Technische Informatik: Abgabe 10

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14. Januar 2014

Exercise 10.1 (7-Segment display PLA)

Sorry, but I switched the order to most-significant-bit-first for the inputs.
So in order to be Question-compatible you have to exchange w and z; and x and y here.

Truthtable for LED-display

i	w	x	y	z	a	b	c	d	e	f	g
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	0	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	0	0	1	1
10	1	0	1	0	-	-	-	-	-	-	-
11	1	0	1	1	-	-	-	-	-	-	-
12	1	1	0	0	-	-	-	-	-	-	-
13	1	1	0	1	-	-	-	-	-	-	-
14	1	1	1	0	-	-	-	-	-	-	-
15	1	1	1	1	-	-	-	-	-	-	-

This leads to these K-maps:

a	yz				b	yz				c	yz				d	yz			
wx	00	01	11	10	wx	00	01	11	10	wx	00	01	11	10	wx	00	01	11	10
00	1	0	1	1	00	1	1	1	1	00	1	1	1	0	00	1	0	1	1
01	0	1	1	0	01	1	0	1	0	01	1	1	1	1	01	0	1	0	1
11	d	d	d	d	11	d	d	d	d	11	d	d	d	d	11	d	d	d	d
10	1	1	d	d	10	1	1	d	d	10	1	1	d	d	10	1	0	d	d

e / wx	yz 00	01	11	10
00	1	0	0	1
01	0	0	0	1
11	d	d	d	d
10	1	0	d	d

f / wx	yz 00	01	11	10
00	1	0	0	0
01	1	1	0	1
11	d	d	d	d
10	1	1	d	d

g / wx	yz 00	01	11	10
00	0	0	1	1
01	1	1	0	1
11	d	d	d	d
10	1	1	d	d

$a = w + xz + \bar{x}\bar{z} + yz$
$b = \bar{x} + \bar{y}\bar{z} + yz$
$c = \bar{y} + z + x$
$d = \bar{x}\bar{z} + x\bar{y}z + y\bar{z} + \bar{x}y$
$e = \bar{x}\bar{z} + y\bar{z}$
$f = w + \bar{y}\bar{z} + x\bar{y} + x\bar{z}$
$g = w + \bar{x}y + y\bar{z} + x\bar{y}$

This gives us this PLA:

input	w	xz	$\bar{x}\bar{z}$	yz	$\bar{y}\bar{z}$	$\bar{x}$	$\bar{y}$	z	x	$x\bar{y}z$	$y\bar{z}$	$\bar{x}y$	$x\bar{y}$	$x\bar{z}$	output
w	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
x	0	2	3	0	0	3	0	0	2	2	0	3	2	2	
y	0	0	0	2	3	0	3	0	0	3	2	2	3	0	
z	0	2	3	2	3	0	0	2	0	2	3	0	0	3	
	1	1	1	1	0	0	0	0	0	0	0	0	0	0	a
	0	0	0	1	1	1	0	0	0	0	0	0	0	0	b
	0	0	0	0	0	0	1	1	1	0	0	0	0	0	c
	0	0	1	0	0	0	0	0	0	1	1	1	0	0	d
	0	0	1	0	0	0	0	0	0	0	1	0	0	0	e
	1	0	0	0	1	0	0	0	0	0	0	0	1	1	f
	1	0	0	0	0	0	0	0	0	0	1	1	1	0	g

We can optimize $x = x\bar{z} + xz$ so we could substitute the x column above, so we would only need 13 columns.
(I am sure there is more, but for the exercise it is *optimized* now.)

input	w	xz	$\bar{x}\bar{z}$	yz	$\bar{y}\bar{z}$	$\bar{x}$	$\bar{y}$	z	$x\bar{y}z$	$y\bar{z}$	$\bar{x}y$	$x\bar{y}$	$x\bar{z}$	output
w	2	0	0	0	0	0	0	0	0	0	0	0	0	
x	0	2	3	0	0	3	0	0	2	0	3	2	2	
y	0	0	0	2	3	0	3	0	3	2	2	3	0	
z	0	2	3	2	3	0	0	2	2	3	0	0	3	
	1	1	1	1	0	0	0	0	0	0	0	0	0	a
	0	0	0	1	1	1	0	0	0	0	0	0	0	b
	0	1	0	0	0	0	1	1	0	0	0	0	1	c
	0	0	1	0	0	0	0	0	1	1	1	0	0	d
	0	0	1	0	0	0	0	0	0	1	0	0	0	e
	1	0	0	0	1	0	0	0	0	0	0	1	1	f
	1	0	0	0	0	0	0	0	0	1	1	1	0	g