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10/16/17
1481947

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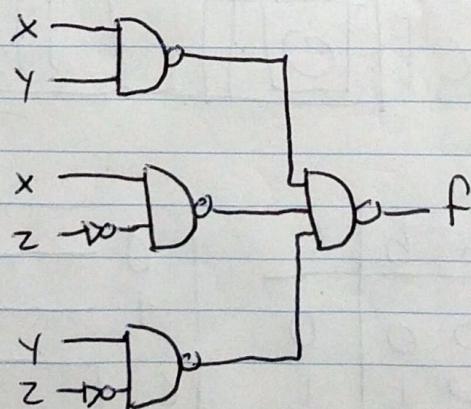
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1) a)



$x \ y \ z$	f	g
000	1	1
001	0	0
010	0	1
011	0	0
100	1	0
101	0	1
110	1	1
111	1	1

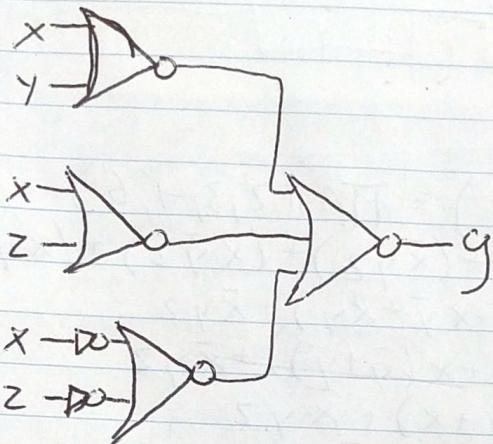
$$\begin{aligned}
b) f(x, y, z) &= \prod m(2, 3, 4, 6) \\
&= (\bar{x}y\bar{z}) + (\bar{x}yz) + (x\bar{y}\bar{z}) + (xy\bar{z}) \\
&= \bar{z}(\bar{x}y + x\bar{y} + xy) + \bar{x}yz \\
&= \bar{z}(\bar{x}y + x(\bar{y} + y)) + \bar{x}yz \\
&= z(\bar{x}y + x) + xyz \\
&= z(x + y) + \bar{x}yz \\
&= x\bar{z} + y\bar{z} + xyz \\
&= x(\bar{z} + yz) + y\bar{z} \\
&= x(y + z) + y\bar{z} \\
&= xy + x\bar{z} + y\bar{z}
\end{aligned}$$



c) on next page

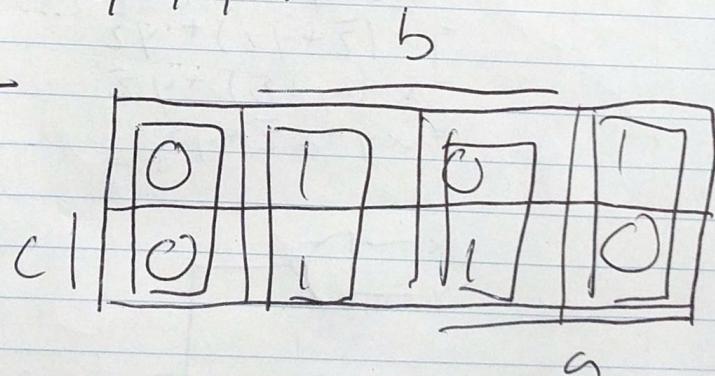
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$$\begin{aligned}
 1 \text{ (cont)} c) g(x, y, z) &= \sum m(0, 3, 4, 6, 7) \\
 &= (x + y + \bar{z})(x + \bar{y} + \bar{z})(\bar{x} + y + z) \\
 &= (x + \bar{z})(\bar{x} + y + z) \\
 &= (xy + xz + \bar{x}\bar{z} + yz) \\
 &= (xy + xz + \bar{x}\bar{z})
 \end{aligned}$$

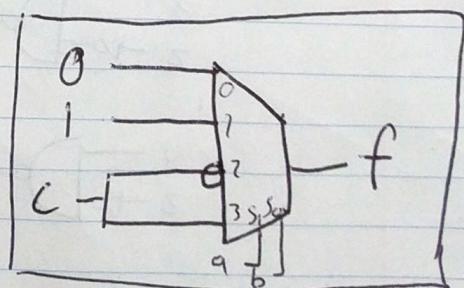


$$2) a) f(a, b, c) = \sum m(2, 3, 4, 7)$$

a	b	c	f
0	0	0	0
1	0	1	0
2	1	0	1
3	0	1	1
4	1	0	1
5	1	0	0
6	1	1	0
7	1	1	1



a	b	c
0	0	0
0	1	1
1	0	1
1	1	1



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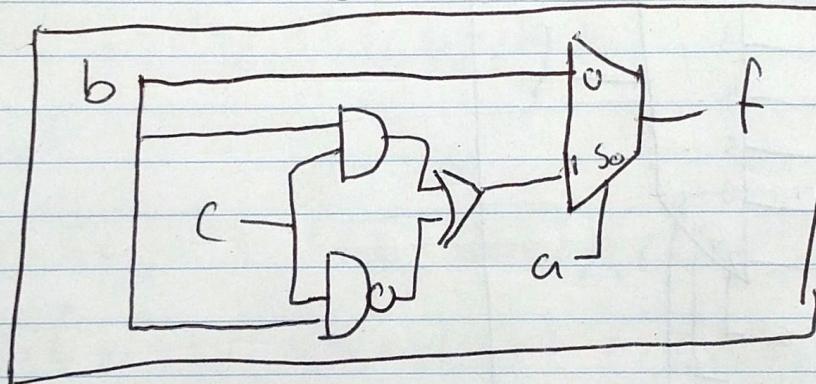
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2 (cont) b)

a	b	c	
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

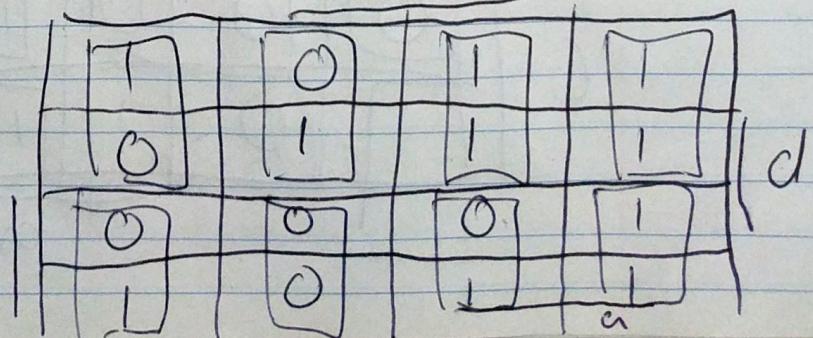
$$\begin{aligned}f(0, b, c) &= b\bar{c} + b\bar{c} \\&= b(\bar{c} + \bar{c}) \\&= b\end{aligned}$$

$$f(1, b, c) = \bar{b}\bar{c} + b\bar{c}$$



a	b	c	d	f
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

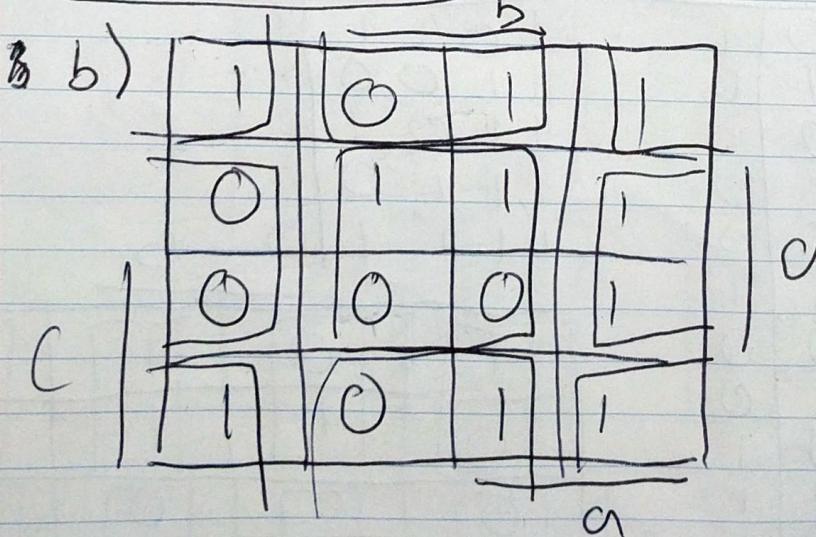
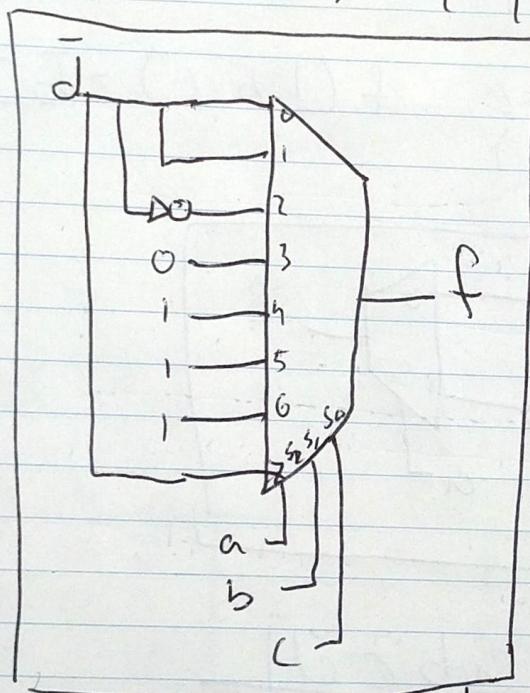
a	b	c	d	f
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1



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3 (cont) a (cont)

	a	b	c	
0	0	0	0	d
1	0	0	1	d
2	0	1	0	d
3	0	1	1	0
4	1	0	0	1
5	1	0	1	1
6	1	1	0	1
7	1	1	1	d

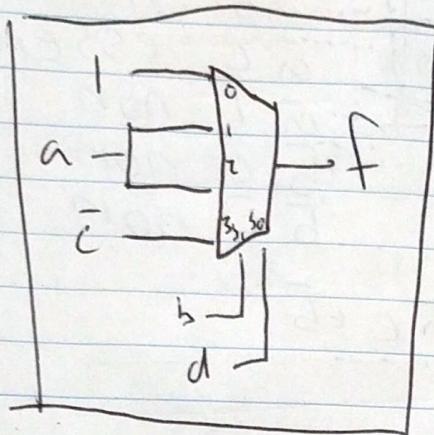


bd	
00	1
01	a
10	a
11	c

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3(cont) b(cont)



$$4) \bar{c}\bar{b} + \bar{d}b$$

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

$$\bar{c}\bar{d}$$

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

$$(a(\bar{c}\bar{b}\bar{d}\bar{b}) + (b\bar{c}\bar{b} + \bar{d}bb)) \quad (\overline{\bar{c}\bar{b}}\bar{c}\bar{d}\bar{b}) \\ (a((\bar{c}+b)(\bar{d}+b)) + \bar{d}b \quad (\bar{c}+b)(\bar{d}+b))$$

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

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

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

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

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

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

py6/q

5) a)

	<u>b</u>				<u>PIs</u>
	0	0	1		$\bar{a}b$ non
c	1	0	1		$\bar{a}c$ essential
	0	1	1		$\bar{a}\bar{b}$ non
	0	1	0		$\bar{b}c$ non
	0	0	1		$b\bar{c}$ non

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

Cost 3 literals
2 gates

b) $f(a, b, c) = \prod_b M(0, 1, 4, 5, 7)$

	<u>b</u>				<u>PIs</u>
	0	1	1	0	$b\bar{c}$ essential
c	0	1	0	0	$\bar{a}b$ essential
	0	0	1		
	0	0	0		

$$\bar{a}b + b\bar{c} = b(\bar{a} + \bar{c})$$

Cost 3 literals
2 gates

c) $f(x_1, y_1, z_1, w_1) = \sum m(1, 2, 5, 6, 7, 11, 12, 13, 14, 15)$

	<u>x</u>	<u>y</u>	<u>z</u>	<u>w</u>	<u>PIs</u>	<u>PIs</u>
	0	0	0	0		bd non
	0	1	0	0		bc non
c	1	0	1	0		acd essential
	0	1	1	0		$\bar{a}cd$ essential
	0	1	0	1		$\bar{a}\bar{c}d$ essential
	0	0	1	1		ab essential

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5 cont) (cont) $acd + \bar{a}cd + \bar{a}\bar{c}d + ab + bcd$

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

cost 4 literals

3 gates

d) $f(x, y, z, w) = \overline{IM}(1, 3, 8, 9, 10, 11, 15)$

		b						c		d		IPIs	
		0	1	0	1	0	1	0	1	0	1	0	1
		0	1	1	0	0	1	0	1	0	1	b̄c̄	non
		1	0	0	1	1	0	1	0	1	0	āb̄	non
		0	1	1	0	0	1	0	1	0	1	b̄d̄	non
		1	0	0	1	1	0	0	1	0	1	abc̄d	ess

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

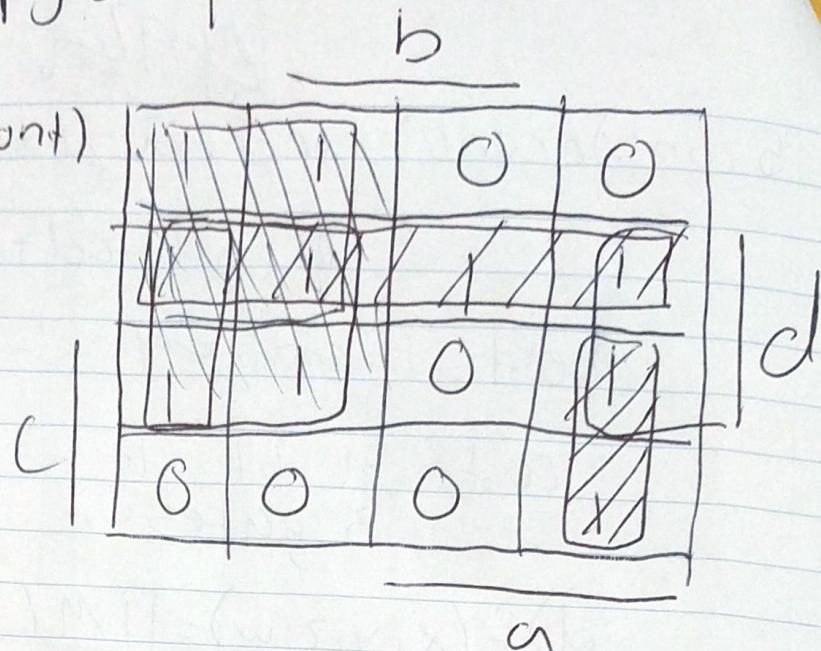
cost 10 literals
7 gates

e) $f(x, y, z, w) = \Sigma m(0, 1, 3, 4, 5, 7, 9, 10, 11, 13)$

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S cont) e cont)



PIs

$\bar{a}\bar{c}$ non essential

$\bar{a}d$ non essential

$\bar{c}d$ essential

$b\bar{c}d$ non

$a\bar{b}c$ essential

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

4 cost 9 literals
7 gates

6) Next page

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6) $a b c d$ | e f g $\bar{e}f$ $\bar{e}f$ $(g+h)$

$a b c d$	e	f	g	$\bar{e}f$	$\bar{e}f$	$(g+h)$
$(a+b)$	$(c+d)$	ef	$\bar{e}f$	$\bar{e}f$	$(g+h)$	
0 0 0 0	0	0	0	0	0	0
0 0 0 1	0	1	0	1	1	1
0 0 1 0	0	1	0	1	1	1
0 0 1 1	0	1	0	1	1	1
0 1 0 0	1	0	1	0	1	1
0 1 0 1	1	1	0	0	0	0
0 1 1 0	1	1	0	0	0	0
0 1 1 1	1	1	0	0	0	0
1 0 0 0	1	0	1	0	1	1
1 0 0 1	1	1	0	0	0	0
1 0 1 0	1	1	0	0	0	0
1 0 1 1	1	1	0	0	0	0
1 1 0 0	1	0	1	0	1	1
1 1 0 1	1	1	0	0	0	0
1 1 1 0	1	1	0	0	0	0
1 1 1 1	1	1	0	0	0	0

$$\bar{a}\bar{b}cd + abcd + \bar{a}\bar{b}cd + \bar{a}\bar{b}cd + \bar{a}\bar{b}cd + a\bar{b}cd + ab\bar{c}d$$

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

Cost 17 literals
7 gates