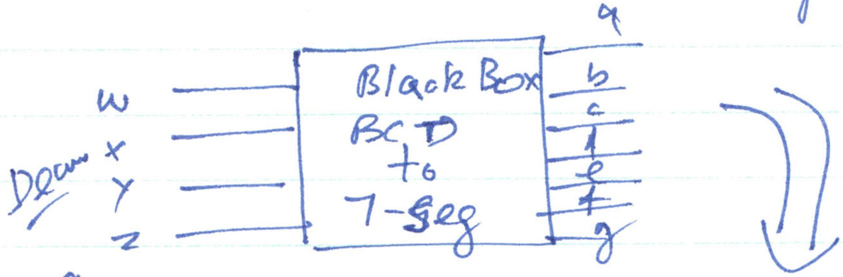
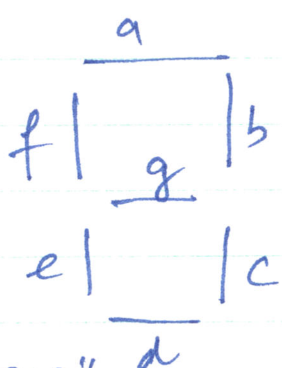
CSE 241 Feb 24, 2014

Design a combinational Circuit (s) that will convert BCD → 7-segment display





Truth Table

7 output functions

BCD	w	x	y	z	a	b	c	d	e	f	g
	"BCD" input variable				output variables						
0	0	0	0	0	1	1	1	1	1	1	0
1	0	0	0	1	0	1	1	0	0	0	0
2	0	0	1	0	1	1	0	1	1	0	1
3	0	0	1	1	1	1	1	1	0	0	1
4	0	1	0	0	0	1	1	0	0	1	1
5	0	1	0	1	1	0	1	1	0	1	1
6	0	1	1	0	1	0	1	1	1	1	1
7	0	1	1	1	1	1	1	0	0	0	0
8	1	0	0	0	1	1	1	1	1	1	1
9	1	0	0	1	1	1	1	1	0	1	1

Simplify using K-maps, expressions for a, b, c, d, e, f, g. Use don't cares.

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$a = ?$ $a(w,x,y,z) = ?$

$a = \Sigma(0,2,3,5,6,7,8,9)$

don't care

10, 11, 12, 13, 14, 15

term1 = Y

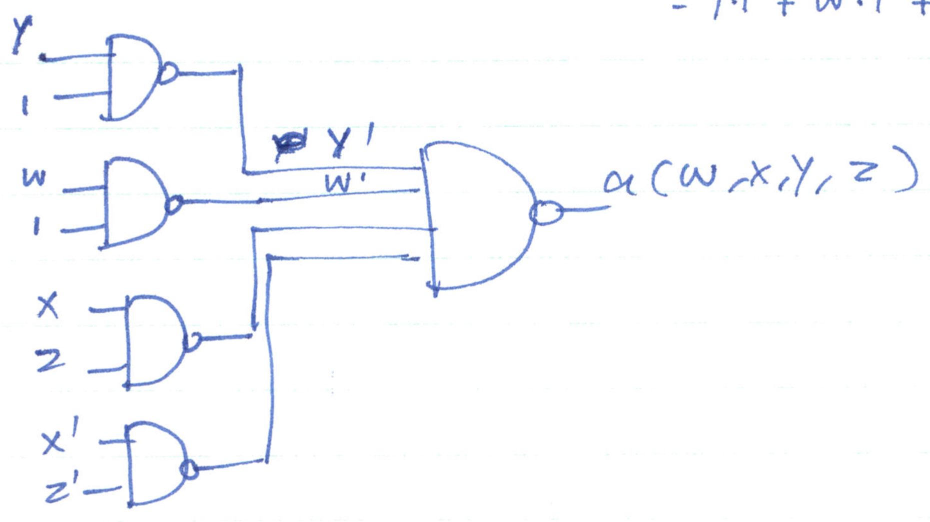
term2 = W

term3 = xz

term4 = $x'z'$

$a(w,x,y,z) = y + w + xz + x'z'$

$= y \cdot 1 + w \cdot 1 + xz + x'z'$



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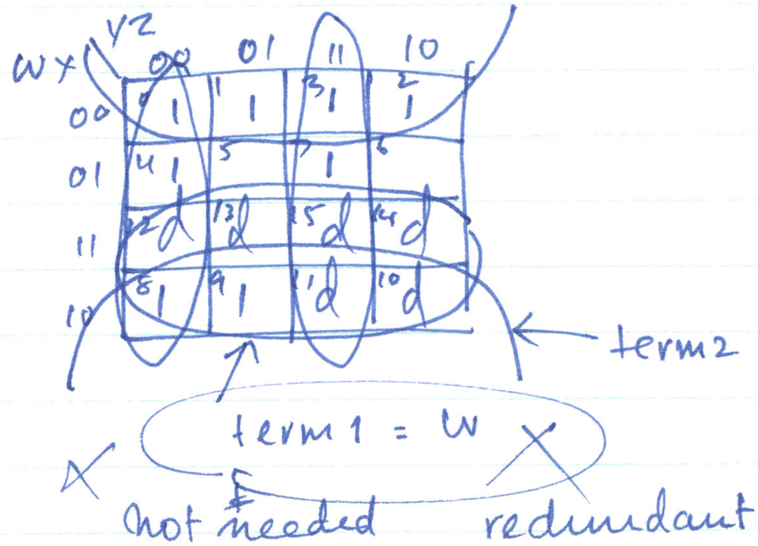
$b(w, x, y, z) = \Sigma\, 0, 1, 2, 3, 4, 7, 8, 9)$

don't cares: 10, 11, 12, 13, 14, 15



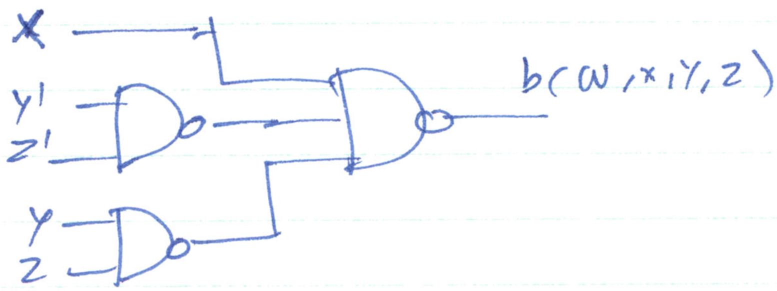
our goal is to cover the 1's using minimal # of groups.

term3 = $y'z'$ term4 = yz

$b(w, x, y, z) = w + x' + y'z' + yz$

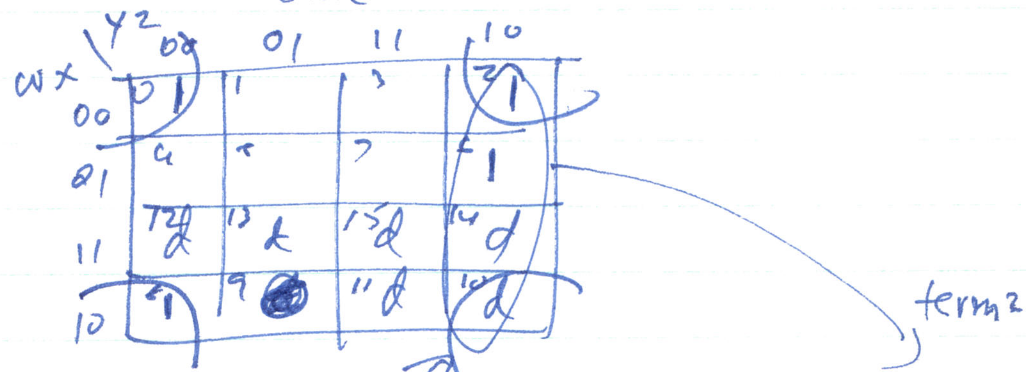
↑ (−1)

$= x' + y'z' + yz$



$e(w, x, y, z) = \Sigma(0, 2, 6, 8)$

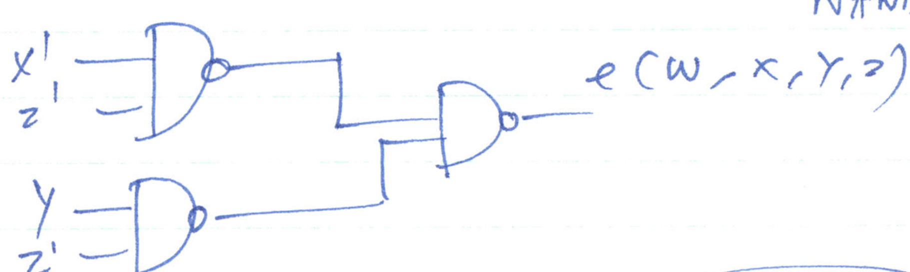
don't care 10, 11, 12, 13, 14, 15



term1 = $x'z' + yz'$

$= z'(x'+y)$

Standard form that can be easily implemented using only NAND gate



a, b, e

c, d, f, g

⇓