

Minimization of Boolean Functions – Reference Solution

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Pre-Lab Tasks:

1. Write the Boolean expression of the following two functions. Simplify the expression using algebraic manipulation and draw the logic diagram.

(a) $F(A, B, C) = \sum(2, 3, 7)$

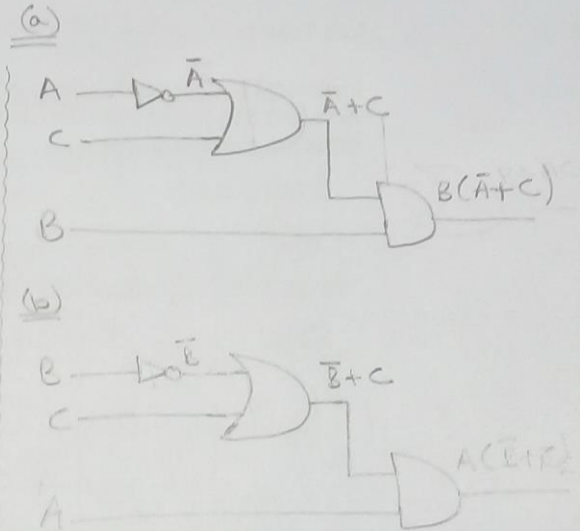
(b) $G(A, B, C) = \sum(4, 5, 7)$

(a)

$$\begin{aligned}\sum(2, 3, 7) &= m_2 + m_3 + m_7 \\ &= \bar{A}B\bar{C} + \bar{A}BC + ABC \\ &= \bar{A}B\bar{C} + BC(\bar{A} + A) \\ &= \bar{A}B\bar{C} + BC(1) \\ &= B(\bar{A}\bar{C} + C) \\ &= B((C + \bar{A})(C + \bar{C})) \\ &= B((C + \bar{A})(1)) \\ &= B(\bar{A} + C)\end{aligned}$$

(b)

$$\begin{aligned}\sum(4, 5, 7) &= m_4 + m_5 + m_7 \\ &= A\bar{B}\bar{C} + A\bar{B}C + ABC \\ &= A\bar{B}(\bar{C} + C) + ABC \\ &= A\bar{B}(1) + ABC \\ &= A\bar{B} + ABC \\ &= A(\bar{B} + BC) \\ &= A((\bar{B} + B)(\bar{B} + C)) \\ &= A(1)(\bar{B} + C) \\ &= A(\bar{B} + C)\end{aligned}$$



2. Mention the number of literals and gates needed for implementing the above function in hardware.

(a) No. of literals = 3
No. of gates needed = 3

(b) No. of literals = 3
No. of gates needed = 3

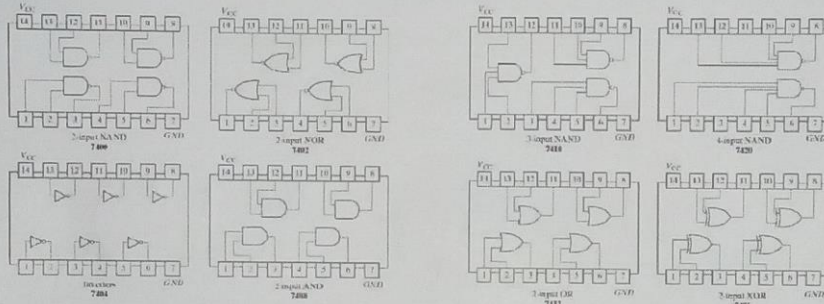


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Lab Tasks:

Lab Task 1:

Implement the Boolean functions in hardware you simplified in your Pre-Lab Task. Make truth table and **Schematic**. Mention what and how many gates you would be using? The following gates are available to you.

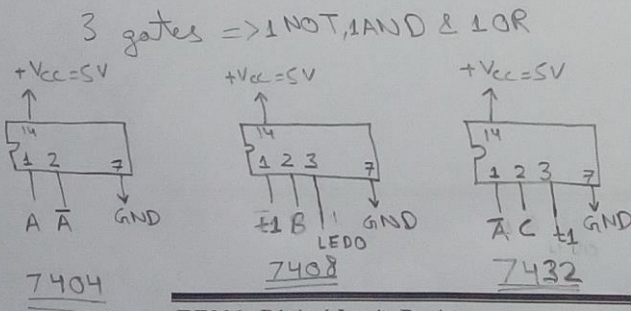


Truth Table:

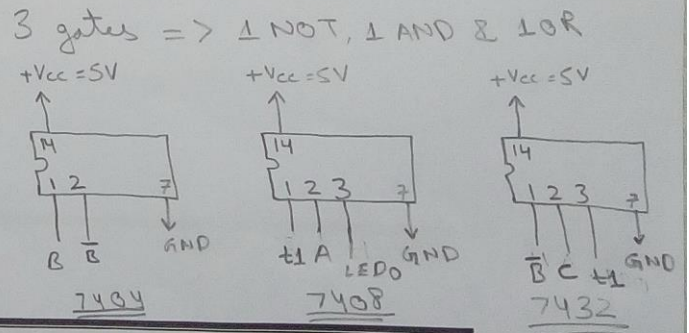
A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

A	B	C	G
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

Schematic:



EE221: Digital Logic Design



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A → SW2 F → LED0
B → SW1 t1 → $\bar{A} + C$
C → SW0

A → SW2 G → LED0
B → SW1 t1 → $\bar{B} + C$
C → SW0