Sept 18, 2017

K-map

visual approach to simplification

2-variable ✗ (3-variable / 4-variable) 5-variable ✗

~~Algebraic Simplification~~ ⇓ → scale →

Step 1: Empty K-maps

3-variable 4-variable

A \ BC	=00	=01	=11	=10
=0	0	1	3	2
=1	4	5	7	6

$2^3 = 8$ cell

1 cell / minterm

	A	B	C	
$A'B'C'$	0	0	0	m_0
$A'B'C$	0	0	1	m_1
$A'BC'$	0	1	0	m_2
$A'BC$	0	1	1	m_3
$AB'C'$	1	0	0	m_4
$AB'C$	1	0	1	m_5
ABC'	1	1	0	m_6
ABC	1	1	1	m_7

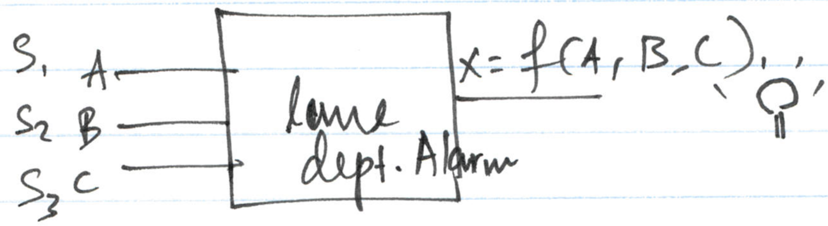
TT

Problem statement:

Three sensor signals are fed into a System. When "majority" of the sensor inputs are "true", turn on the alarm.

(1)

Sept 18, 2017



	A	B	C	$X = f(A, B, C)$
m_0	0	0	0	0
m_1	0	0	1	0
m_2	0	1	0	0
m_3	0	1	1	1
m_4	1	0	0	0
m_5	1	0	1	1
m_6	1	1	0	1
m_7	1	1	1	1

Step 1
Problem Statement
⇓
Step 2
Truth Table
⇓

$X = f(A, B, C) = \sum m_3, m_5, m_6, m_7$

4 terms × 3 = 12 literals

$= \sum (3, 5, 6, 7)$

Step 3:

A \ BC	00	01	11	10
0			1	
1		1	1	1

"plot" minterms

group of 8 1's? No
group of 4's? No
group of 2's? g1, g2, g3

Cover All the 1's with minimal # of groups

overlapping

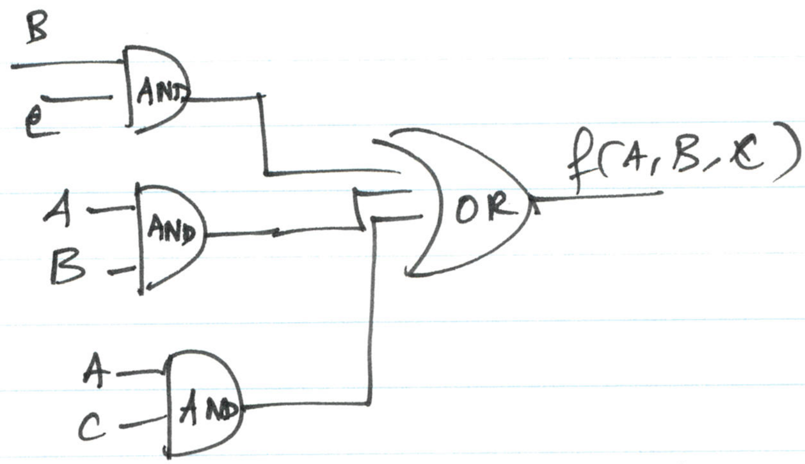
Step 4: Write the simplified terms:

$g1 = BC \qquad g2 = AB \qquad g3 = AC$

Sept 18, 2017

$$f(A, B, C) = BC + AB + AC$$

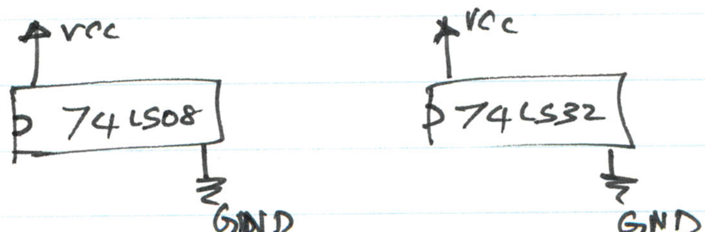
Step 5:



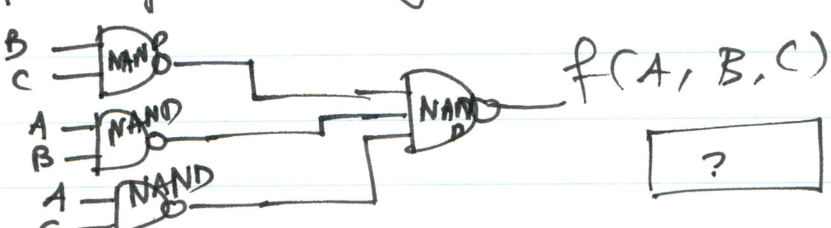
Step 6: Implement it using ICs?

What ICs do you need?

AND	IC	7408	74LS08	2-input AND
OR	IC	74LS32	74LS32	2-input OR



Extra: $f(A, B, C) = \underline{BC + AB + AC}$. Implement using only NAND gates.



4

Sept 18, 2017

4-variable K-map:

$2^4 = 16$ minterms

16 cells   4 x 4 K-map

There are no don't care's

AB \ CD	=00	=01	=11	=10
=00	0: 1	1	3	2: 1
=01	4	5	7	6: 1
=11	12	13	15	14: 1
=10	8: 1	9	11	10: 1

g1

$f(~~A~~, A, B, C, D)$

$= \Sigma(0, 2, 8, 10, 6, 14)$

plot the minterms

Group the 1's: ~~16~~ 1's ? No

8 1's ? No

4 1's ? yes g1

are all 1's covered? No

4 1's ? yes g2

are all 1's covered? yes

$f(A, B, C, D) = g1 + g2$

$f(A, B, C, D) = CD' + B'D'$ // ~~$= D'(C + B')$~~