# Problem Set 3

"Sources Consulted: None"

P1 $x(w+y)\bar{z}+z\bar{w}$ $\quad a \cdot b = \overline{\bar{a}+\bar{b}}$

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

$= \overline{\overline{(x \cdot \overline{(\bar{w} \cdot \bar{y})} \cdot \bar{z} \cdot \overline{z\bar{w}})}}$

P2 a) $(\bar{x}yz)+(x\bar{y}\bar{z})+(x\bar{y}z)+(xy\bar{z})$

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

P3 a)

| x | y | z | xyz |
|---|---|---|---|
| F | F | F | T |
| F | F | T | F |
| F | T | F | T |
| F | T | T | F |
| T | F | F | F |
| T | F | T | F |
| T | T | F | T |
| T | T | T | F |

$(x\,y\bar{z}) + (\bar{x}\,y\bar{z}) + (x\bar{y}z) + (xy\bar{z}) + (xyz)$

True when the truth table is a DNF form

b)

| x | y | z | xyz |
|---|---|---|---|
| F | F | F | T |
| F | F | T | F |
| F | T | F | T |
| F | T | T | F |
| T | F | F | F |
| T | F | T | F |
| T | T | F | F |
| T | T | T | T |

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

Negation of all the false output when is a CNF form

"Sources Consulted: a friend"

P4 a) $a_0 \oplus b_0$

b) $(a_0 \cdot b_0) \oplus a_1 \oplus b_1$

c) $(a_1 \cdot b_1) + (a_0 \cdot b_0)(a_1 \oplus b_1)$

| $a_1$ | $a_0$ | $b_1$ | $b_0$ | $s_1$ | $s_2$ |
|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 0 | 1 | 0 |
| 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 0 | 1 | 0 |
| 1 | 0 | 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 |

P5 a) $a_0 \cdot b_0$

b) $a_1 \cdot b_0$

$$\begin{array}{r} a_1 a_0 \\ \times \quad b_0 \\ \hline s_1 \; s_0 \end{array}$$

| $a_0$ | $b_0$ | |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

| $a_1$ | $b_0$ | |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

P6 a) $a_0 \cdot b_0$

b) $((a_1 \cdot b_0) \cdot \overline{(a_0 \cdot b_1)}) + (\overline{(a_1 \cdot b_0)} \cdot (a_0 \cdot b_1))$

c) $(a_1 \cdot b_1) \cdot \overline{(a_0 \cdot b_0)}$

d) $a_1 \cdot b_1 \cdot (a_1 b_0 \cdot a_0 b_1)$

$$\begin{array}{r} a_1 a_0 \\ \times \quad b_1 b_0 \\ \hline a_1 b_0 \cdot a_0 b_0 \end{array}$$

$$\begin{array}{r} a_1 b_1 \; a_0 b_1 \\ \hline s_3 \; s_2 \; s_1 \; s_0 \end{array}$$

$a_1 b_1$

$(a_1 \cdot b_1) \cdot \text{not}\,(a_0 \cdot b_0)$

| $a_1$ | $a_0$ | $b_1$ | $b_0$ | $s_1$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | |
| 0 | 0 | 1 | 0 | |
| 0 | 0 | 1 | 1 | |
| 0 | 1 | 0 | 0 | |
| 0 | 1 | 0 | 1 | |
| 0 | 1 | 1 | 0 | |
| 0 | 1 | 1 | 1 | |
| 1 | 0 | 0 | 0 | |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | |
| 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | |
| 1 | 1 | 1 | 1 | 0 |

$a_1 b_0 = 1$

$(a_1 b_0) \cdot (b$

P7.a) $\bar{a}\,b$

"Sources Consulted: a friend"

not a and b

| a | b | |
|---|---|---|
| 0 | 0 | |
| 0 | 1 | 1 |
| 1 | 0 | |
| 1 | 1 | |

$\bar{a}b$

b) $[(a1 == b1)\cdot(\overline{a0}\cdot b0)] + (\bar{a1}\cdot b1)$

when $a1 < b1$ / $a1 = b1$ and $a0 < b0$

| a1 | a0 | b1 | b0 | |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | |
| 0 | 0 | 0 | 1 | |
| 0 | 0 | 1 | 0 | |
| 0 | 0 | 1 | 1 | |
| 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 | |
| 0 | 1 | 1 | 0 | |
| 0 | 1 | 1 | 1 | |
| 1 | 0 | 0 | 0 | |
| 1 | 0 | 0 | 1 | |
| 1 | 0 | 1 | 0 | |
| 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | |

c) $(\overline{a2}\cdot b2) + (a2 == b2)\cdot(\overline{a1}\cdot b1) +$
$(a2 == b2)(a1 == b1)\cdot(\overline{a0}\cdot b0)$

a2 a1 a0
b2 b1 b0

$(\overline{a_2}\cdot b2) + [$