

Justin Fortner
j_fortner
1481947
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CE100 HW#3 pg 1/8

1) a) $f(x,y,z,w) = \Sigma m(0,4,6,8,9,15) + \Sigma d(3,7,11,13)$

SOP

				<u>y</u>	
				0	1
				0	1
	w	x	z	0	1
	0	0	0	0	1
	0	0	1	1	0
	1	0	0	1	1
	1	0	1	1	0
	1	1	0	0	0
	1	1	1	0	1
	w	x	z	0	1

PIs

$\bar{w}\bar{x}\bar{z}$	non-essential
$\bar{w}\bar{y}\bar{z}$	
$\bar{w}x\bar{y}$	
$x\bar{y}\bar{z}$	
wx	
wz	

$$\bar{w}\bar{y}\bar{z} + \bar{w}\bar{x}y + wx$$

Cost 8 literals
4 gates

POS

				<u>y</u>	
				0	1
				0	1
	w	x	z	0	0
	0	0	0	0	0
	0	0	1	1	1
	1	0	0	1	1
	1	0	1	1	0
	1	1	0	0	0
	1	1	1	0	1
	w	x	z	0	1

PIs

$w+x$	essential
$\bar{y}+z$	essential
$w+x+z$	non-essential
$\bar{w}+x+y$	non-essential
$x+y+z$	non-essential

$$(w+\bar{x})(\bar{y}+z)(\bar{w}+x+y)$$

cost 7 literals
4 gates

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I (continued) b)

$$f(x,y,z,w) = \text{PIM}(0,2,4,5,7,8,9,15) + D(11,13)$$

SOP

	<u>y</u>				
	0	0	1	0	
	1	0	1	0	w
z	1	0	0	1	
	0	1	1	1	
					x

PIs	
$w\bar{x}\bar{y}$	essential
$w\bar{y}z$	non-essential
$\bar{w}yz$	essential
$\bar{w}xy$	non-essential
$x\bar{y}\bar{z}$	non-essential
$\bar{w}x z$	non-essential
$x\bar{y} z$	non-essential

$$w\bar{x}\bar{y} + \bar{w}yz + x\bar{y}z + xy\bar{z}$$

Cost 12 Literals
5 gates

SOP POS

	<u>y</u>				
	0	1	0	1	
	1	1	0	1	w
	0	1	1	1	
z	1	0	0	0	
	1	0	0	0	x

PIs	
$\bar{w}\bar{x}\bar{y}$	essential
$\bar{x}\bar{y}\bar{z}$	non-essential
$\bar{w}\bar{x}\bar{z}$	non-essential
$w\bar{y}$	essential
$w\bar{x}$	non-essential
$x\bar{y}\bar{z}$	non-essential
$\bar{w}\bar{x}\bar{z}$	non-essential

$(\bar{w}\bar{x}\bar{y})$ $(\bar{w} + \bar{x} + \bar{y})(w + \bar{y})$ $(x + \bar{y} + \bar{z})(\bar{x} + y + \bar{z})$
cost 11 literals 5 gates

I (cont) (c)

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$$f(x_1, y_1, z_1, w_1) = \text{PIm}(3, 4, 5, 9, 10, 11) + \text{D}(7, 14)$$

SOP

		<u>y</u>				
		0	1	0	1	w
	z	0	1	0	1	
	1	0	1	0	1	
	0	1	0	1	0	
	1	0	1	0	1	
	0	1	0	1	0	
		0	1	0	1	x

PIs

$$yz$$

$$\bar{w}x\bar{z}$$

$$\bar{w}\bar{y}\bar{z}$$

$\bar{x}\bar{y}\bar{z}$ essential

$$\bar{w}\bar{x}y$$

$$\bar{w}\bar{x}z$$

$$xy + \bar{x}\bar{y}\bar{z} + \bar{w}\bar{x}z + \bar{w}\bar{y}\bar{z}$$

Cost 11 literals
5 gates

POS

		<u>y</u>				
		0	1	0	1	w
	z	0	1	0	1	
	1	0	1	0	1	
	0	1	0	1	0	
	1	0	1	0	1	
	0	1	0	1	0	
		0	1	0	1	x

PIs

$$\bar{x}+y+\bar{z}$$
 essential

$$w+x+y$$

$$w+\bar{x}+z$$

$$w+\bar{y}+z$$

$$\bar{w}+x+z$$

$$x+\bar{y}+z$$

$w+x+\bar{y}$ essential

$$(\bar{x}+y+\bar{z})(w+x+\bar{y})(\bar{w}+x+z)(\bar{w}+\bar{x}+z)$$

cost 12 literals 5 gates

0-
25
3

py 4/8
 1 (cont) d) $f(a, b, c, d, e) = \sum m(1, 3, 7, 8, 9, 10, 11, 15, 17, 25, 27, 28)$
 $+ D(19, 23, 24, 26)$

SOP

4c

c

	0	0	D	X	e
d	X	0	0	X	
b	X	X	X	X	
a	0	0	0	1	

PIS

~~abcde~~

~~ab~~

de essential

ce essential

abe essential

$\bar{a}\bar{b}\bar{d}\bar{e}$ non-essential

$a'b\bar{c}$ essential

~~abcde~~

b

$$f = de + \bar{c}e + abe + b\bar{c}$$

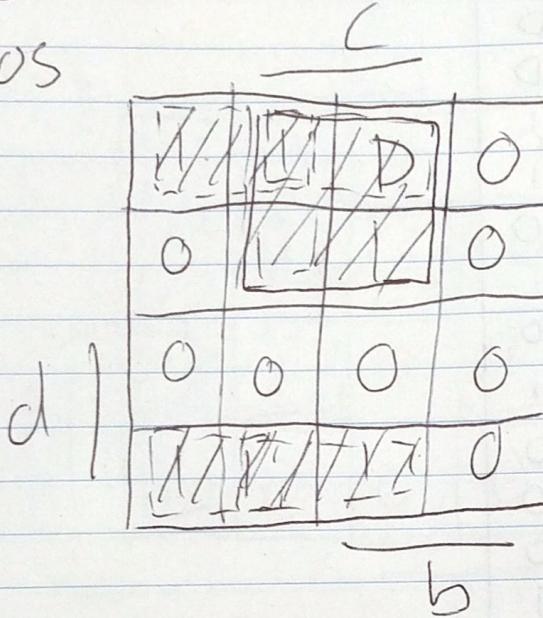
Cost ~~to~~ 9 literals

5 gates

py 5/18

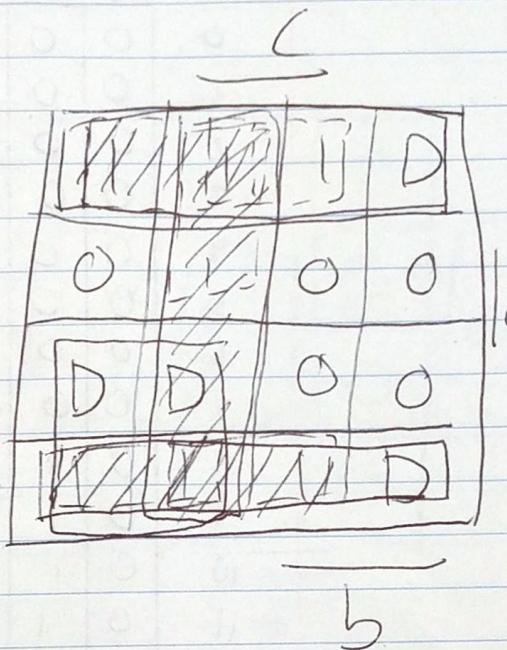
l (cont) d (cont)

POS



e

4



5

PIs

$\bar{b}^+ \bar{d}^- \bar{e}$ essenha

$\bar{a} + \underline{c} + \bar{d}$ essential

C₊ CH₃ non essential

$\overline{b+c+d}$ non essential

$a+b+cd$ non essenziali

a+d+e non ess

b+d+e essenheit

è non essere

\rightarrow ~~extra~~ non-essential

$\text{Ca}^{+2} + \text{C}_6\text{H}_5\text{COO}^-$ non essential

$$(\bar{b} + \bar{d} + \bar{e}) (\bar{a} + c + \bar{d}) (\bar{b} + d + \bar{e}) (c + d + \bar{e}) (a + \bar{d} + \bar{e}) (a + \bar{b} + c)$$

1

Cost 18 literals
7 gates

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2) a)	<u>n_1</u>	<u>n_2</u>	<u>n_3</u>	<u>n_4</u>	<u>n_5</u>	<u>n_6</u>	<u>n_7</u>
0	0	0	0	0	0	0	D
1	0	0	0	0	1	0	D
2	0	0	0	1	0	0	1
3	0	0	0	1	1	1	1
4	0	0	i	0	0	0	0
5	0	0	i	0	1	1	1
6	0	0	i	1	0	0	0
7	0	0	i	1	1	1	1
8	0	i	0	0	0	0	0
9	0	i	0	0	1	0	0
10	0	i	0	1	0	0	0
11	0	i	0	1	1	1	1
12	0	i	1	0	0	0	0
13	0	i	1	0	1	1	1
14	0	i	1	1	1	0	0
15	0	i	1	1	1	1	0
16	1	0	0	0	0	0	0
17	1	0	0	0	1	1	1
18	1	0	0	1	0	0	0
19	1	0	0	1	1	1	1
20	1	0	1	0	0	0	0
21	1	0	i	0	1	0	0
22	1	0	i	1	0	0	0
23	1	0	i	1	1	1	1
24	1	1	0	0	0	0	0
25	1	1	0	0	1	0	0
26	1	1	0	1	0	0	0
27	1	1	0	1	1	0	0
28	1	1	1	0	0	0	0
29	1	1	1	0	1	1	1
30	1	1	1	1	1	0	0
31	1	1	1	1	1	1	1

2 (cont) b)

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pos a

c				
D	0	0	0	
	X	X	X	0
		X	X	e
d		0	X	
			X	
	0	0	0	
b				

a

c				
0	0	0	0	
	X	0	X	0
		X	X	e
d		0	X	
			X	
	0	0	0	
b				

PIS

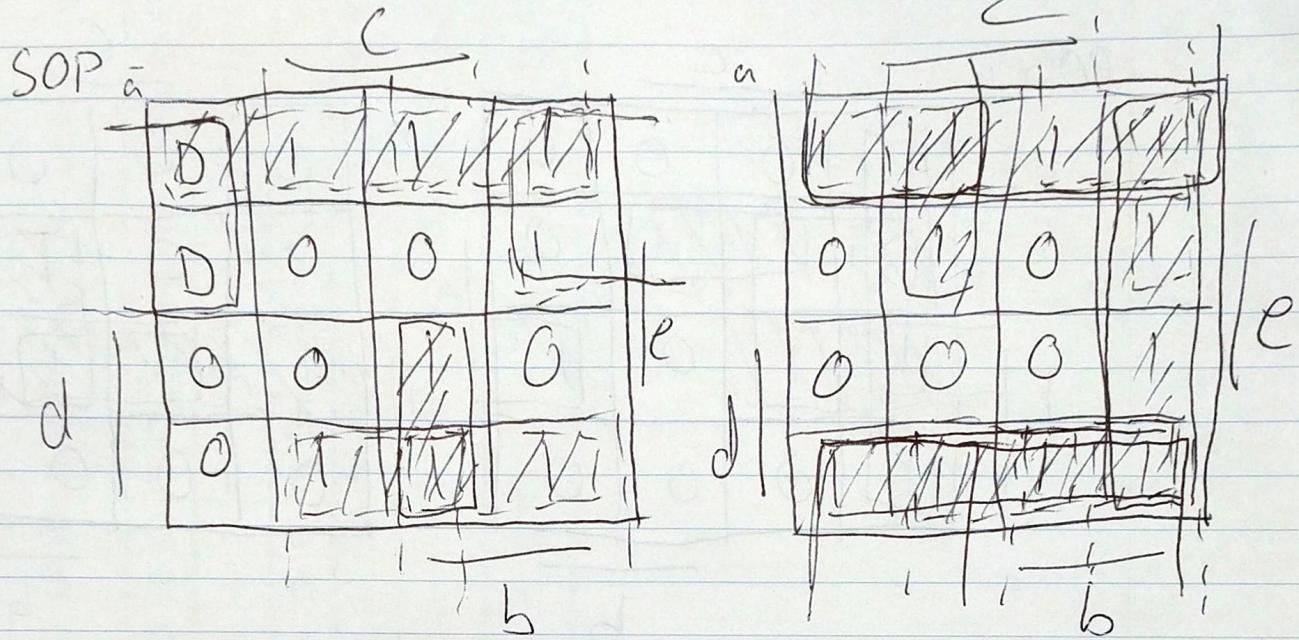
$\bar{a} \bar{b} e$	non-essential
$\bar{a} \bar{b} \bar{c}$	essential ✓
$\bar{b} \bar{c} e$	essential ✓
$\bar{b} d e$	non-essential
$\bar{a} \bar{c} d e$	essential ✓
$\bar{a} c \bar{d} e$	essential ✓
$a b \bar{c} e$	essential
$a c d e$	non essential

$$\bar{b} \bar{c} e + \bar{a} \bar{b} \bar{c} + \bar{a} c \bar{d} e + \bar{a} \bar{c} d e + a b \bar{c} e + \bar{b} d e$$

cost 21 literals
7 gates

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z cont) b cont)



PI's

$$\bar{d} + \bar{e}$$

essential

\leftarrow

$$b + \bar{c} + \bar{d}$$

$$a + b + \bar{c}$$

essential

\leftarrow

$$a + \bar{c} + \bar{d} + \bar{e}$$

$$b + \bar{d} + \bar{e}$$

$$c + \bar{d} + \bar{e}$$

\leftarrow

$$\bar{a} + b + c + d$$

essential

\leftarrow

$$a + \bar{b} + c + \bar{d}$$

essential

\leftarrow

$$b + \bar{e}$$

$$c + \bar{e}$$

$$\bar{a} + \bar{c} + \bar{d}$$

$$\bar{a} + \bar{c} + \bar{e}$$

\leftarrow

$a b c =$

$$(d + \bar{e})(a + b + \bar{c})(b + d + \bar{e})(\cancel{c} + \bar{d} + \bar{e})(\bar{a} + b + c + d)$$

$$(a + \bar{b} + c + \bar{d})(a + \bar{e})$$

Cost 7 literals 8 gates