3	O_2	O_1	O_0	O
3	4	+	0	0	1	1	0	1	0	0	0	1	1	1	7
6	7	-	0	1	1	0	0	1	1	1	1	1	1	1	-1
-3	-5	+	1	1	0	1	1	0	1	1	1	0	0	0	-8
-8	-2	-	1	0	0	0	1	1	1	0	1	0	1	0	-6

Table 1: Observation table

Result

We have successfully designed a 4-bit adder/subtractor using IC 7483. The circuit correctly adds or subtracts two 4-bit numbers based on the value of S .