

Sirindhorn International Institute of Technology
Thammasat University at Rangsit
School of Information, Computer and Communication Technology

ECS 371: Problem Set 3

Semester/Year: 1/2009

Course Title: Digital Circuits

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Course Web Site: <http://www.siit.tu.ac.th/prapun/ecs371/>

Due date: July 9, 2009 (Thursday)

Please submit your homework to the instructor 3 minutes BEFORE your class starts.

Instructions

1. The questions are assigned from the following textbook:

Thomas L. Floyd, [*Digital Fundamentals*](#), 10th Edition, Pearson Education International (2009).
2. Only ONE of the problems will be graded. Of course, you do not know which problems will be selected; so you should work on all of them.
3. Late submission will not be accepted.
4. **Write down all the steps** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.

Chapter 4

- 5(b,d), 26b, 30b, 32a, 34a, 44
5. Find the values of the variables that make each product term 1 and each sum term 0.
- (a) AB (b) $\overline{A}BC$ (c) $A + B$ (d) $\overline{A} + B + \overline{C}$
(e) $\overline{A} + \overline{B} + C$ (f) $\overline{A} + B$ (g) \overline{ABC}

5. (a) $AB = 1$ when $A = 1, B = 1$
 (b) $\overline{ABC} = 1$ when $A = 1, B = 0, C = 1$
 (c) $A + B = 0$ when $A = 0, B = 0$
 (d) $\overline{A} + B + \overline{C} = 0$ when $A = 1, B = 0, C = 1$
 (e) $\overline{A} + \overline{B} + C = 0$ when $A = 1, B = 1, C = 0$
 (f) $\overline{A} + B = 0$ when $A = 1, B = 0$
 (g) $\overline{ABC} = 1$ when $A = 1, B = 0, C = 0$

24. Convert the following expressions to sum-of-product (SOP) forms:

(a) $AB + CD(\overline{AB} + CD)$ (b) $AB(\overline{BC} + BD)$ (c) $A + B[AC + (B + \overline{C})D]$

26. Convert each SOP expression in Problem 24 to standard SOP form.

26. (a) $AB + CD = ABCD + ABC\overline{D} + AB\overline{C}D + AB\overline{C}\overline{D} + \overline{A}BCD + \overline{A}B\overline{C}D + \overline{A}B\overline{C}\overline{D}$
 (b) $ABD = ABCD + AB\overline{C}D$
 (c) $A + BD = \overline{A}BC\overline{D} + \overline{A}B\overline{C}D + \overline{A}B\overline{C}\overline{D} + \overline{A}BCD + ABC\overline{D} + ABCD$
 $+ ABC\overline{D} + ABCD + \overline{A}BC\overline{D} + \overline{A}B\overline{C}D$

30. Convert each standard SOP expression in Problem 26 to standard POS form.

30. (a) $(A + B + C + D)(A + B + C + \overline{D})(A + B + \overline{C} + D)(A + \overline{B} + C + D)(A + \overline{B} + C + \overline{D})$
 $(A + \overline{B} + \overline{C} + D)(\overline{A} + B + C + D)(\overline{A} + B + C + \overline{D})(\overline{A} + B + \overline{C} + D)$
 (b) $(A + B + C + D)(A + B + C + \overline{D})(A + B + \overline{C} + D)(A + B + \overline{C} + \overline{D})$
 $(A + \overline{B} + C + D)(A + \overline{B} + C + \overline{D})(A + \overline{B} + \overline{C} + D)(A + \overline{B} + \overline{C} + \overline{D})(\overline{A} + B + C + D)$
 $(\overline{A} + B + C + \overline{D})(\overline{A} + B + \overline{C} + D)(\overline{A} + B + \overline{C} + \overline{D})(\overline{A} + \overline{B} + C + D)(\overline{A} + \overline{B} + \overline{C} + D)$
 (c) $(A + B + C + D)(A + B + C + \overline{D})(A + B + \overline{C} + D)(A + B + \overline{C} + \overline{D})$
 $(A + \overline{B} + C + D)(A + \overline{B} + \overline{C} + D)$

32. Develop a truth table for each of the following standard SOP expressions:

(a) $\overline{A}BC\overline{D} + \overline{A}BCD + \overline{A}\overline{B}C\overline{D} + \overline{A}\overline{B}C\overline{D}$
 (b) $WXYZ + WXY\overline{Z} + \overline{W}XYZ + \overline{W}\overline{X}YZ + W\overline{X}YZ$

32. (a) Table 4-5

A	B	C	D	X
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

(b) Table 4-6

W	X	Y	Z	Q
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

34. Develop a truth table for each of the standard POS expressions:

(a) $(\bar{A} + \bar{B} + \bar{C})(A + B + C)(A + \bar{B} + C)$

(b) $(\bar{A} + B + \bar{C} + D)(A + \bar{B} + C + \bar{D})(A + \bar{B} + \bar{C} + D)(\bar{A} + B + C + \bar{D})$

34. (a) Table 4-9

A	B	C	X
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

(b) Table 4-10

A	B	C	D	X
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	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	1

44. Use a Karnaugh map to reduce each expression to a minimum SOP form:

(a) $A + B\bar{C} + CD$

(b) $\overline{ABCD} + \overline{ABCD} + ABCD + ABC\bar{D}$

(c) $\overline{AB}(\overline{CD} + \overline{CD}) + AB(\overline{CD} + \overline{CD}) + \overline{ABCD}$

(d) $(\overline{AB} + \overline{AB})(CD + \overline{CD})$

(e) $\overline{AB} + \overline{AB} + \overline{CD} + \overline{CD}$

44. See Figure 4-15.

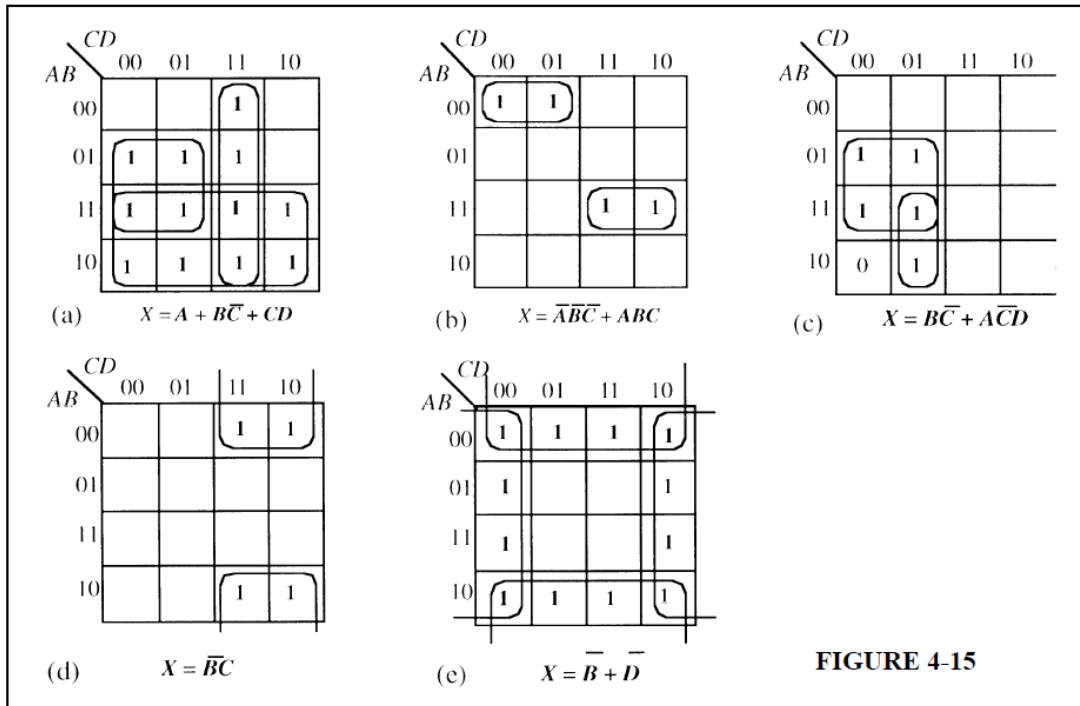


FIGURE 4-15