Michael Maxwell 9/19/23

A two bit adder can be constructed from two one bit adde

From the table below, we can define a boolean expression

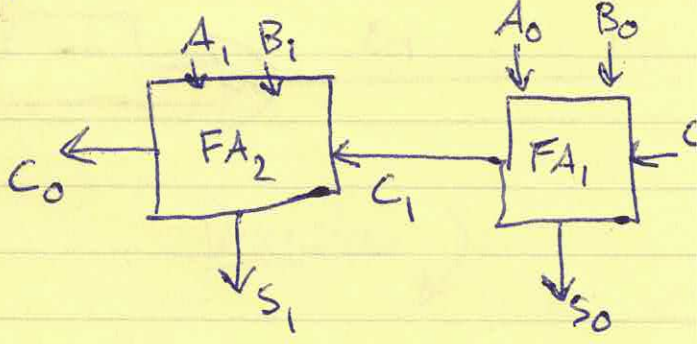
A_0	A_1	B_0	B_1	C_i	S_0	S_1	C_0
0	0	0	0	0	0	0	0
1	0	0	0	0	1	0	0
0	1	0	0	0	0	1	0
1	0	0	1	0	0	1	0
0	1	0	0	1	1	0	0
0	1	1	0	0	1	1	0
1	0	1	0	0	1	1	0
1	1	1	1	1	1	1	1

$$S_0 = A_0 \oplus B_0 \oplus C_i$$

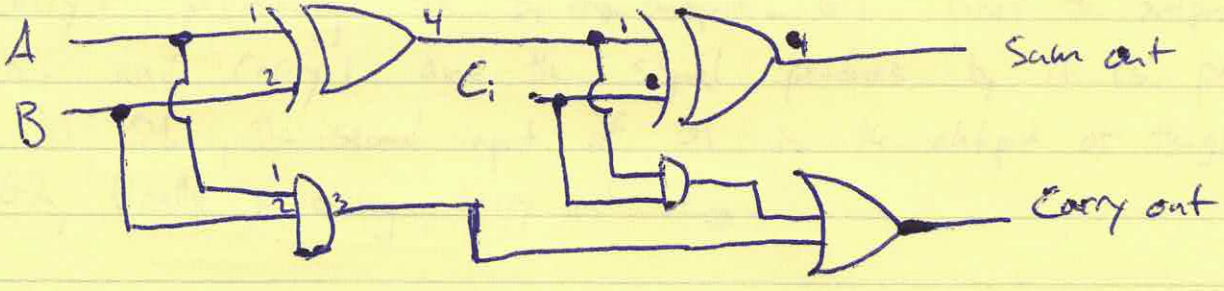
$$C_1 = A_0B_0 + B_0C_i + A_0C_i$$

$$S_1 = A_1 \oplus B_1 \oplus C_1$$

$$C_0 = A_1B_1 + B_1C_1 + A_1C_1$$

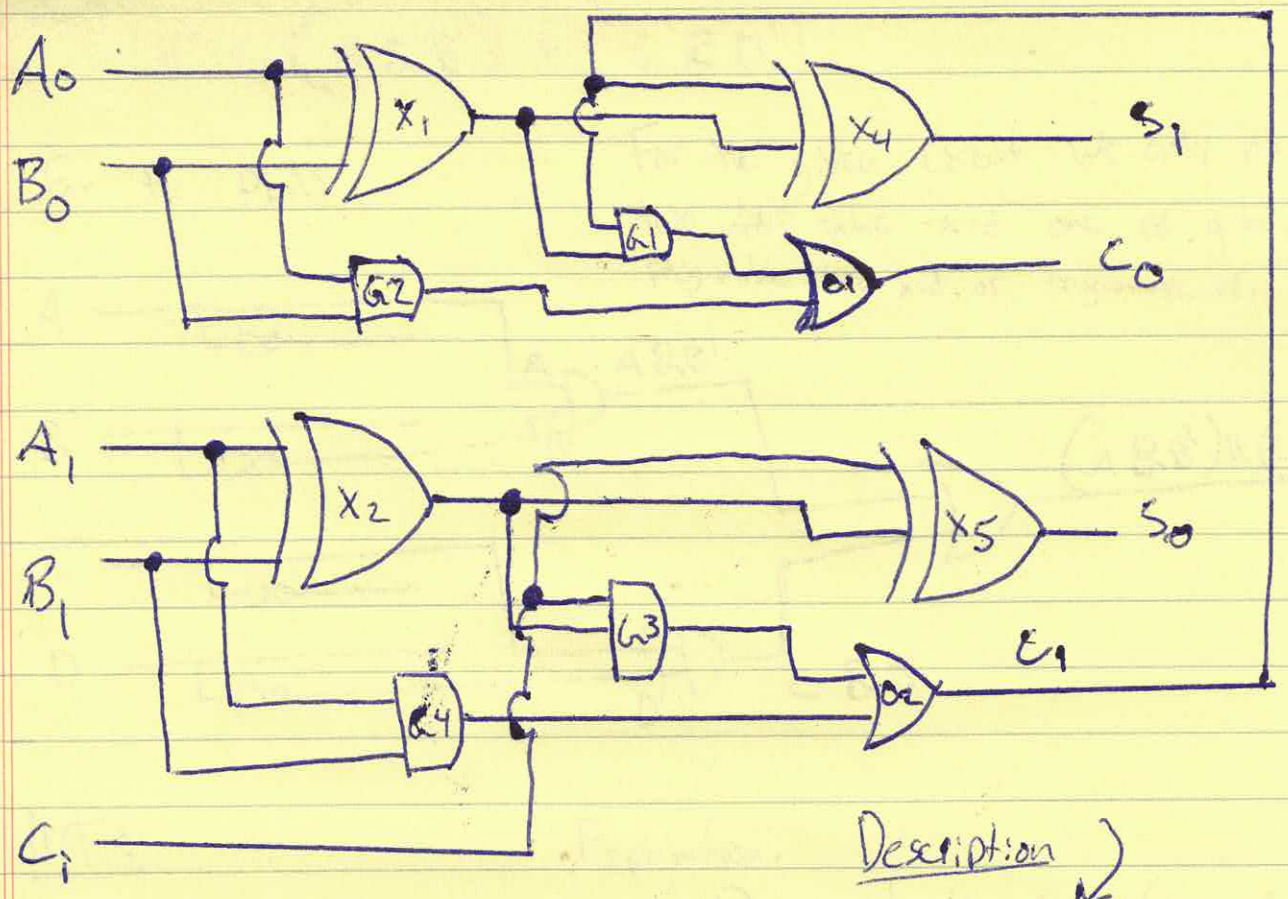


Full adder circuit



We have two inputs A and B and Carry in (C_i) which produces the output Sum and Carry out.

A two bit full adder will look like the following.



Description

The Xor gate X_1 takes the input A_0 and B_0 and xor gate X_2 takes the input A_1 and B_1. The same for g2 and g respectively. X_4 takes the output of the x1 and the output Carry 1, producing the S_1 output. G1 Takes the output X_1 and Carry 1 and the signal produces by it is pass to O1, The second input of O1 is the output of the gate G2, finally producing carry out C_0.

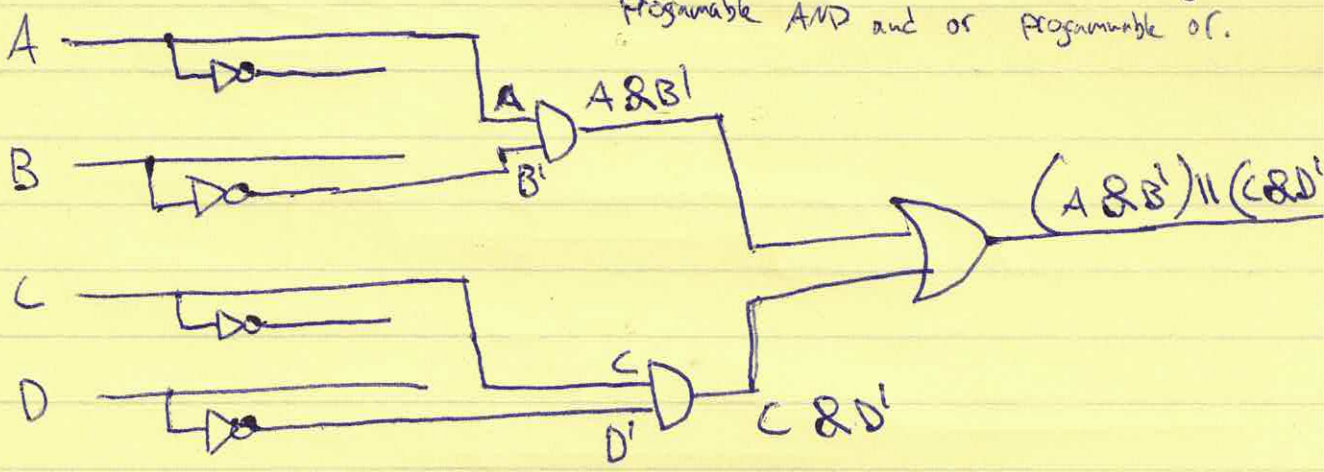
Gate X5 takes the carry in and output of X2 and produces the sum S_0. G3 Takes carry in and Output of X2 and the output of this with G4 is passe to the gate O2 to produce the output Carry 1.

Q2

$$F = (A \& B') \,||\, (C \& D')$$

For the PLA:

For the given circuit we only need two AND gates and one OR gate. Programable AND and or programable or.



LUT:

Explaination:

1) convert to SOP (sum of prod
2) products implemented by AND
3) sums are implemented by OR

F	00-000-0----00-0
D	0-0-0-0-0-0-0-0-
C	00--00--00--00--
B	0000----0000----
A	00000000----------