EECS 281: Homework #5 Due: Tuesday, October 26, 2004

Name: _____ Email: _____

0. Practice, study (do not hand in) Wakerly problems (solutions at www.wakerly.com): 4.13(a) and 4.13(b).

1a. Apply T13 & T4 to the expression $\overline{a\bar{b}\bar{c}}$ resulting in:

1b. Apply T13 & T4 to the expression $\overline{a \vee \bar{b} \vee \bar{c}}$ resulting in:

1c. Apply T8 to the expression $(a \vee b)(a \vee \bar{b})$ resulting in (note: same as saying: $(a+b)(a+\bar{b})$:

1d. Apply T8 to the expression $(a \vee b)(a \vee \bar{b})(\bar{a} \vee b)$ resulting in:

1e. Given the minterms $\sum_{abc}(1,2,4,7)$, write the DNF (i.e. SOP) expression:

1f. Give the maxterms of 1e: _____

1g. Give the CNF (i.e. POS) expression of 1f (read Wakerly page 208):

1h. Draw the logic gate schematic of 1g:

2a. Give the truth table, minterms, and Maxterms for the following function $f(a,b,c) = \overline{a\bar{b} \vee ac} \vee \bar{a}$;

a b c	$a\bar{b}$	ac	$a\bar{b} \vee ac$	$\overline{a\bar{b} \vee ac}$	$\bar{a}$	f	minterms	maxterms
0 0 0								
0 0 1								
0 1 0								
0 1 1								
1 0 0								
1 0 1								
1 1 0								
1 1 1								

2b. Using boolean algebra (Wakerly page 199 Table 4-2, page 201, Table 4-3), give the DNF (i.e. SOP):

2b. Applying theorem T13' on $\overline{a\bar{b} \vee ac} \vee \bar{a}$, we now have _____

2b. Applying theorem T13, we now have _____

2b. Applying theorem T4, we now have _____

2b. Applying theorem T8', we now have _____

2b. Factor out $\bar{a}$ and applying theorem T2, we now have _____

2bbb. Applying theorem T1', we now have _____
(note: Does 2bbb match the truth table of 2a?)

2c. Give the n-cubes for part 2bbb: _____

2d. Give the minterms (i.e. 0-cubes or ON-set) for part 2bbb: _____

2e. Did 2d match your truth table of 2a? ___

2f. Fill in the k-map from 2bbb, showing circles of only the terms of 2bbb:

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

2g. Give the optimal minimal SOP of 2f: _____

2h. Give the Maxterms (i.e. OFF-set) from part 2d: _____

2i. Give the CNF of 2h (i.e. canonical product, POS, see Wakerly, page 208): _____

3a. Show by circling in the k-map each term in function $f(a, b, c) = \bar{a}\bar{b} \vee \bar{b}c \vee ac \vee ab \vee \bar{c}\bar{b}$;

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

3b. Show the optimal mimimal circling in the k-map of 3a (Wakerly, page 223, Fig. 4-27, Fig. 4-29):

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

3c. Give the Minimal SOP of the k-map: _____

3d. Give the CNF (i.e POS) of 3c: _____

4a Show by circling in the k-map each term in function $f(a,b,c,d) = \bar{a}\bar{b}\bar{c} \vee \bar{b}c \vee bcd$;

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

4b Show the optimal mimimal circling in the k-map of 4a:

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

4c. Give the Minimal SOP of the k-map: _____

4d. Give the CNF (i.e POS) of 4c: _____

4e. Give the minterms of the k-map in 4a: _____

4f. Group the minterms of 4e by the number of 1's:

4g. Do the Quine-McCluskey Algorithm in 4f.

5a Show the optimal k-map for $\sum_{a,b,c,d}(1,2,3,5,7)$:

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

5b. Give the Minimal SOP of the k-map: _____

5c. Given the don't cares (10,11,12,13,14,15), show the optimal k-map:

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

5d. Give the Minimal SOP of the k-map: _____

5e. Do the Quine-McCluskey Algorithm of 5a only (not 5c):

6. A programmer as written the following C code fragment:

```
f=0;
if (a & b) {
     if (c) { f=1; }
}
else if (b | c) { f=1; }
```

6a. Give the truth table for the variable f (assume that a, b, c are boolean values only):

6b. Give the optimal k-map of 6a.

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

6c. Give the optimal minimum SOP:

6d. Re-write as optimal C code: