Pre-Lab

Experiment No. 2 - Comparators, Adders, and Subtractors.

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* Date: 4/5/2023.

* Section: 2.

At first there is the truth table and Boolean equations for the half adder

- Truth table:

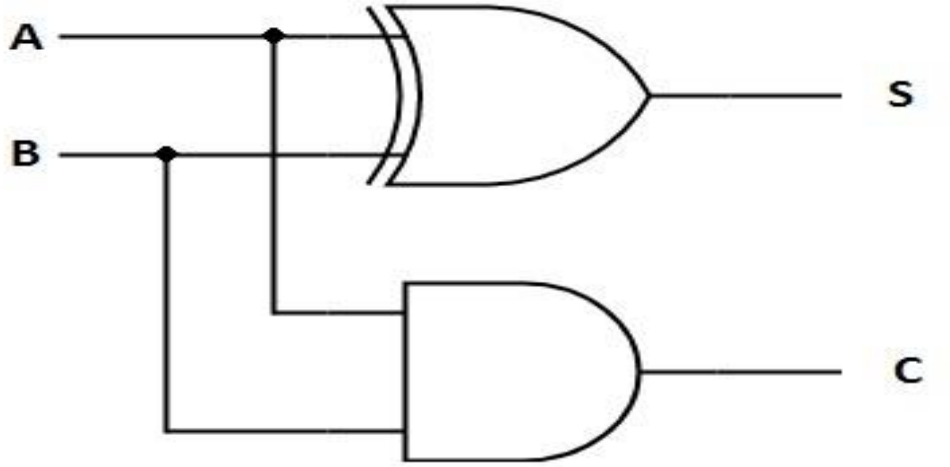
Inputs		Outputs	
A	B	Sum	Carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Boolean equation in min terms:

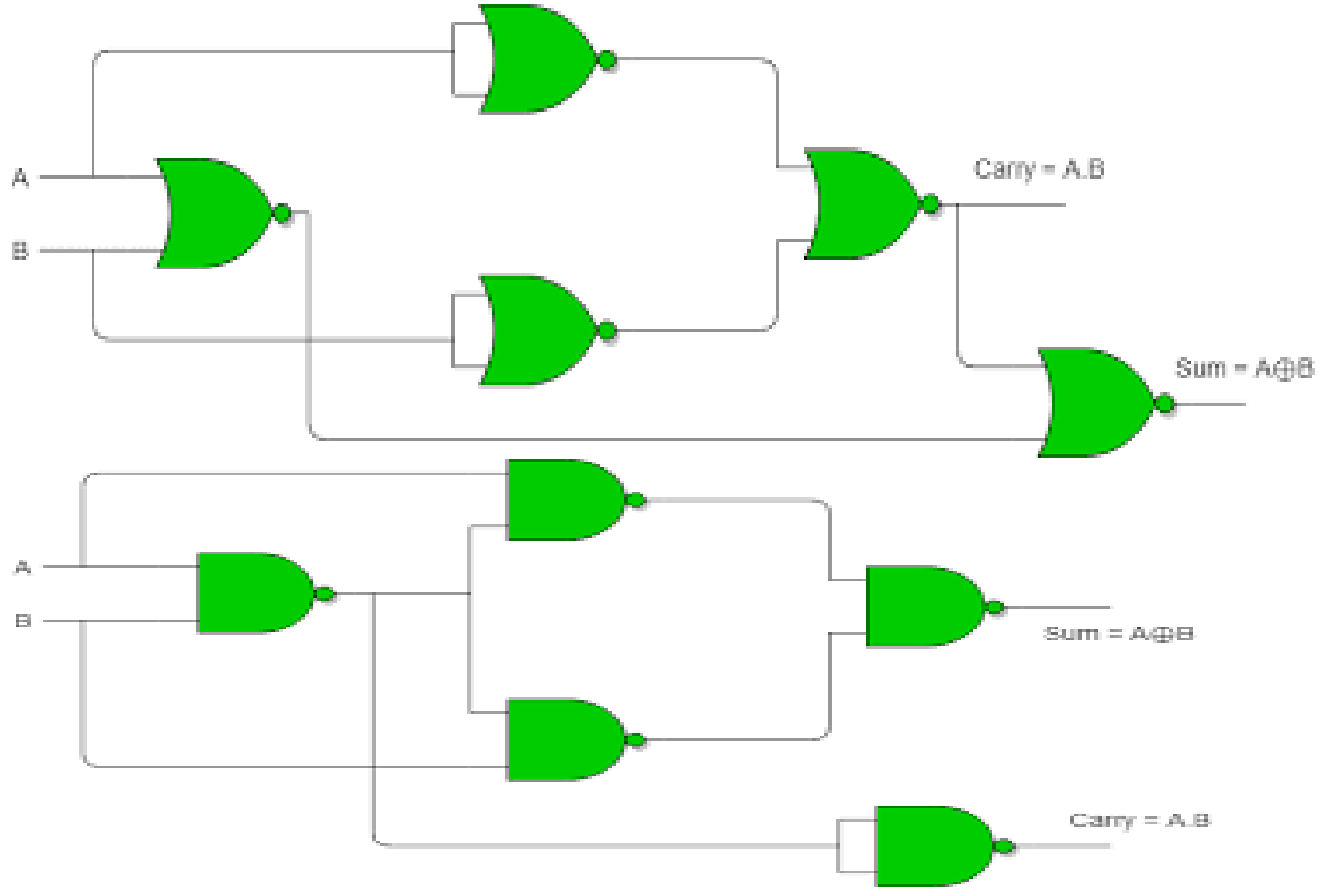
Sum = X’Y +XY’

Carry = XY

Q2: Build half adder using basic gates:



Q3: Build the above circuit using universal gates:



At first there is the truth table and Boolean equations for the full adder:

Truth table:

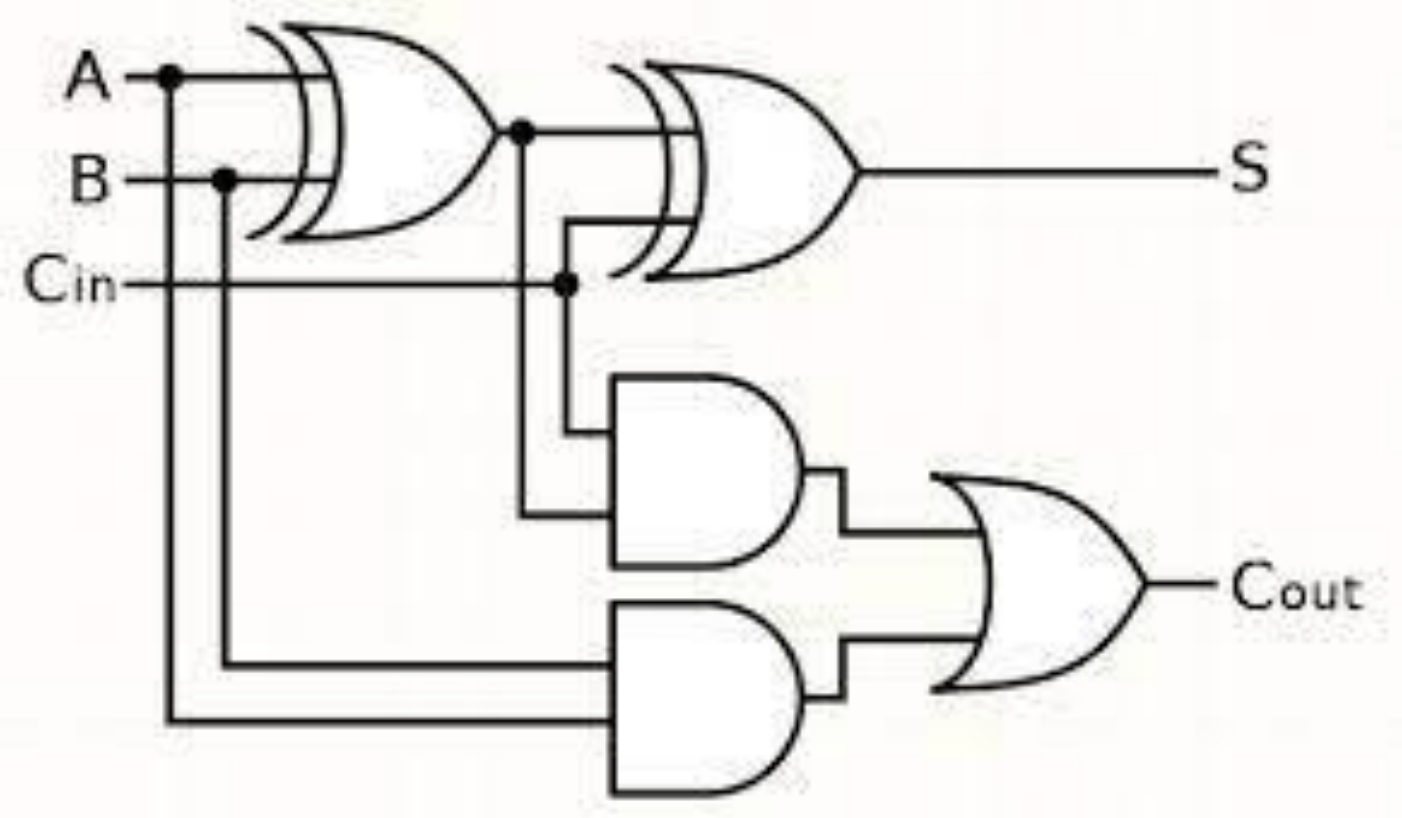
Inputs			Outputs	
A	B	C – IN	Sum	C - Out
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

Boolean equation in min terms:

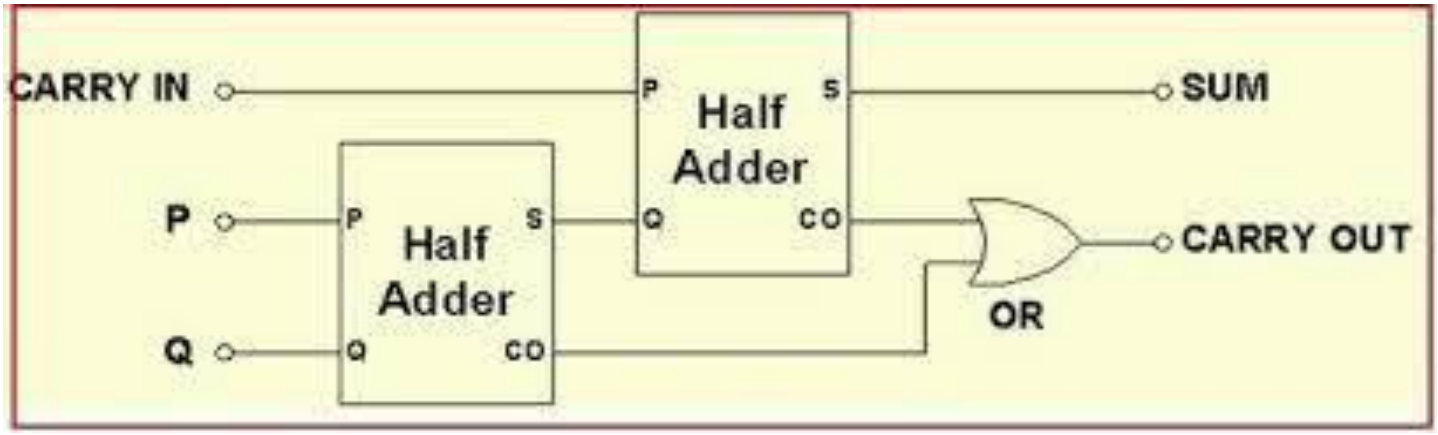
$$Sum = X'Y'C' + X'YC' + XY'C' + XYC$$

$$Carry = XY + YC + XC$$

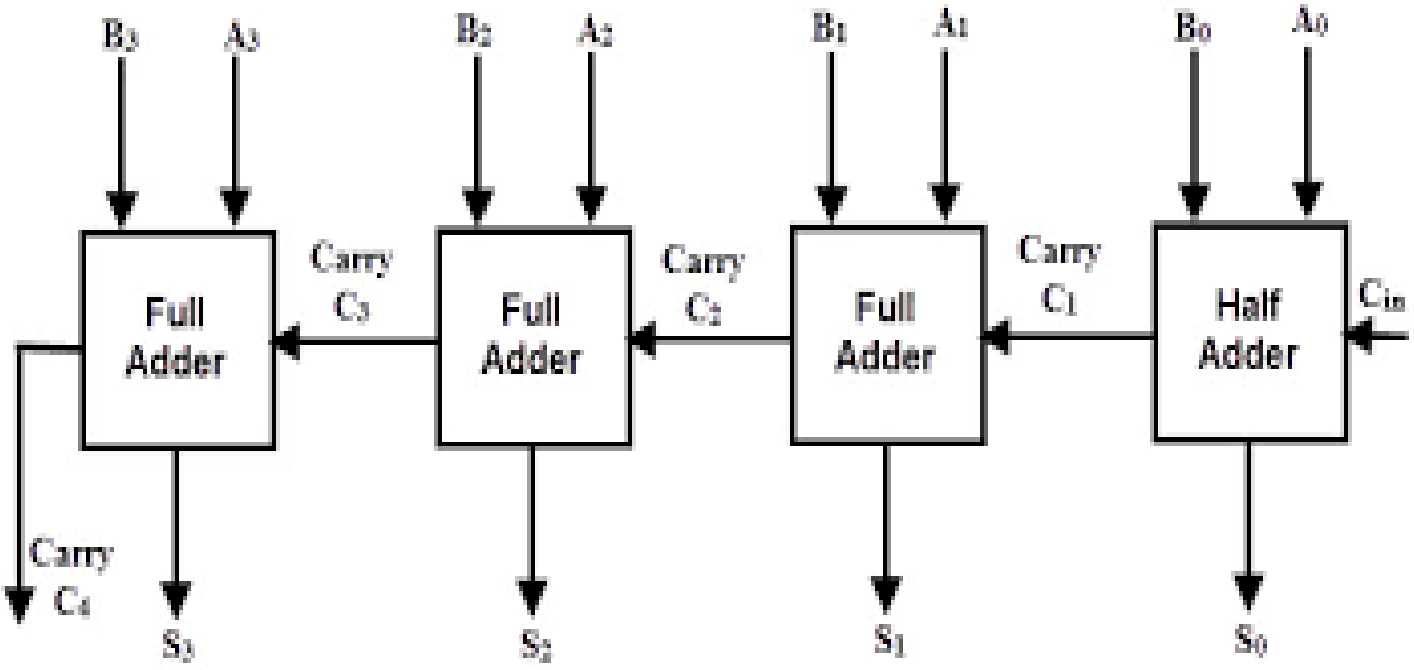
Q4: Build a full adder using basic gates:



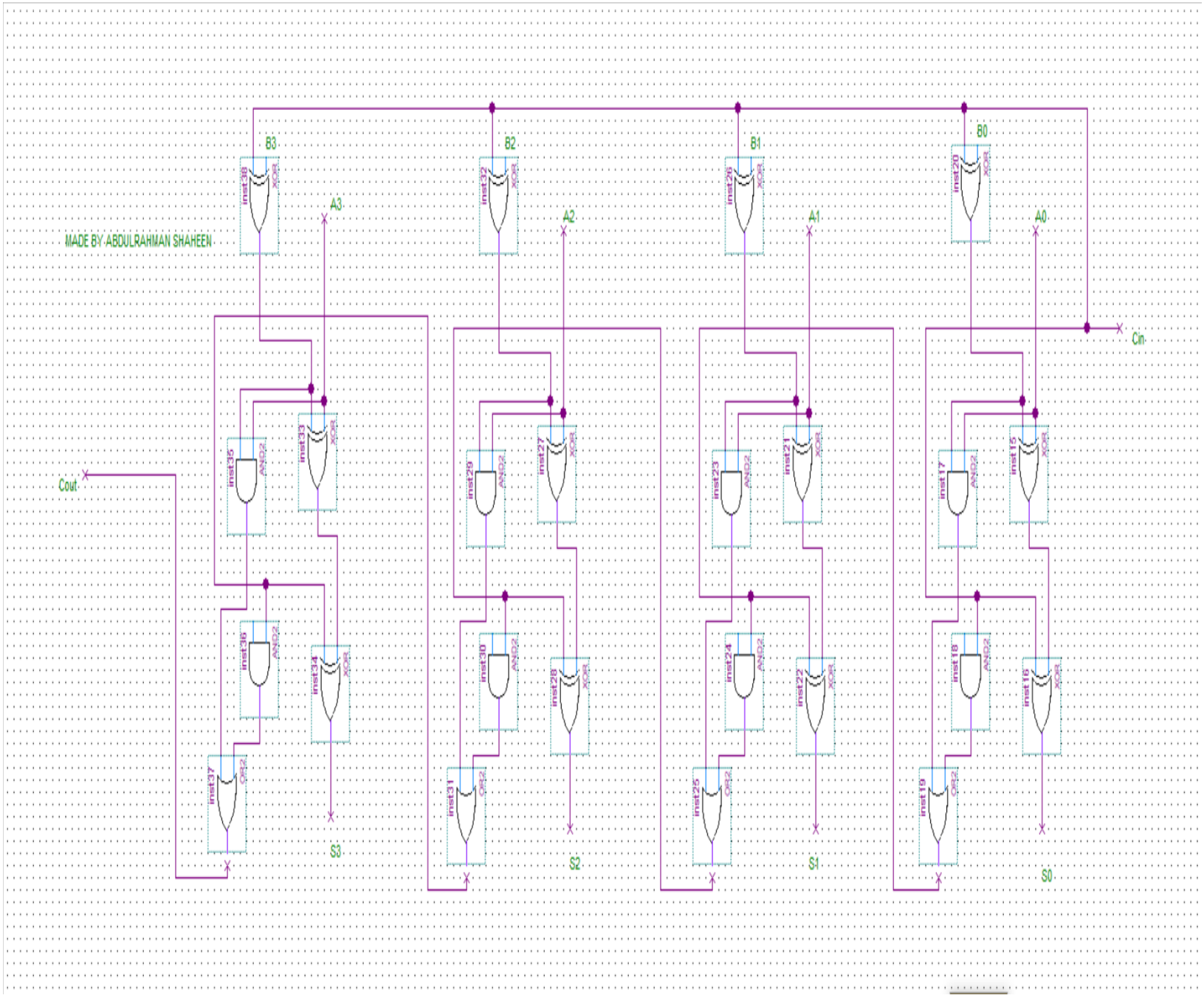
Q5: Build a full adder using half adder and another gate:



Q6: Build a 4-bit adder using a full adder:

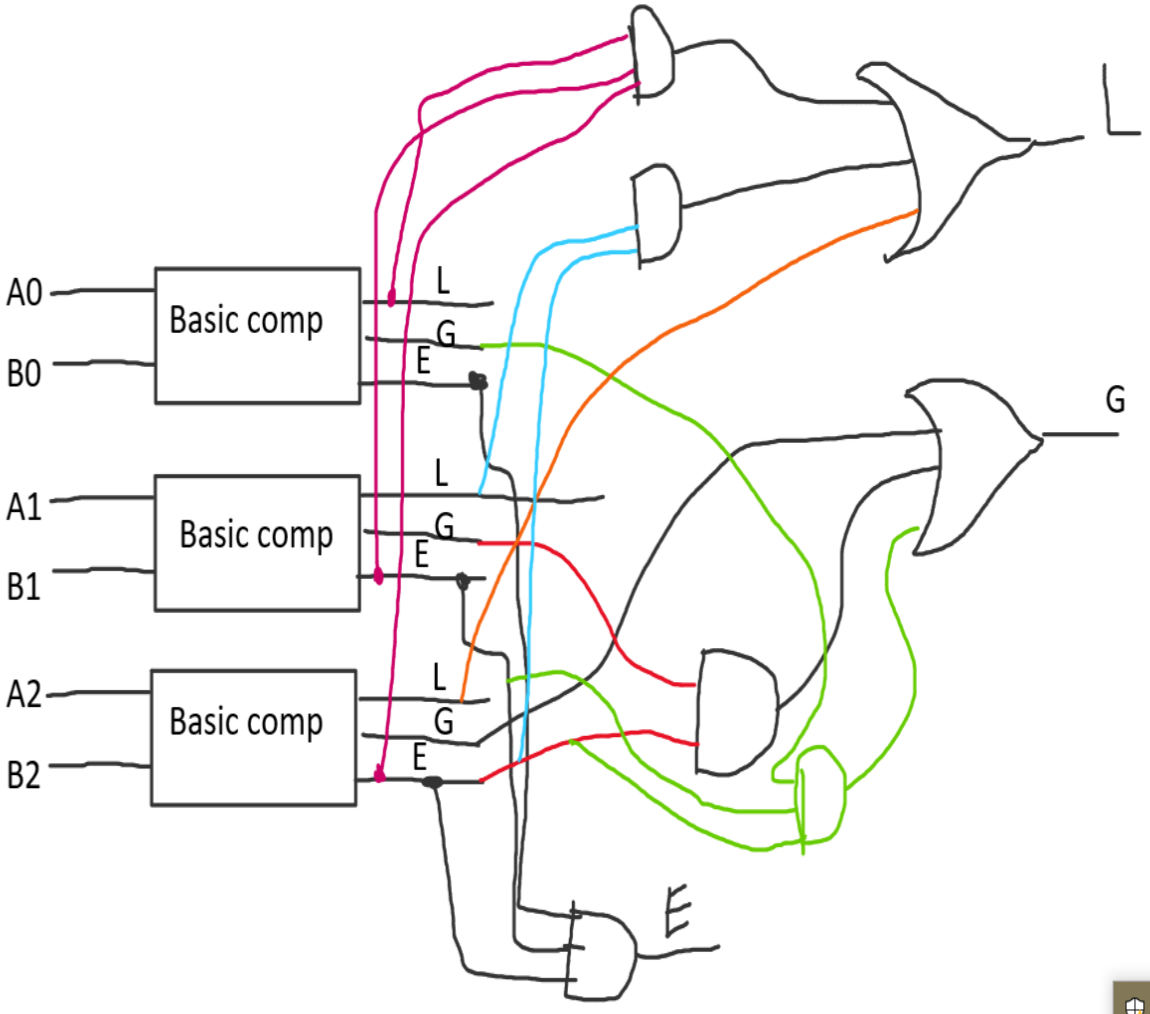


Q7: Build a 4-bit subtractor using basic gates.


MADE BY ABDULRAHMAN SHAHEEN
B3
B2
B1
B0
A3
A2
A1
A0
Cin
Cout
S3
S2
S1
S0
inst38 XOR2
inst32 XOR2
inst26 XOR2
inst20 XOR2
inst35 AND2
inst33 XOR2
inst29 AND2
inst27 XOR2
inst23 AND2
inst21 XOR2
inst17 AND2
inst15 XOR2
inst36 AND2
inst34 XOR2
inst30 AND2
inst28 XOR2
inst24 AND2
inst22 XOR2
inst18 AND2
inst16 XOR2
inst37 OR2
inst31 OR2
inst25 OR2
inst19 OR2

Q1: all sections:

Design a three-bit comparator (using the basic comparator) and hand it out to your TA. (Pre Lab).



Hand out, Design, Boolean function, and truth table of half- and full-adder to your TA. (Pre Lab).

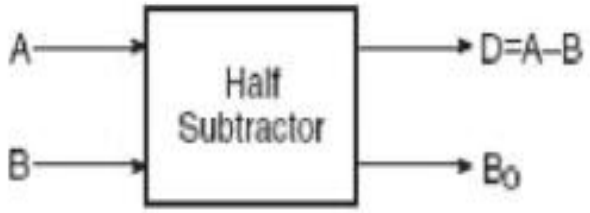
Done already in the previous sections. Q2+Q4

Hand out, Design, Boolean function, and truth table of half- and full-subtractor to your TA. (Pre Lab).

Half subtractor:

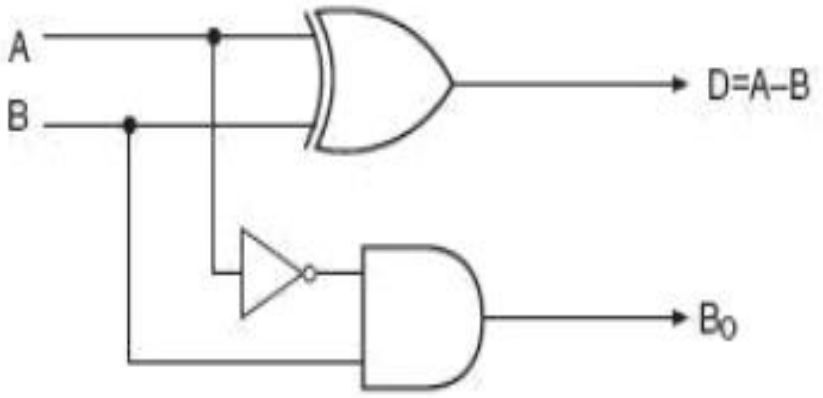
$$D = \overline{A}.B + A.\overline{B}$$

$$B_o = \overline{A}.B$$



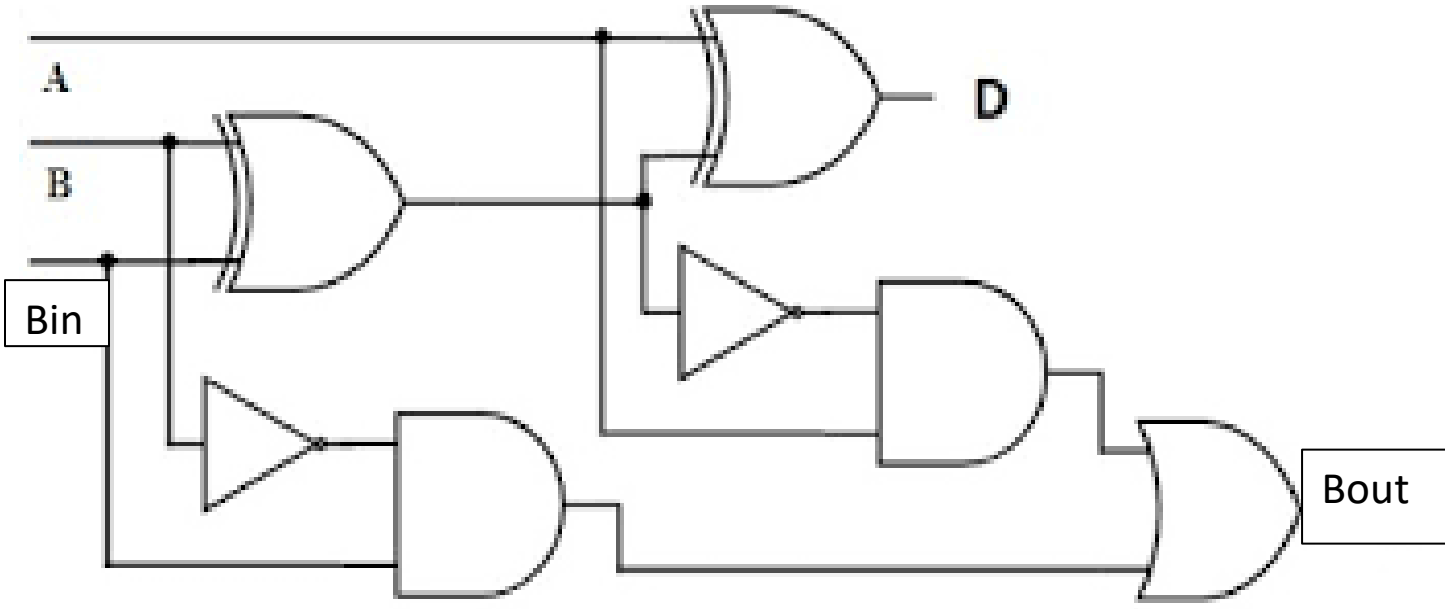
A	B	D	B_O
0	0	0	0
0	1	1	1
1	0	1	0
1	1	0	0

Half Subtractor



full subtractor:

Inputs			Outputs	
A	B	Bin	Diff	Bout
0	0	0	0	0
0	0	1	1	1
0	1	0	1	1
0	1	1	0	1
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1



$D=A \oplus B \oplus C$

$Bout=A'B+A'Bin+BBin$