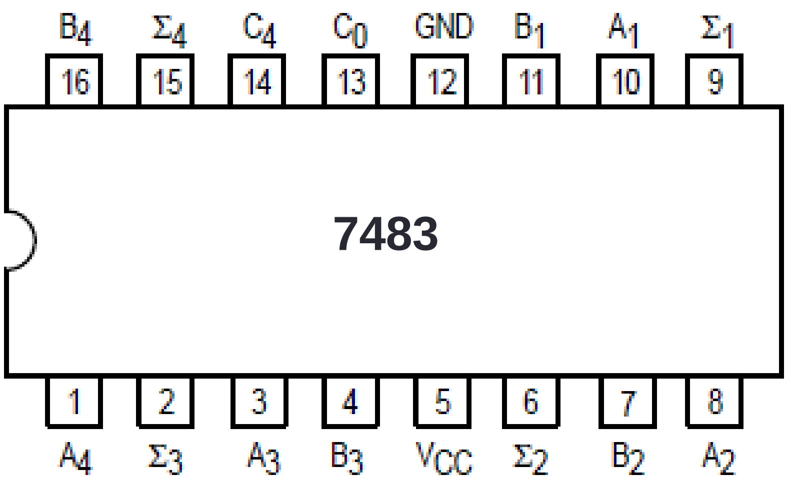
EXP. NO. 5
2'S COMPLEMENT ADDER-SUBTRACTOR

Full-Adder IC 7483

- inputs are A, B, and CI.
- outputs are S and CO



$A_1 - A_4$	Operand A Inputs
$B_1 - B_4$	Operand B Inputs
C_0	Carry Input
$\Sigma_1 - \Sigma_4$	Sum Outputs (Note b)
C_4	Carry Output (Note b)

Addition and subtraction operations

Using XOR gate properties:

- 1- Mode M=1 : $x \oplus 1 = \bar{x}$, the carry in (Ci) =1, and the
- output = A + (2's complement of B), we have **subtraction operation**

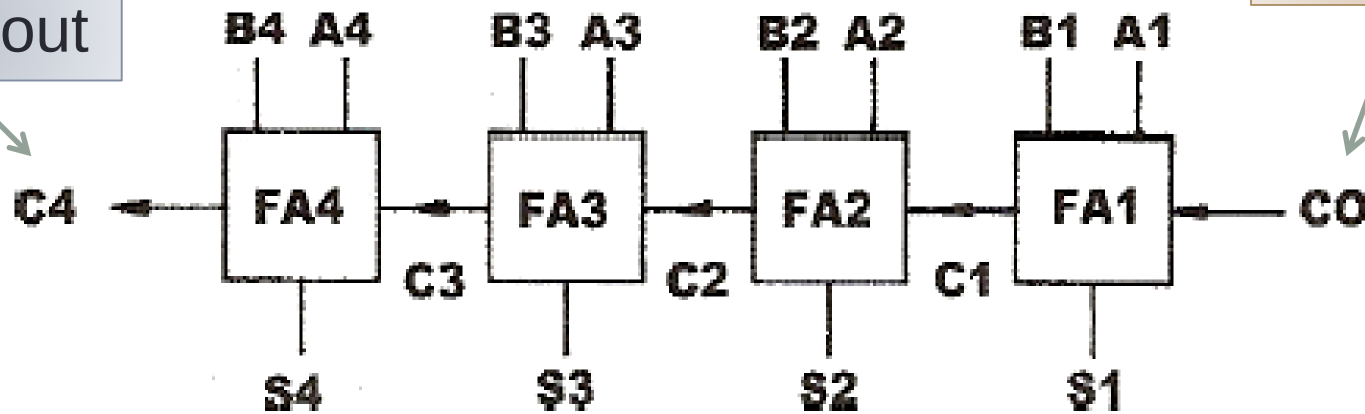
- 2- Mode M=0 : $x + 0 =$ x , the carry in (Ci) =0, and the
- output = A + B, we have ***addition operation***

four bit binary parallel adder

Inputs two words (each 4-bit0

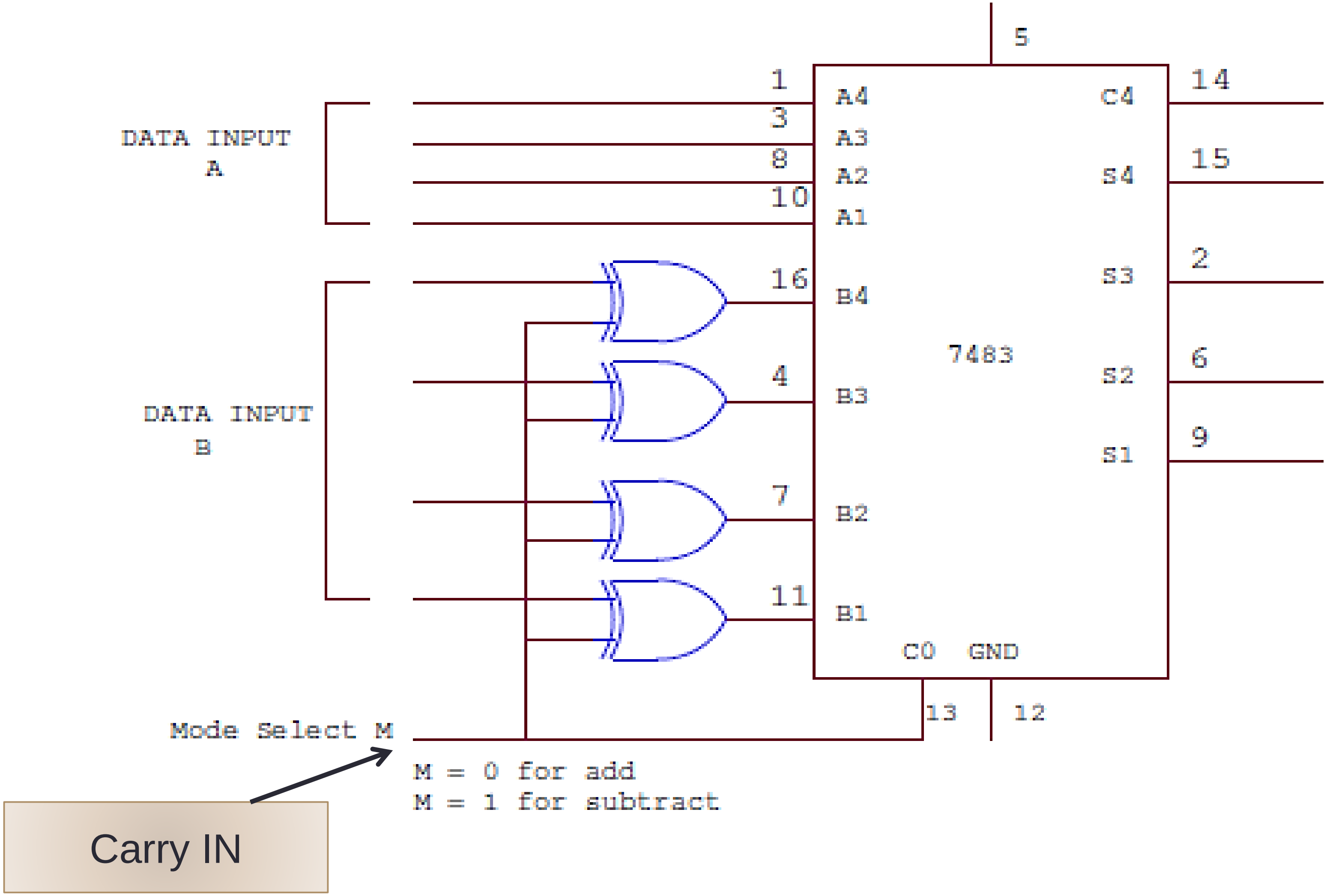
Carry-in

Carry-out



Output (SUM)

Adder-Subtractor using IC 7483



Example: Given the two binary numbers X = 1010100 and Y = 1000011, perform the subtraction (a) X - Y *and* (b) Y - X using 2's complements

(a)

$X =$	1010100
2's complement of $Y =$	+ 0111101
Sum =	10010001
Discard end carry $2^7 =$	− 10000000
Answer: $X - Y =$	0010001

(b)

$Y =$	1000011
2's complement of $X =$	+ 0101100
Sum =	1101111

There is no end carry.

Answer: $Y - X = -(\text{2's complement of } 1101111) = -0010001$

Example: Given the two binary numbers X = 1010100 and Y = 1000011, perform the subtraction (a) X - Y *and* (b) Y - X **using 1's complements**

(a) $X - Y = 1010100 - 1000011$

$X =$	1010100
1's complement of $Y =$	+ 0111100
Sum =	10010000
End-around carry	+ 1
Answer: $X - Y =$	0010001

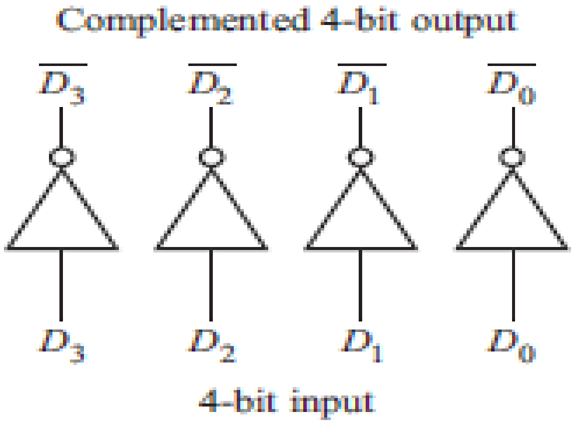
(b) $Y - X = 1000011 - 1010100$

$Y =$	1000011
1's complement of $X =$	+ 0101011
Sum =	1101110

There is no end carry.

Answer: $Y - X = -(1\text{'s complement of } 1101110) = -0010001$

Circuit for 1's complement (4-bit)



Subtractor circuit