National Chiao Tung University
Dept. of Computer & Information Science
Intro. to Digital Systems, Spring 1998

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Handout #5
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Sample Solutions to Quiz #1

1. (10 pts) $(94.D2)_{16} = A_2 = B_8 = C_{10}$. Find A, B, and C.

$A = 10010100.1101001$; $B = 224.644$; $C = 148.8203125$.

2. (10 pts) The following addition is performed in base r: $(35)_r + (146)_r = (214)_r$. Find r.

$(3 \times r^1 + 5) + (1 \times r^2 + 4 \times r + 6) = 2 \times r^2 + 1 \times r^1 + 4 \Longrightarrow (r-7)(r+1) = 0 \Longrightarrow r = 7.$

3. (5 pts) Find the *even parity bit* of the binary bit stream 1010111.

Because there are five 1 bits in the bit stream, the even parity bit is 1.

4. (10 pts) Simplify the following Boolean expression to three literals: $yz + y(xw + x\bar{w})$, and find the **complement** of the simplified result.

$$\begin{aligned} yz + y(xw + x\bar{w}) &= yz + y(x(w+\bar{w})) = yz + yx = y(x+z). \\ \overline{y(x+z)} &= \bar{y} + \overline{(x+z)} = \bar{y} + \bar{x}\bar{z}. \end{aligned}$$

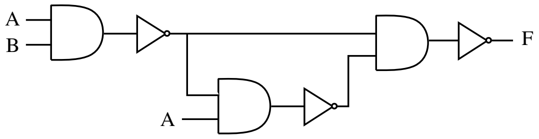
5. (10 pts) Let $F(a,b,c)$ be a Boolean function defined as follows:

$$F(a,b,c) = \overline{a \cdot b} \cdot (a + b \cdot \bar{c}) \cdot (a + b + c)$$

Fill in the function table entries for F below and **copy the resulting table to your answer sheet.**

abc	$\overline{a \cdot b}$	$(a + b \cdot \bar{c})$	$a + b + c$	$F(a,b,c)$
000	1	0	0	0
001	1	0	1	0
010	1	1	1	1
011	1	0	1	0
100	1	1	1	1
101	1	1	1	1
110	0	1	1	0
111	0	1	1	0

6. (10 pts) Find F and **simplify**.



$$
\begin{aligned}
\overline{\overline{AB} \cdot \overline{A \cdot \overline{AB}}} &= \overline{\overline{AB}} + \overline{\overline{A \cdot \overline{AB}}} \\
&= AB + A \cdot \overline{AB} \\
&= AB + A\bar{B} \\
&= A.
\end{aligned}
$$

7. (15 pts) Below shows the Karnaugh map for a three-variable function G.

X \ YZ	00	01	11	10
0	1		1	1
1	1	1		

(Y spans columns 11 and 10; Z spans columns 01 and 11; X spans row 1.)

(a) (5 pts) Write G in canonical sum-of-minterms form.

$G = \sum(0, 2, 3, 4, 5) = \bar{x}\bar{y}\bar{z} + \bar{x}y\bar{z} + \bar{x}yz + x\bar{y}\bar{z} + x\bar{y}z.$

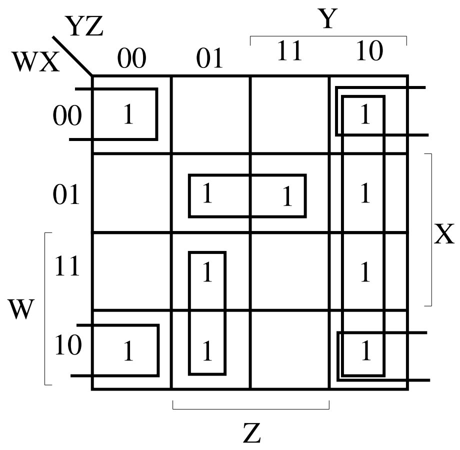
(b) (5 pts) Write G in canonical product-of-maxterms form.

$G = \Pi(1, 6, 7) = (x + y + \bar{z})(\bar{x} + \bar{y} + z)(\bar{x} + \bar{y} + \bar{z}).$

(c) (5 pts) Write the **complement** of G in canonical product-of-maxterms form.

$\bar{G} = \Pi(0, 2, 3, 4, 5) = (x + y + z)(x + \bar{y} + z)(x + \bar{y} + \bar{z})(\bar{x} + y + z)(\bar{x} + y + \bar{z}).$

8. (10 pts) Below shows the Karnaugh map for a four-variable function F. Write $F(W, X, Y, Z)$ in a **minimal literal sum-of-products** form.



Thus, the minimal literal sum-of-products form is $\bar{X}\bar{Z} + Y\bar{Z} + \bar{W}XZ + W\bar{Y}Z$.