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BATCH :- D-1

Page No. 1
Date

ASSIGNMENT :- 02.

AIM :-

To realise full adder and full subtractor using a) Basic gates and b) ~~NA~~ Universal gates.

I.C REQUIRED :-

IC 7486 (XOR), IC 7408 (AND), ~~IC 7432~~ IC 7432 (OR), IC 7400 (NAND)

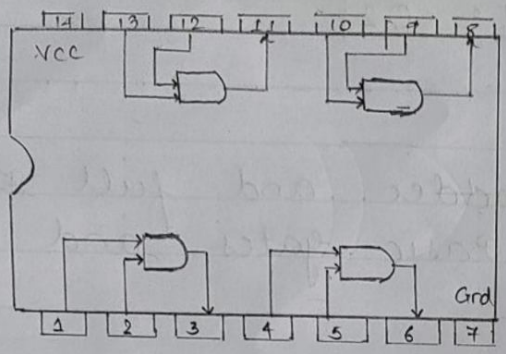
PROCEDURE :-

The following operations could be performed by writing down pin diagrams, Truth Table, K-maps, and expressions of full adder and full subtractor

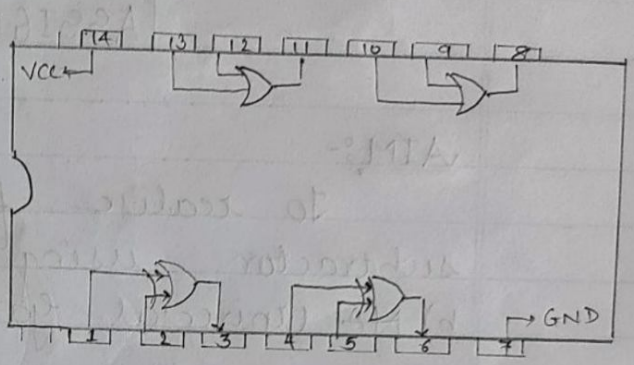
THEORY :-

① The full adder performs addition of two binary digits A and B together with a "carry-in" from a previous addition.
② A full adder has three inputs A, B and "CARRY-IN" which is abbreviated here as 'in' and two output, 'sum' and 'carry out'.
③ The full subtractor performs subtraction bet^n two binary digits A and B with an extra "borrow" from previous subtraction.
④ A full subtractor has three inputs A, B and "BORROW" and two output.

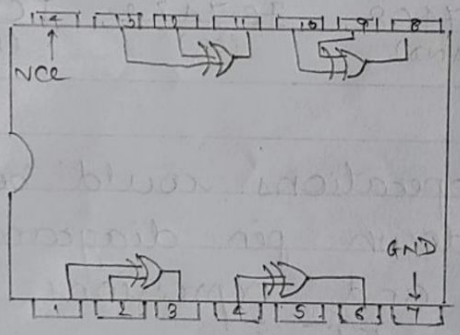
PIN DIAGRAMS:-



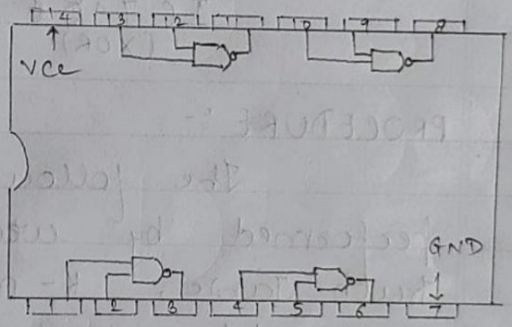
IC 7408 (AND GATE)



IC 7432 (OR GATE)



IC 7486 (XOR GATE)



IC 7400 (NAND GATE)

⑤ Full adder truth table

INPUT			OUTPUT	
A	B	Cin	Sum	Cout
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

⑥ Full subtractor truth table

INPUT			OUTPUT	
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

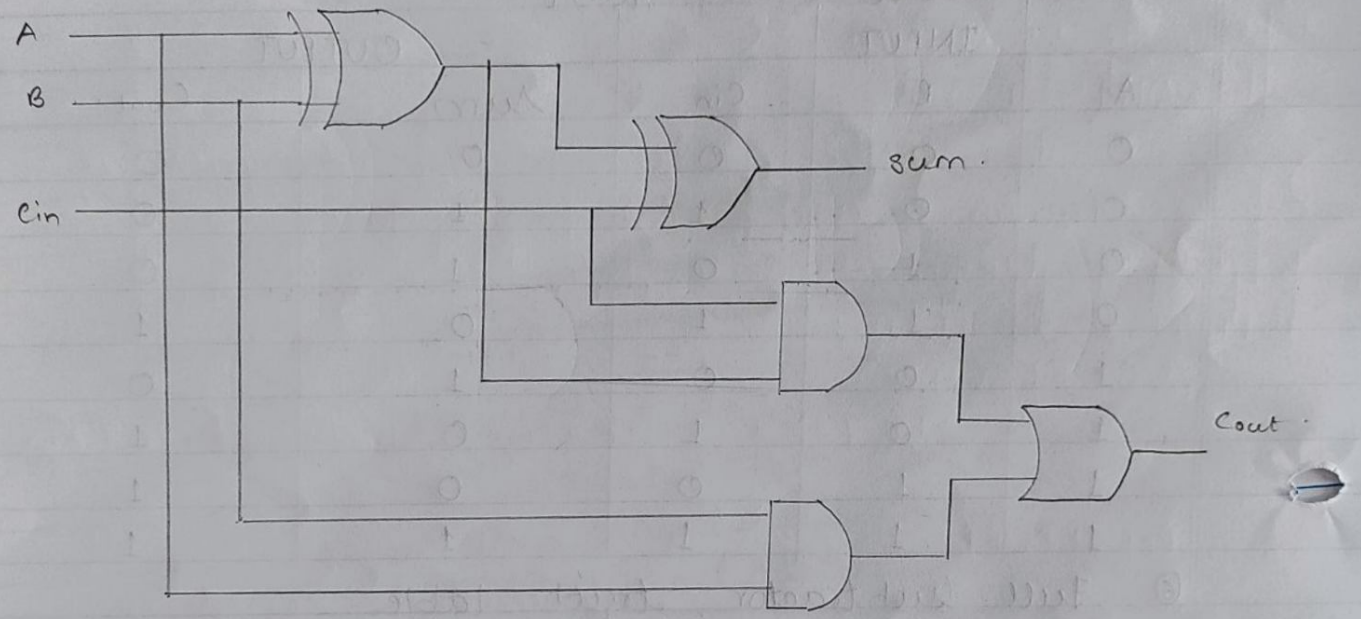
a) FULL ADDER USING BASIC GATES & AND UNIVERSAL GATES

① K-MAP for sum :-

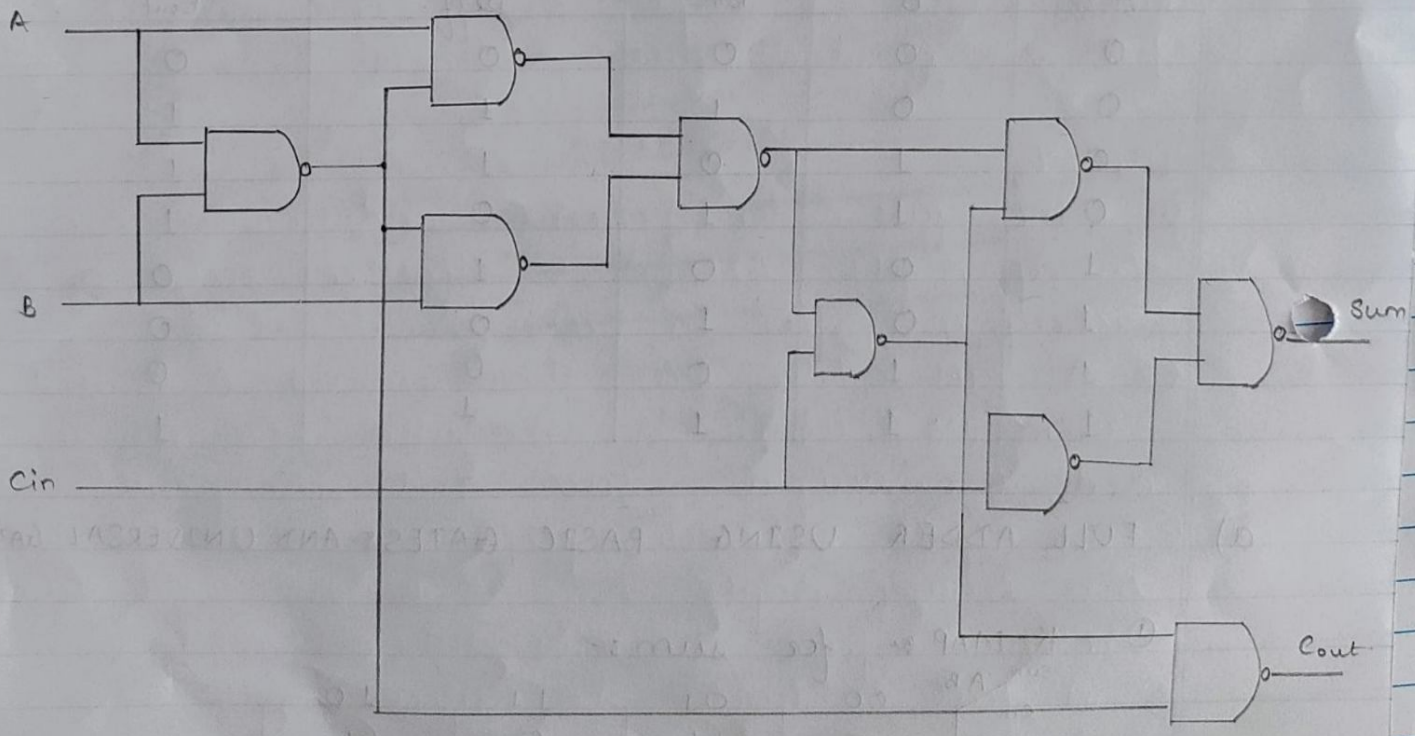
Sum / AB / Cin	00	01	11	10
0	0	(1)	0	(1)
1	(1)	0	(1)	0

Sum = $\bar{A}\bar{B}Cin + \bar{A}B\bar{C}in + ABCin + A\bar{B}\bar{C}in$

FULL ADDER THROUGH BASIC GATES:-



FULL ADDER USING NAND GATES:-



Page No. 3
Date

$Sum = C_{in}(\bar{A}\bar{B} + AB) + \bar{C}_{in}(\bar{A}B + \bar{B}A)$

$= C_{in} + \bar{C}_{in}(A \oplus B)$

$= C_{in} \oplus (A \oplus B)$

② K-MAP for Cout :-

Cout / Cin \ AB	00	01	11	10
0	0	0	1	0
1	0	1	1	1

$C_{out} = AB + AC_{in} + BC_{in}(A + \bar{A})$

$= \bar{A}BC_{in} + A\bar{B}C_{in} + AB\bar{C}_{in} + ABC_{in}$

$= AB + C_{in}(\bar{A}B + A\bar{B})$

$= AB + C_{in}(A \oplus B)$

b) FULL SUBTRACTOR USING BASIC GATES AND UNIVERSAL GATES:

a) K-MAP FOR DIFFERENCE

Deff. / A \ B Bin	00	01	11	10
0	0	(1)	0	(1)
1	(1)	0	(1)	0

$Deff = \bar{A}\bar{B}B_{in} + A\bar{B}\bar{B}_{in} + \bar{A}B\bar{B}_{in} + ABB_{in}$

$= B_{in}(\bar{A}\bar{B} + AB) + \bar{B}_{in}(A\bar{B} + \bar{A}B)$

$= B_{in}(\overline{A \oplus B}) + \bar{B}_{in}(A \oplus B)$

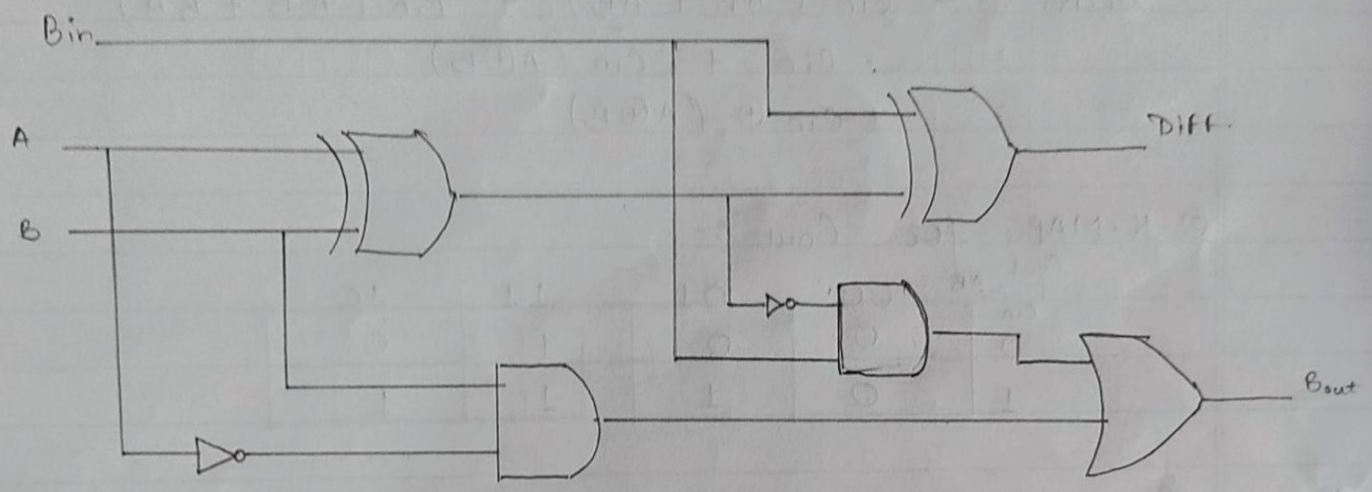
$= \overline{B_{in}(A \oplus B)} + \bar{B}_{in}(A \oplus B)$

$= B_{in} \oplus (A \oplus B)$

b) K-MAP FOR Bout :-

Bout / A \ BBin	00	01	11	10
0	0	1	1	1
1	0	0	1	0

FULL SUBTRACTOR TROUGH BASIC GATES:-



$B_{out} = \bar{A}\bar{B}B_{in} + \bar{A}B\bar{B}_{in} + \bar{A}BB_{in} + ABB_{in}$

$= \bar{A}B_{in}(B+\bar{B}) + \bar{A}B(B_{in} + \bar{B}_{in}) + BB_{in}(A+\bar{A})$

$= \bar{A}B_{in} + \bar{A}B + BB_{in}.$

CONCLUSION :-

By following above procedures, truth tables, k-maps and expressions we were able to decived desired results.