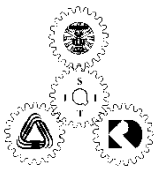


Sirindhorn International Institute of Technology

Thammasat University at Rangsit

School of Information, Computer and Communication Technology

ECS 371: Solution for Problem Set 2

Semester/Year: **1/2009**
Course Title: Digital Circuits
Instructor: Dr. Prapun Suksompong (prapun@siit.tu.ac.th)
Course Web Site: http://www.siit.tu.ac.th/prapun/ecs371/

Due date: July 2, 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 TWO 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

6. Find the value of X for all possible values of the variables.

(a) $X = (A + B)C + B$ **(b)** $X = (\overline{A + B})C$ **(c)** $X = A\overline{B}C + AB$

(d) $X = (A + B)(\overline{A} + B)$ **(e)** $X = (A + BC)(\overline{B} + \overline{C})$

6. (a) $X = (A + B)C + B$

A	B	C	$A + B$	$(A + B)C$	X
0	0	0	0	0	0
0	0	1	0	0	0
0	1	0	1	0	1
0	1	1	1	1	1
1	0	0	1	0	0
1	0	1	1	1	1
1	1	0	1	0	1
1	1	1	1	1	1

(b) $X = (\overline{A+B})C$

A	B	C	$\overline{A+B}$	X
0	0	0	1	0
0	0	1	1	1
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	0	0

(c) $X = A\overline{B}C + AB$

A	B	C	$A\overline{B}C$	AB	X
0	0	0	0	0	0
0	0	1	0	0	0
0	1	0	0	0	0
0	1	1	0	0	0
1	0	0	0	0	0
1	0	1	1	0	1
1	1	0	0	1	1
1	1	1	0	1	1

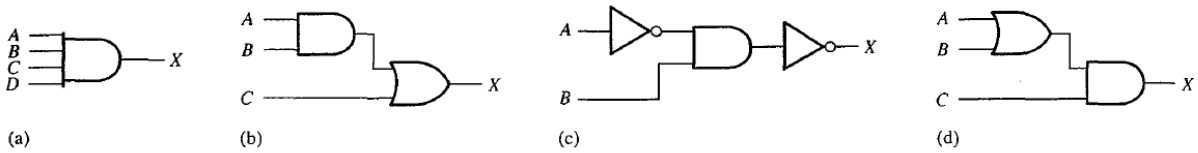
(d) $X = (A + B)(\overline{A} + B)$

A	B	$A + B$	$\overline{A} + B$	X
0	0	0	1	0
0	1	1	1	1
1	0	1	0	0
1	1	1	1	1

(e) $X = (A + BC)(\overline{B} + \overline{C})$

A	B	C	$A + BC$	$\overline{B} + \overline{C}$	X
0	0	0	0	1	0
0	0	1	0	1	0
0	1	0	0	1	0
0	1	1	1	0	0
1	0	0	1	1	1
1	0	1	1	1	1
1	1	0	1	1	1
1	1	1	1	0	0

13. Write the Boolean expression for each of the logic circuits in Figure 4–54.



13. See Figure 4-1.

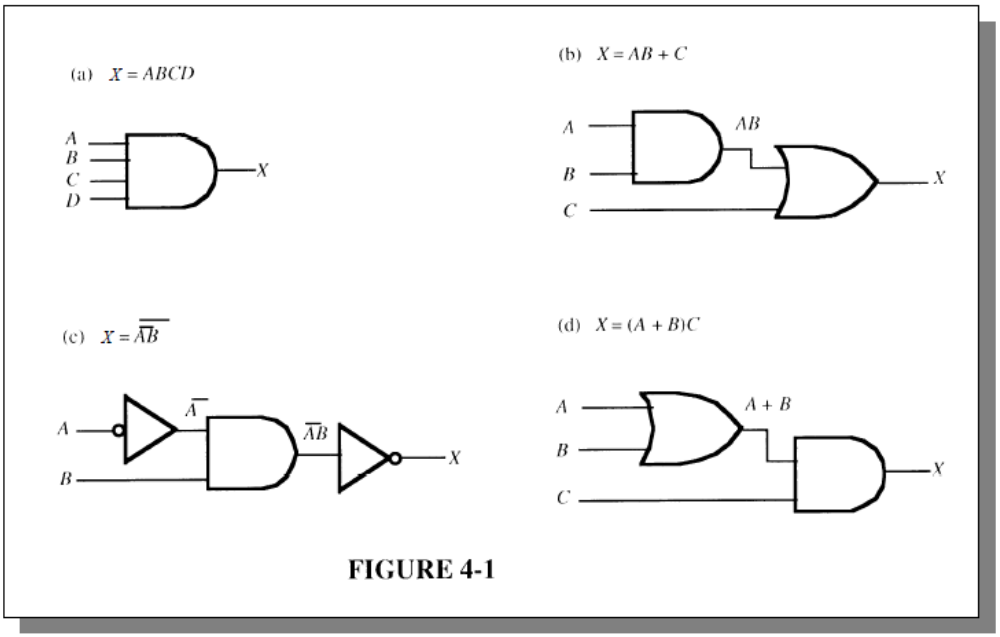


FIGURE 4-1

15. Draw the logic circuit represented by each expression:

(a) $A\overline{B} + \overline{A}B$ **(b)** $AB + \overline{A}\overline{B} + \overline{A}BC$

(c) $\overline{A}B(C + \overline{D})$ **(d)** $A + B[C + D(B + \overline{C})]$

15. See Figure 4-3.

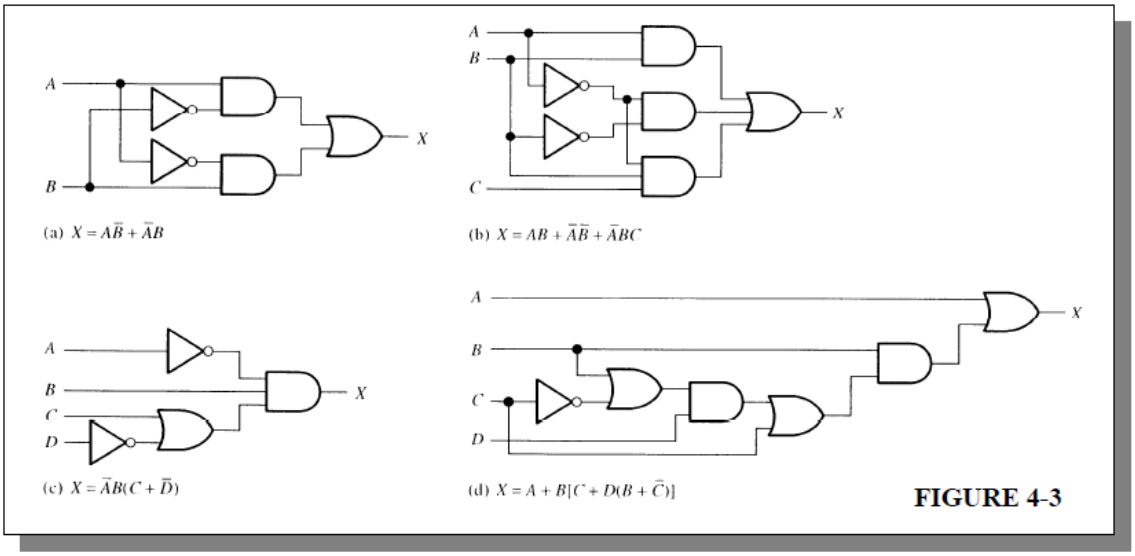


FIGURE 4-3

20. Using Boolean algebra, simplify the following expressions:

(a) $(A + \overline{B})(A + C)$ **(b)** $\overline{A}B + \overline{A}B\overline{C} + \overline{A}BCD + \overline{A}B\overline{C}\overline{D}E$

(c) $AB + \overline{A}\overline{B}C + A$ **(d)** $(A + \overline{A})(AB + AB\overline{C})$

(e) $AB + (\overline{A} + \overline{B})C + AB$

20. (a) $(A+\overline{B})(A+C) = AA + AC + A\overline{B} + \overline{B}C = A + AC + A\overline{B} + \overline{B}C$

$= A(1 + C + \overline{B}) + \overline{B}C = A(1) + \overline{B}C = \boldsymbol{A + \overline{B}C}$

(b) $\overline{A}B + \overline{A}B\overline{C} + \overline{A}BCD + \overline{A}B\overline{C}\overline{D}E = \overline{A}B(1 + \overline{C} + CD + \overline{C}\overline{D}E) = \overline{A}B(1)$

$= \boldsymbol{\overline{A}B}$

(c) $AB + \overline{A}\overline{B}C + A = AB + (\overline{A} + \overline{B})C + A = AB + \overline{A}C + \overline{B}C + A$

$A(B + 1) + \overline{A}C + \overline{B}C = A + \overline{A}C + \overline{B}C = A + C + \overline{B}C = A + C(1 + \overline{B})$

$= \boldsymbol{A + C}$

(d) $(A + \overline{A})(AB + AB\overline{C}) = AAB + AAB\overline{C} + \overline{A}AB + \overline{A}AB\overline{C}$

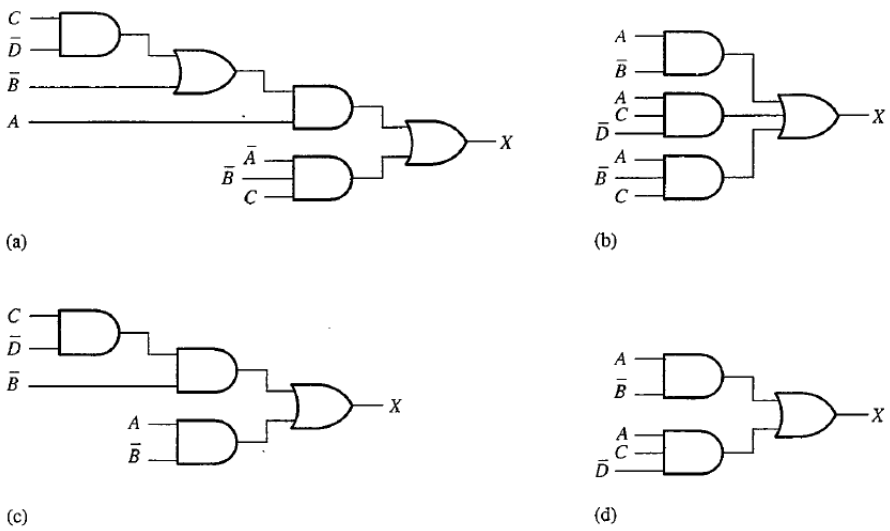
$= AB + AB\overline{C} + 0 + 0 = AB(1 + \overline{C}) = \boldsymbol{AB}$

(e) $AB + (\overline{A} + \overline{B})C + AB = AB + \overline{A}C + \overline{B}C + AB = AB + (\overline{A} + \overline{B})C$

$= AB + \overline{A}\overline{B}C = \boldsymbol{AB + C}$

22. Determine which of the logic circuits in Figure 4–56 are equivalent.

FIGURE 4–56



22. First develop the Boolean expression for the output of each gate network and simplify.

(a) See Figure 4-5.

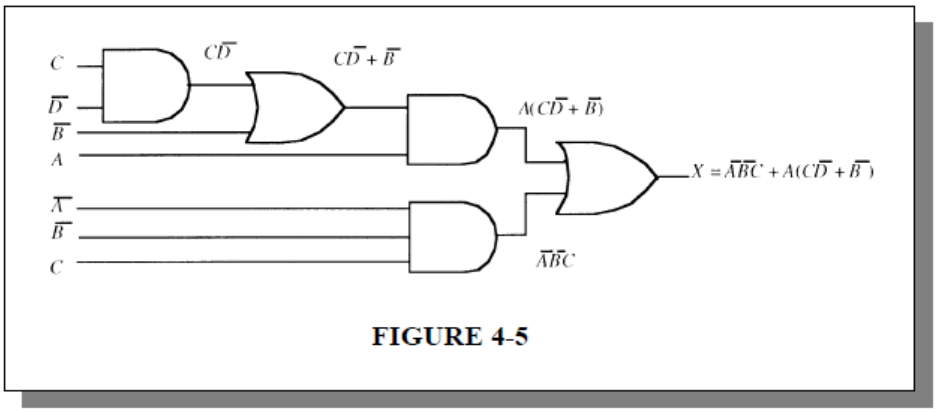


FIGURE 4-5

$$X = \overline{A}\,\overline{B}C + A(C\overline{D} + \overline{B}) = \overline{A}\,\overline{B}C + AC\overline{D} + A\overline{B} = \overline{B}(A + \overline{A}C) + AC\overline{D}$$
$$= \overline{B}(A + C) + ACD = \boldsymbol{A\overline{B} + \overline{B}C + AC\overline{D}}$$

(b) See Figure 4-6.

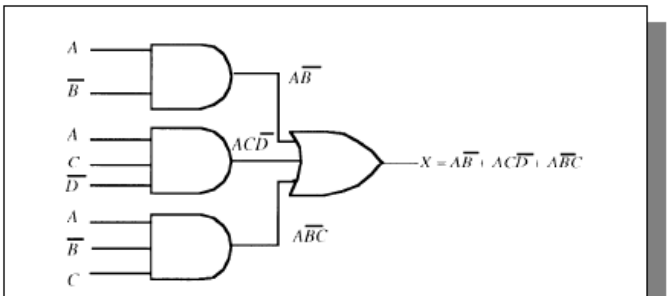


FIGURE 4-6

$$X = A\overline{B} + AC\overline{D} + A\overline{B}C = A\overline{B}(1 + C) + AC\overline{D} = \boldsymbol{A\overline{B} + AC\overline{D}}$$

(c) See Figure 4-7.

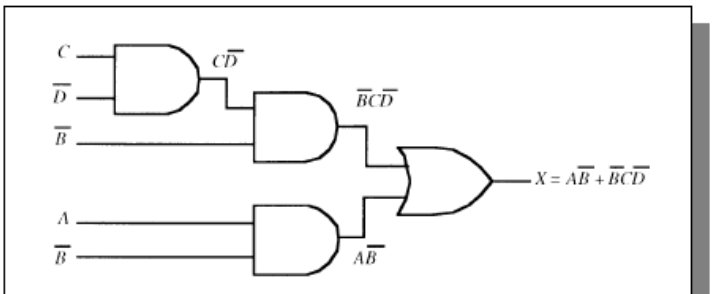


FIGURE 4-7

$X = \boldsymbol{A\overline{B} + \overline{B}C\overline{D}}$ No further simplification is possible.

(d) See Figure 4-8.

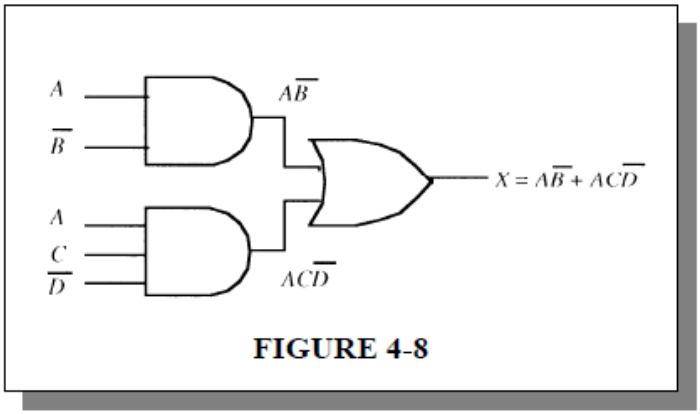


FIGURE 4-8

$X = A\overline{B} + AC\overline{D}$ No further simplification is possible.

Therefore, (b) and (d) are equivalent.