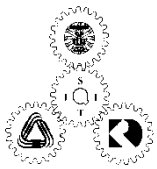


Sirindhorn International Institute of Technology

Thammasat University at Rangsit

School of Information, Computer and Communication Technology

ECS 371: Solution for Problem Set 4

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 16, 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 5

- 4(b,c,e), 20a, 22a, 56

4. Write the output expression for each circuit as it appears in Figure 5–56 and then change each circuit to an equivalent AND-OR configuration.

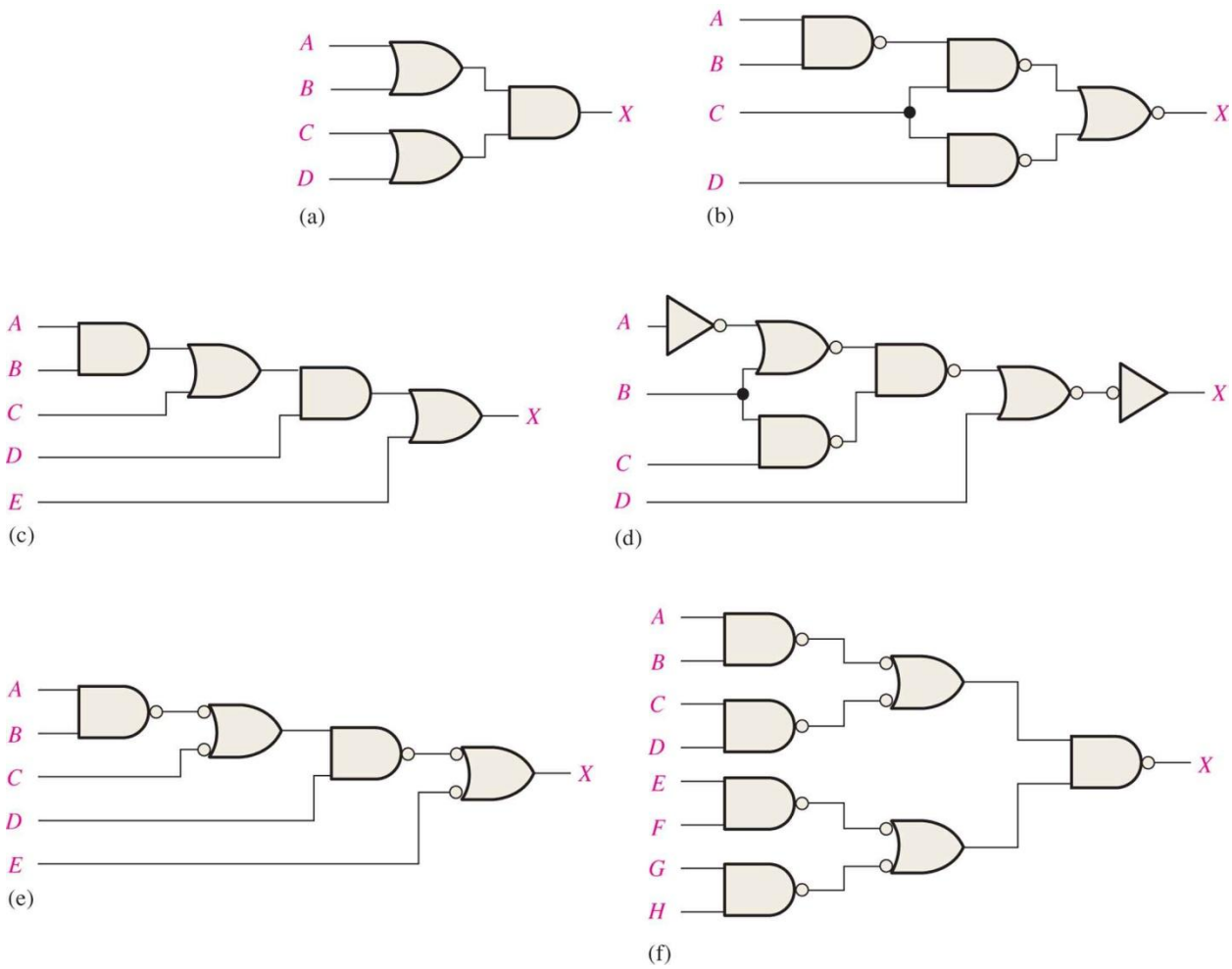


FIGURE 5–56

4. See Figure 5-2 for the circuit corresponding to each expression.

(a) $X = (A + B)(C + D) = AC + AD + BC + BD$

(b) $X = \overline{\overline{ABC} + \overline{CD}} = (\overline{ABC})(CD) = (\overline{A} + \overline{B})CCD = \overline{A}CD + \overline{B}CD$

(c) $X = (AB + C)D + E = ABD + CD + E$

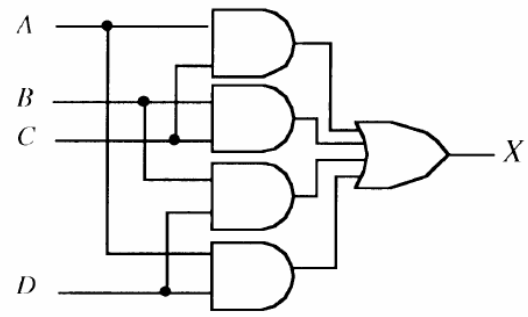
(d) $X = \overline{\overline{(\overline{A} + B)(\overline{BC})} + D} = \overline{(\overline{A} + B)(\overline{BC})} + D = \overline{A} + B + BC + D = \overline{A} + B + D$

(e) $X = \overline{(\overline{AB} + \overline{C})}D + \overline{E} = (AB + \overline{C})D + \overline{E} = ABD + \overline{C}D + \overline{E}$

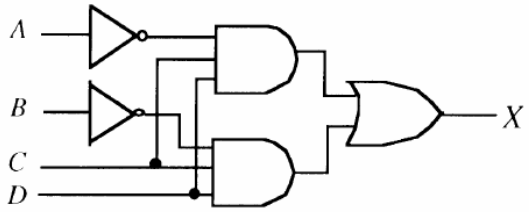
(f) $X = \overline{(\overline{AB} + \overline{CD})(\overline{EF} + \overline{GH})} = \overline{(AB + CD)(EF + GH)} = \overline{(AB + CD)} + \overline{(EF + GH)}$

$= (\overline{AB})(\overline{CD}) + (\overline{EF})(\overline{GH})$

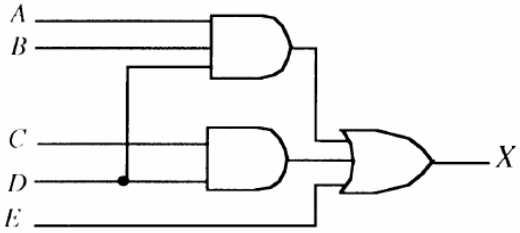
$= (\overline{A} + \overline{B})(\overline{C} + \overline{D}) + (\overline{E} + \overline{F})(\overline{G} + \overline{H}) = \overline{A}\,\overline{C} + \overline{B}\,\overline{C} + \overline{A}\,\overline{D} + \overline{B}\,\overline{D} + \overline{E}\,\overline{G} + \overline{F}\,\overline{G} + \overline{E}\,\overline{H} + \overline{F}\,\overline{H}$



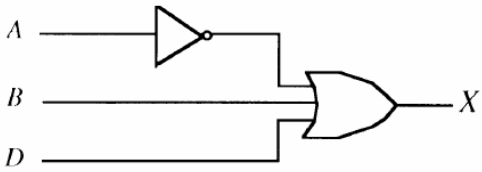
(a)



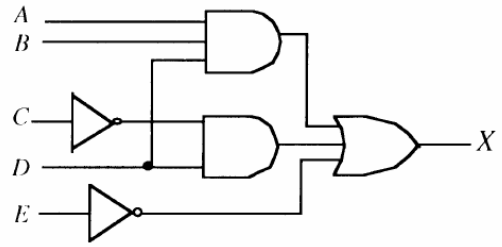
(b)



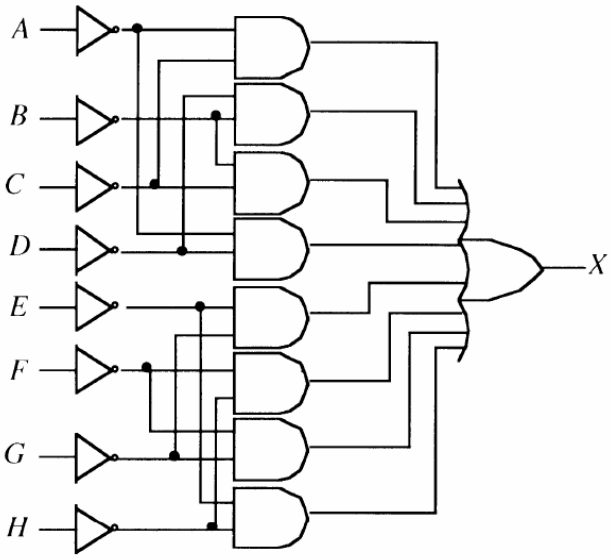
(c)



(d)



(e)



(f)

FIGURE 5-2

20. Implement the logic circuits in Figure 5–54 using only NAND gates.

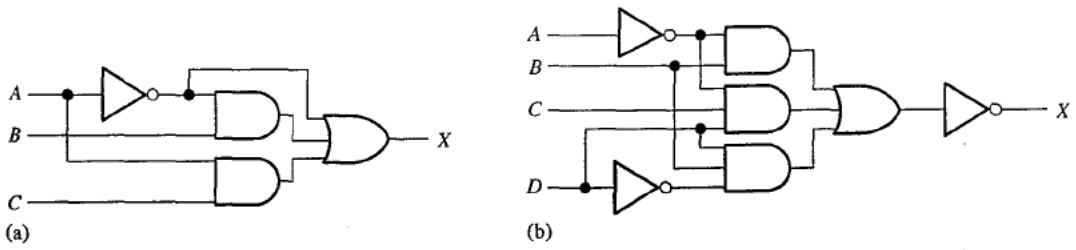


FIGURE 5–54

20. See Figure 5-20.

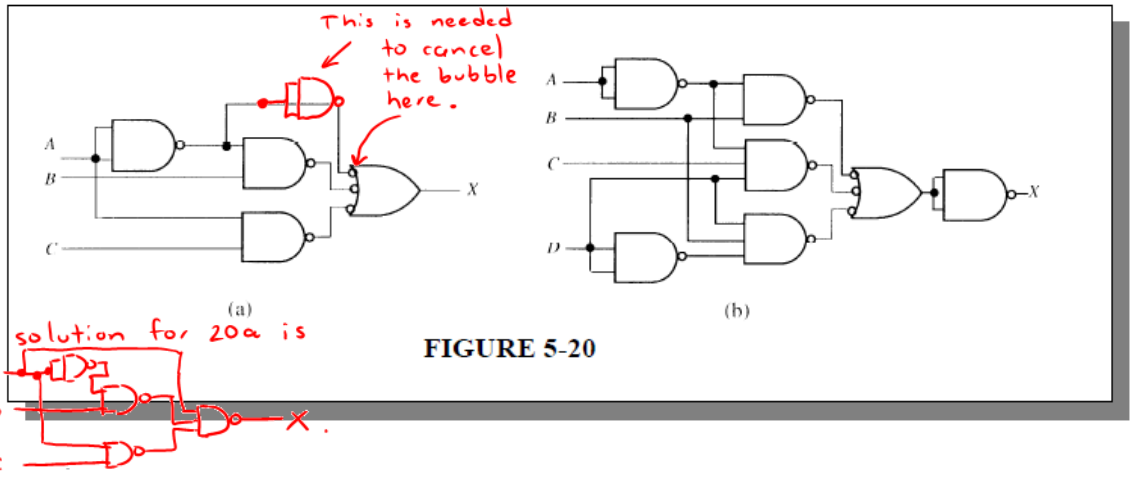


FIGURE 5-20

22. Repeat Problem 20 using only NOR gates.

22. See Figure 5-22.

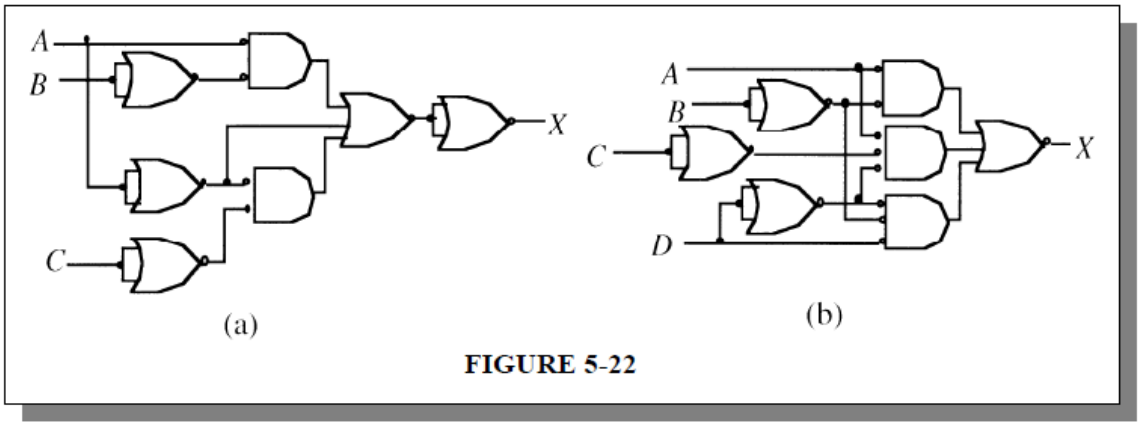


FIGURE 5-22

56. Design a logic circuit to produce a HIGH output only if the input, represented by a 4-bit binary number, is greater than twelve or less than three. First develop the truth table and then draw the logic diagram.

56.

A_3	A_2	A_1	A_0	X
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
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
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

See Figure 5-68.

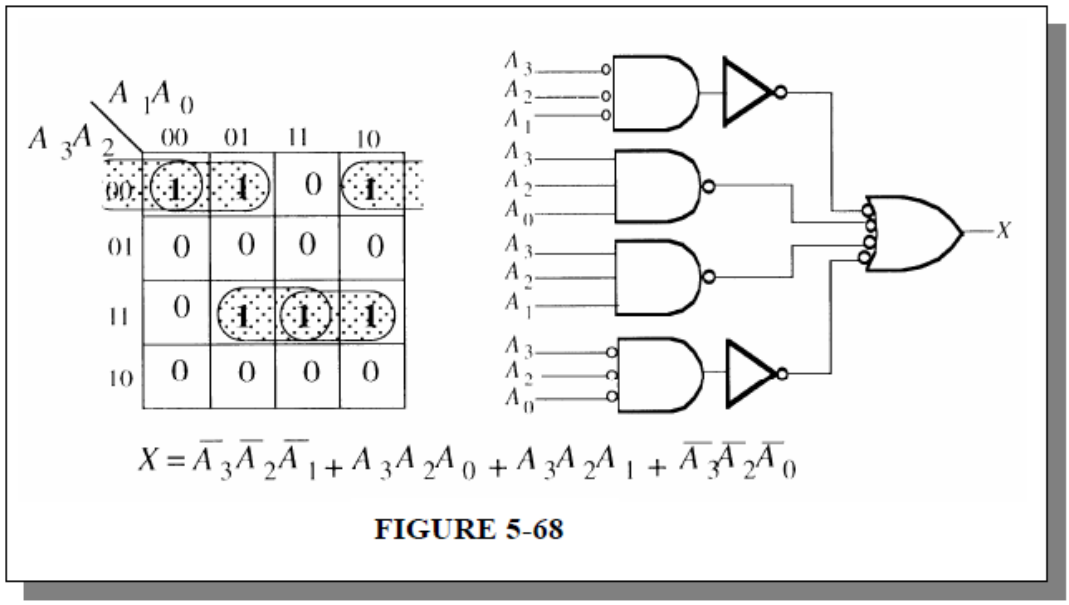


FIGURE 5-68