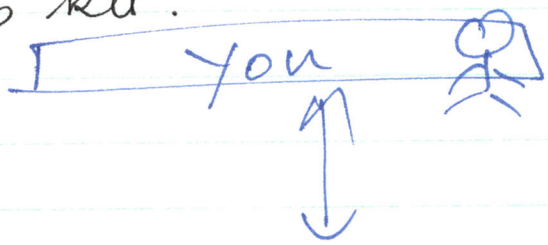
CSE 241 Feb 15, 2017 (1)

On Friday 2/17 we will go over the lab kit.



USA (Karnaugh) DeMorgan's London George Boole UK

Computers; Logic gates; ICs	20th Century
Laws and theorems	20th Century
Boolean Algebra	19th Century

Today's topic : Karnaugh Map
K-map

Last Class: Boolean algebraic simplification

K-map plots minterms are plotted on a map

This map has 1 cell / minterm.

$f(x, y)$ - 2 variable map

$2^2 = 4$ minterms m_0, m_1, m_2, m_3

x \ y	y=0	y=1
x=0	0 m_0	1 m_1
x=1	2 m_2	3 m_3

3- variable K-map
4 - variable K-map

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3-variable K-map $2^3 = 8$ cell

W \ XY	00	01	11	10
0	m_0	m_1	m_3	m_2
1	m_4	m_5	m_7	m_6

$f(w, x, y)$

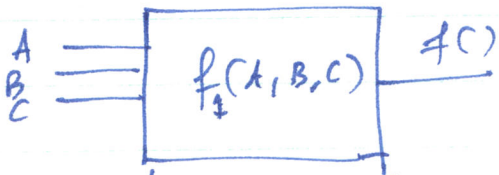
4-variable K-map $f(w, x, y, z)$ $2^4 = 16$

WX \ YZ	00	01	11	10
WX = 00	m_0	m_1	m_3	m_2
01	m_4	m_5	m_7	m_6
11	m_{12}	m_{13}	m_{15}	m_{14}
10	m_8	m_9	m_{11}	m_{10}

Problem: $F1(A, B, C) = \sum(1, 4, 5, 6, 7)$

Simplify this to minimum of terms and minimum # of literals.

Start: 5 terms * 5x3 = 15 literals



Step 1: Draw the empty K-map; label cells.

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

Step 2: Plot the 1's for the minterms defining the function.

Step 3: Group the 1's into largest rectangular group and cover all the 1's with smallest number of groups

↓ # literals ⇒ ↓ # terms

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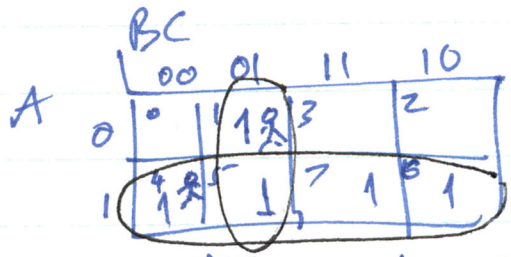

Step 2: Is there a group of 8 rectangular 1's?

NO

is there a group of 4 rectangular 1's?

Yes 1

cover it or group it.

Are all the 1's covered?

Box 1 not covered - No

Is there a group of 2 1's?

overlap Yes

Are all the 1's covered?

1 group of 4 1's + 1 group of 2 1's

Step 4: ~~write the terms representing the~~ groups.

Term 1 : A

Term 2 : $B'C$ B=0 C=1

Simplified ~~data~~ expression =

5 terms, 15 literals $f(A, B, C) = A + B'C$

End: 2 terms, 3 literals

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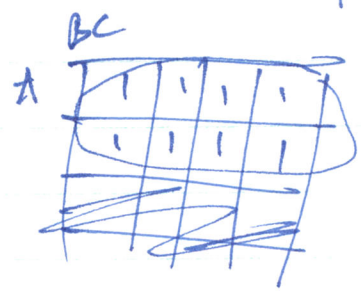
Problem:

BCD → odd parity generator

add a new helper concept:

don't cares.

$f(A,B,C) = 1$



$2^3 = 8$