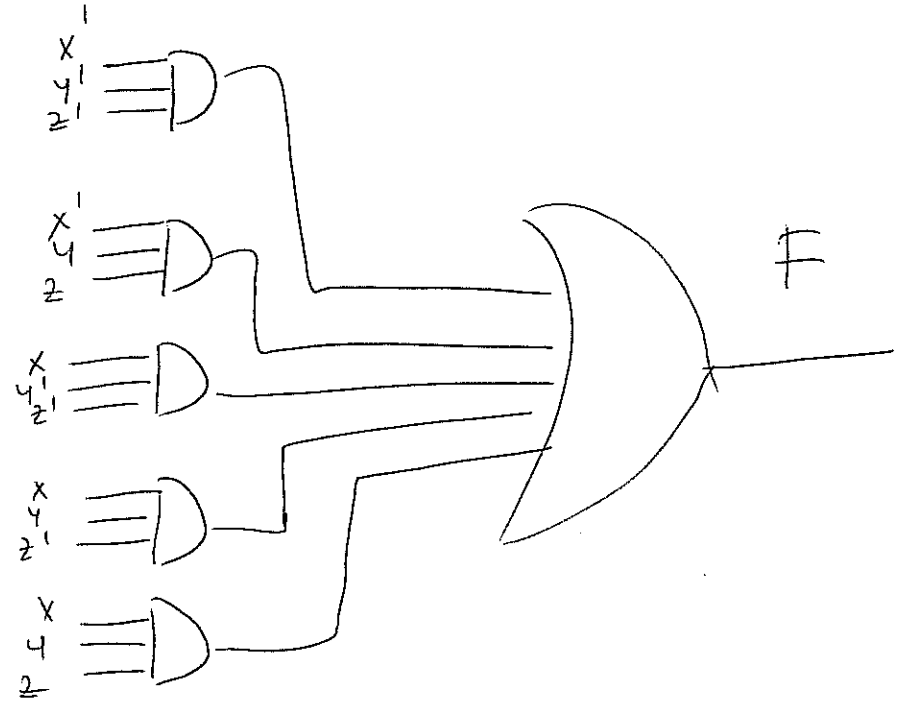
EECS 281, February 3, 2015

Example:

Row	X	Y	Z	F	minterms	maxterms
0	0	0	0	(1)	$X' \cdot Y' \cdot Z'$	
1	0	0	1	[0]		$X + Y + Z'$
2	0	1	0	[0]		$X + Y' + Z$
3	0	1	1	(1)	$X' \cdot Y \cdot Z$	
4	1	0	0	(1)	$X \cdot Y' \cdot Z'$	
5	1	0	1	[0]		$X' + Y + Z'$
6	1	1	0	(1)	$X \cdot Y \cdot Z'$	
7	1	1	1	(1)	$X \cdot Y \cdot Z$	

$$F = \sum_{X,Y,Z} (0, 3, 4, 6, 7)$$

$$= X' \cdot Y' \cdot Z' + X' \cdot Y \cdot Z + X \cdot Y' \cdot Z' + X \cdot Y \cdot Z' + X \cdot Y \cdot Z$$



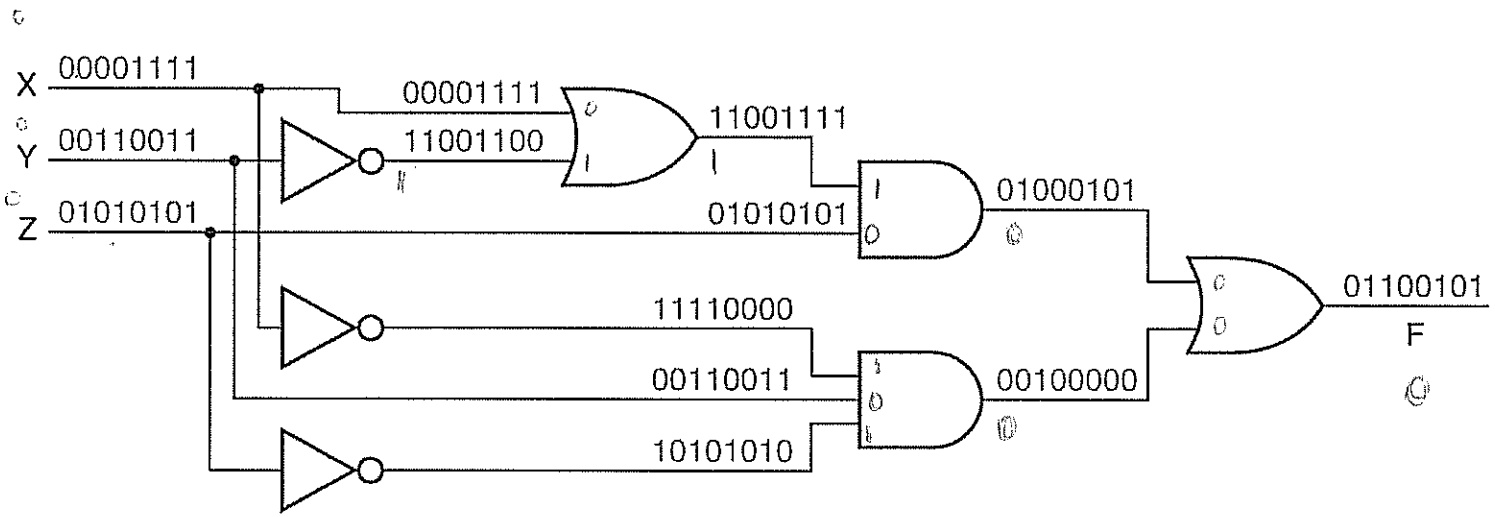


Figure 4-10

Gate outputs created by all input combinations.

Row	X	Y	Z	F
0	0	0	0	0
1	0	0	1	1
2	0	1	0	1
3	0	1	1	0
4	1	0	0	0
5	1	0	1	1
6	1	1	0	0
7	1	1	1	1

Table 4-7

Truth table for the logic circuit of Figure 4-9.

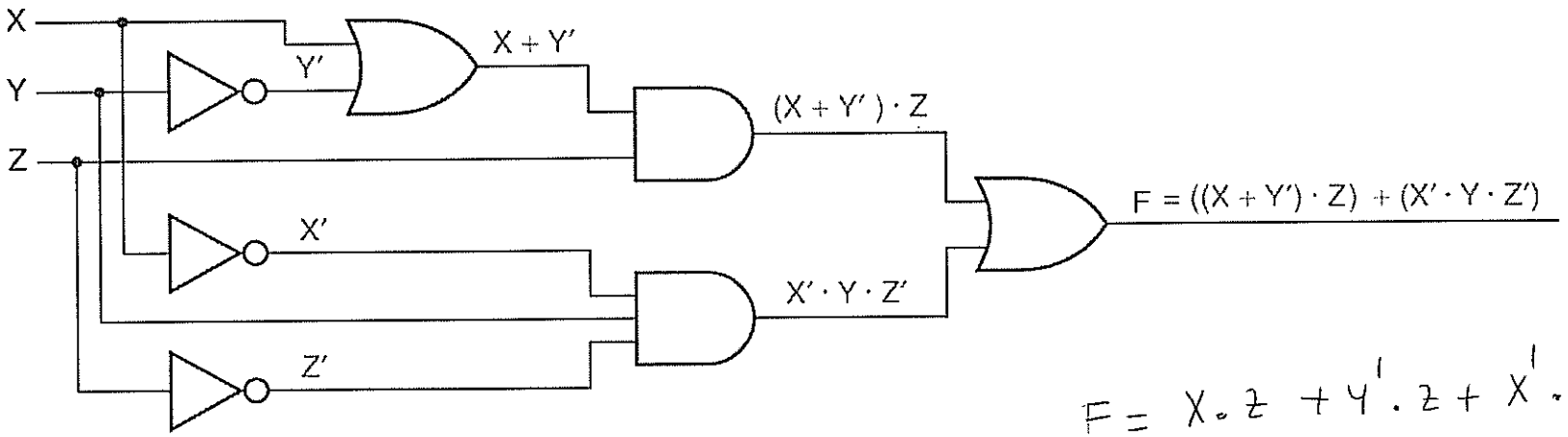


Figure 4-11

Logic expressions for signal lines

Canonical product: product of maxterms corresponding to input combinations for which function produces a 0-output.

$$F = \prod_{X,Y,Z} (1, 2, 5)$$

$$F = \sum_{X,Y,Z} (0, 3, 4, 6, 7)$$

$$F = (X + Y + Z') \cdot (X + Y' + Z) \cdot (X' + Y + Z')$$

Example: The ALARM output is 1 if the PANIC input is 1, or if the ENABLE input is 1 and the EXITING input is 0, and the house is not SECURE; The house is SECURE if the WINDOW, DOOR and GARAGE inputs are all 1.

ALARM = PANIC + ENABLE · EXITING' · SECURE'

SECURE = WINDOW · DOOR · GARAGE

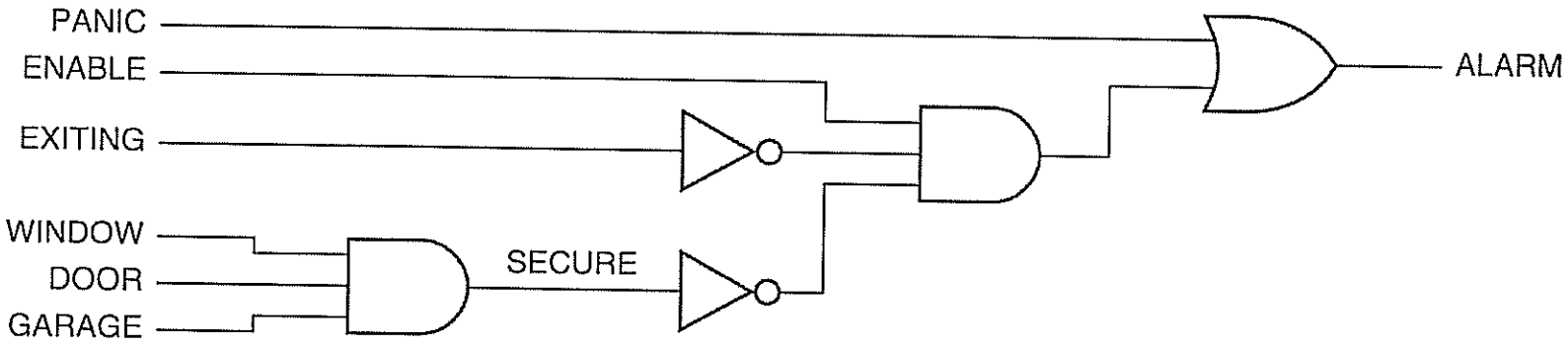
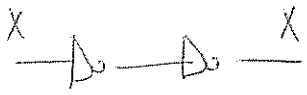
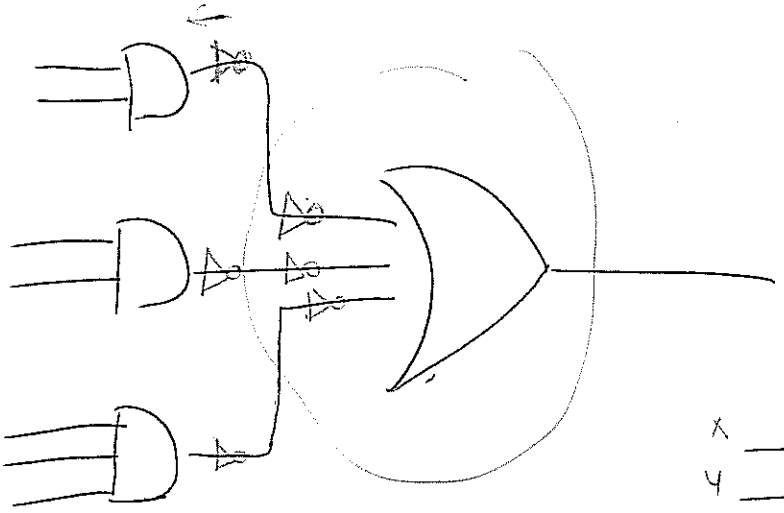
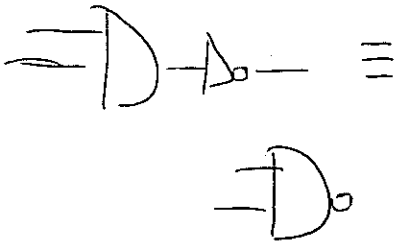
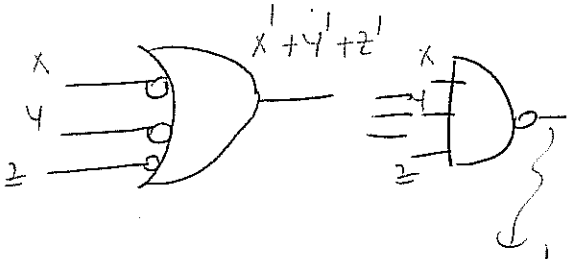


Figure 4-19
Alarm circuit derived from logic expression.



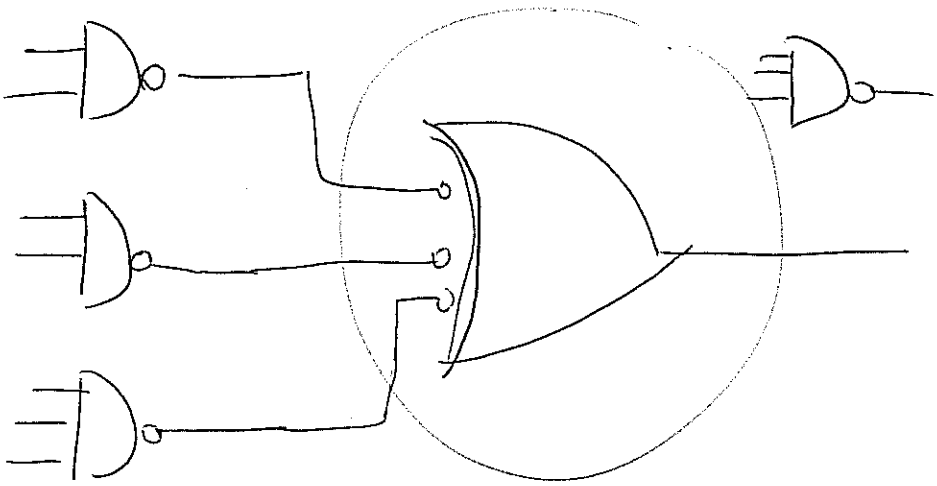


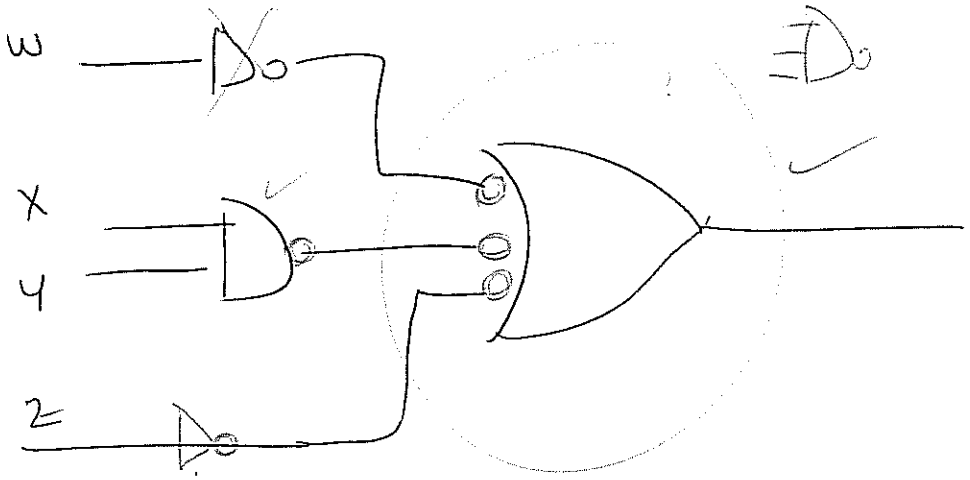


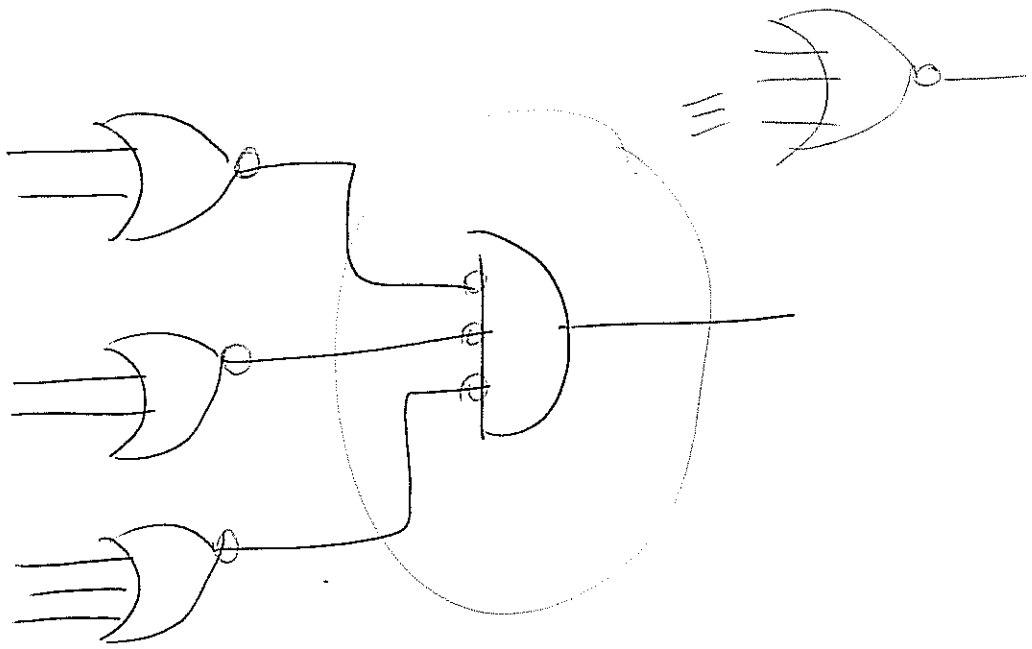


$(X \cdot Y \cdot Z)' =$

$X' + Y' + Z'$




w
x
y
z



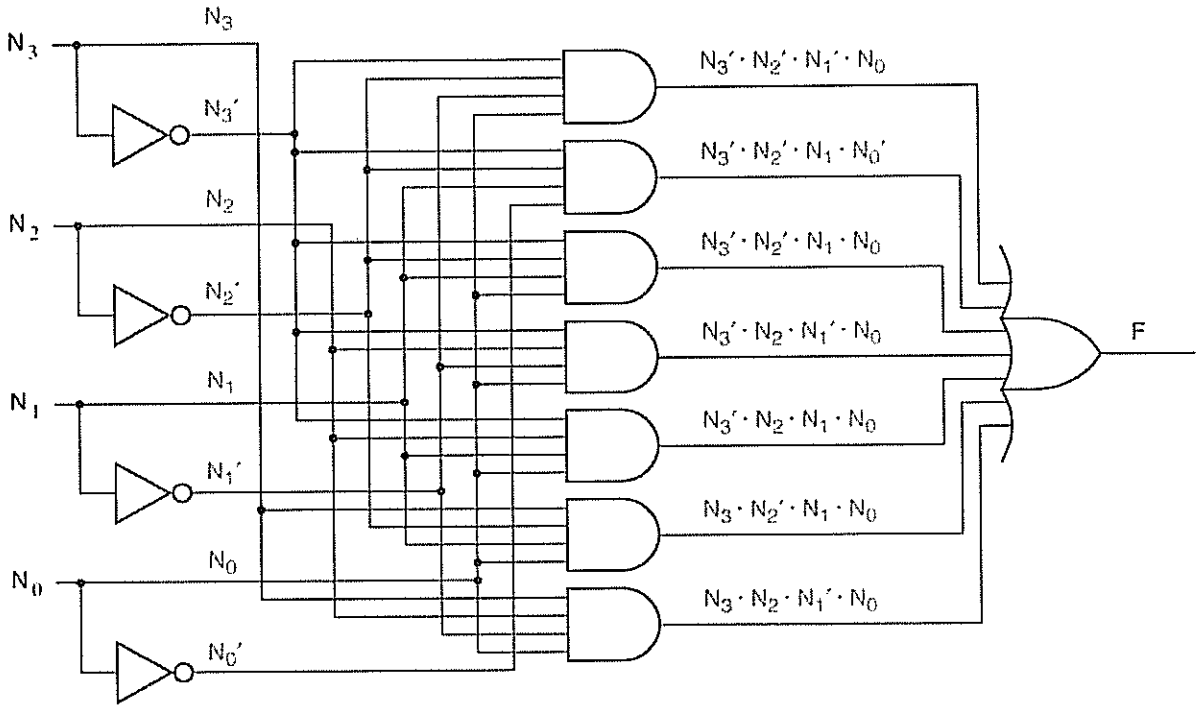


Figure 4-18

Canonical-sum design for 4-bit prime-number detector.

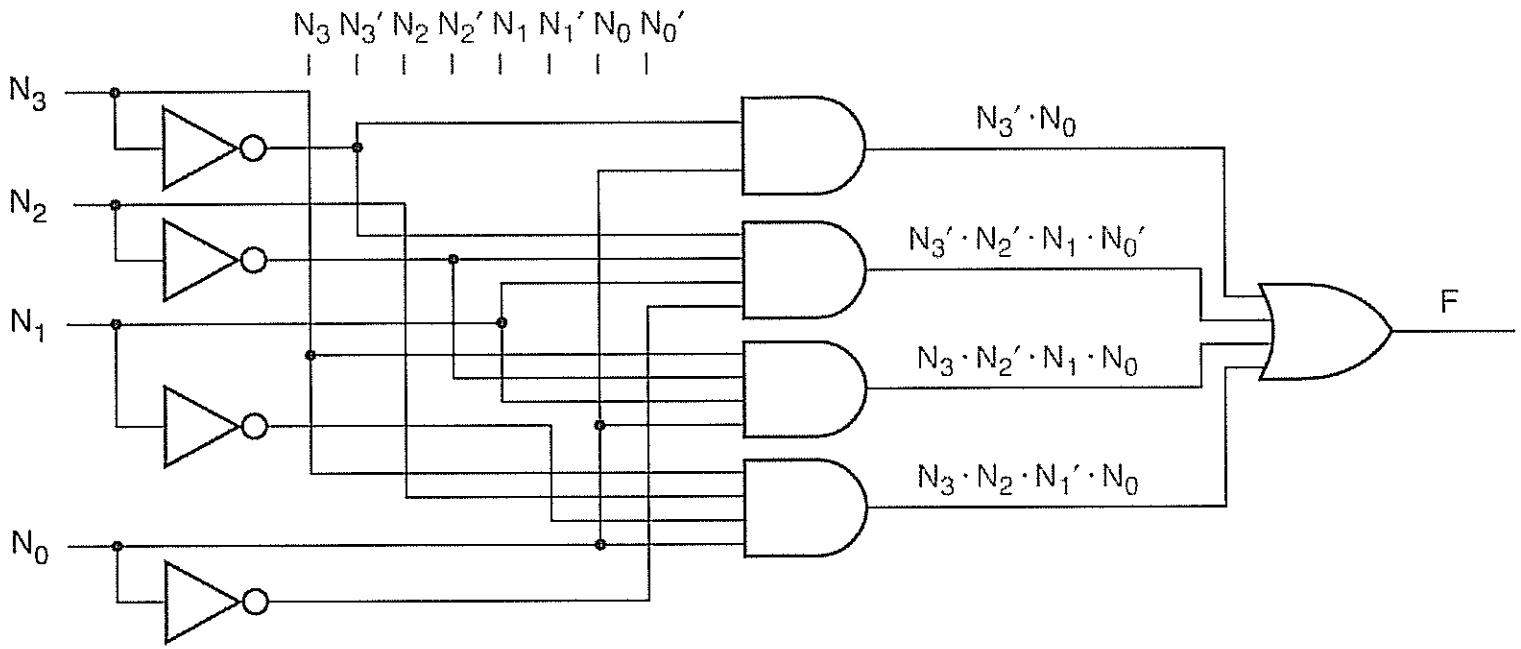


Figure 4-25

Simplified sum-of-products realization for 4-bit prime-number detector.

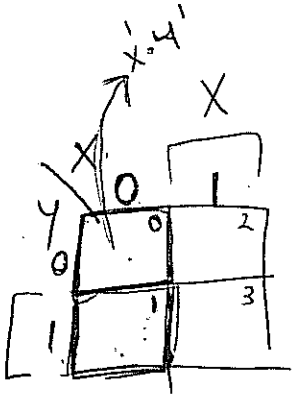
Karnaugh Maps

Graphical representations of the truth table.

For n-input logic function: array with 2^n cells, & one for each possible input combination or minterm.

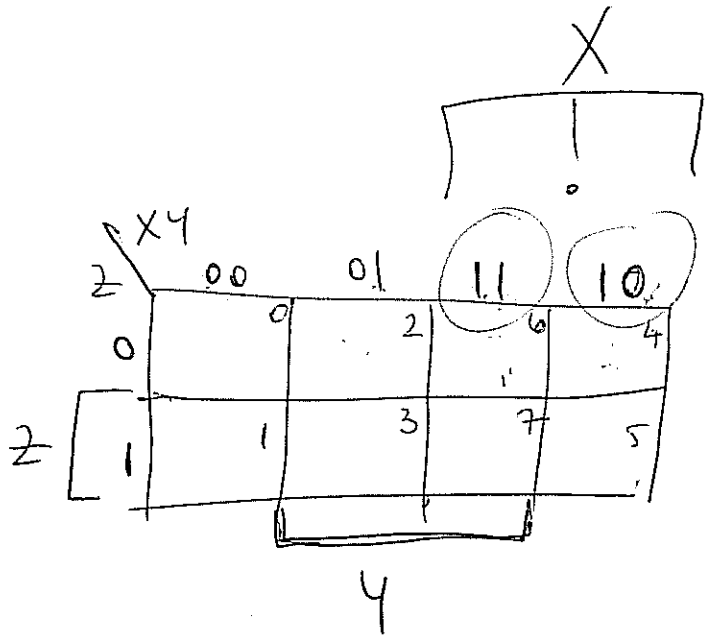
e.g.

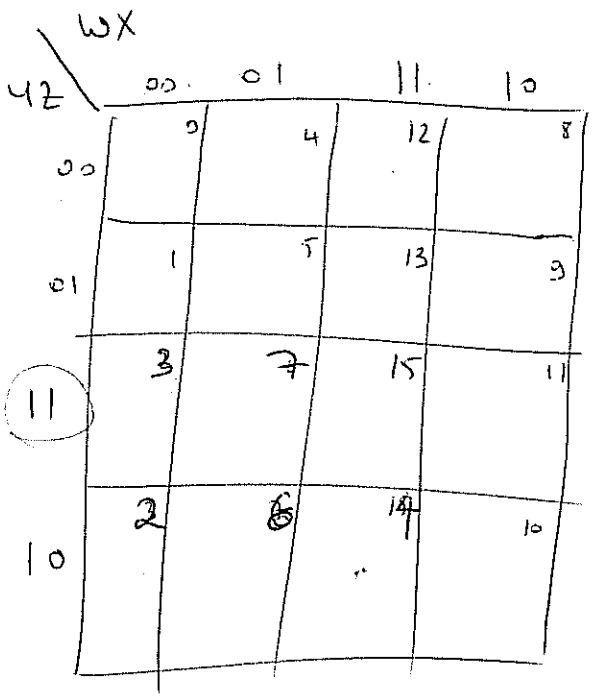
Row	X	Y
0	0	0
1	0	1
2	1	0
3	1	1



e.g.

X	Y	Z
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1





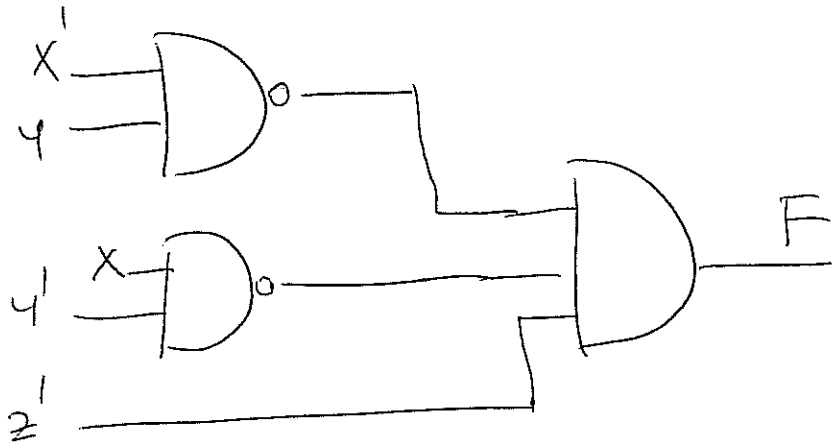
wx yz

Example: $F = (x' \cdot y + x \cdot y' + z)'$

use two nand gates and one and gate.

complements of the inputs are available.

$F = (x' \cdot y)' \cdot (x \cdot y')' \cdot z'$



Example: $F = A'B'C + D'$

two-input
two NAND gates
one NOR gate
two input