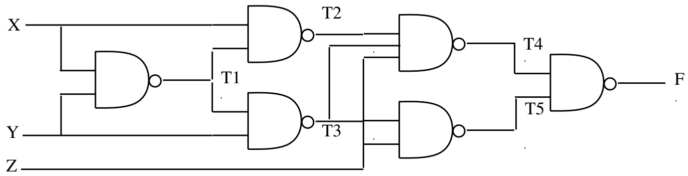
National Chiao Tung University
Dept. of Computer & Information Science
Intro. to Digital Systems, Spring 1998

May 11, 1998
Handout #11
TA: Ze-Hong Li

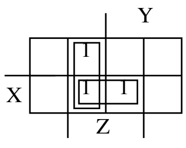
Simple Solutions to Homework #3

Problems 1–17 are adopted from M. M. Mano and C. R. Kime, *Logic and Computer Design Fundamentals*, Prentice-Hall, Inc., 1997.

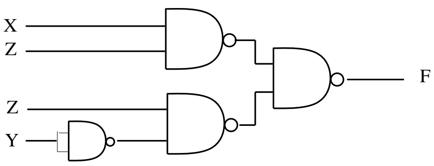
1. Problem 3–2 (pages 163).



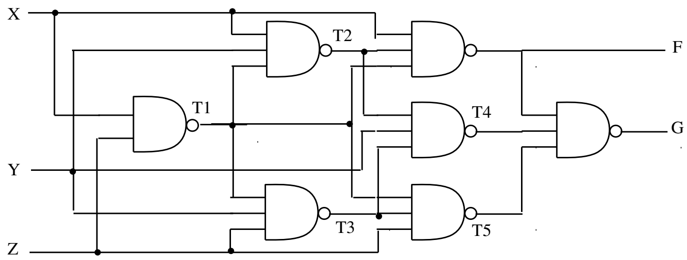
X	Y	Z	T1	T2	T3	T4	T5	F
0	0	0	1	1	1	1	1	0
0	0	1	1	1	1	0	0	1
0	1	0	1	1	0	1	1	0
0	1	1	1	1	0	1	1	0
1	0	0	1	0	1	1	1	0
1	0	1	1	0	1	1	0	1
1	1	0	0	1	1	1	1	0
1	1	1	0	1	1	0	0	1



$XZ+Z\overline{Y}$



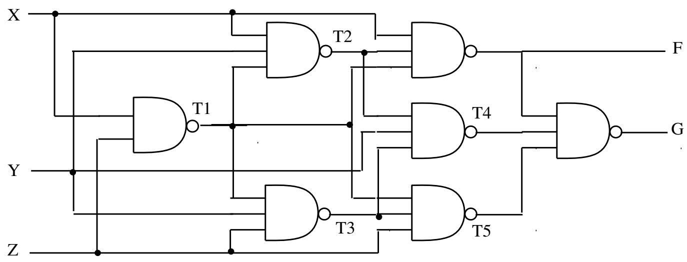
2. Problem 3–4 (page 163).

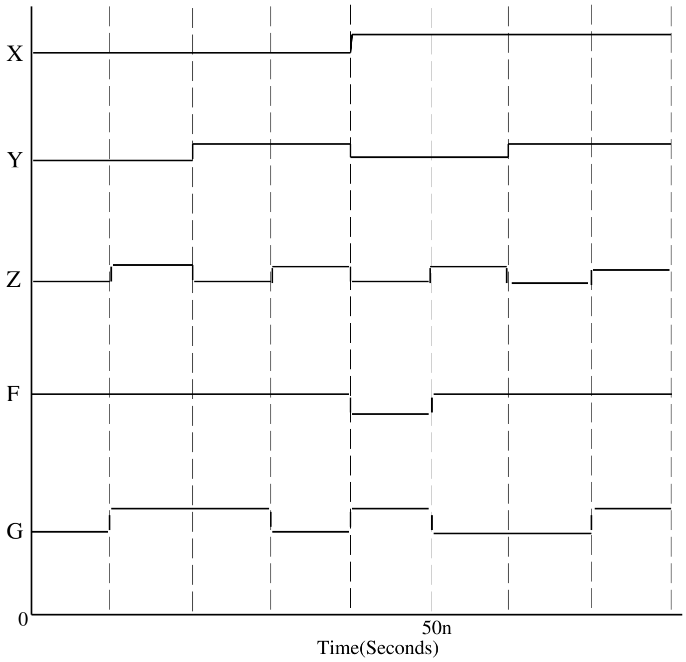


X	Y	Z	T1	T2	T3	T4	T5	F	G
0	0	0	1	1	1	1	1	1	0
0	0	1	1	1	1	1	0	1	1
0	1	0	1	1	1	0	1	1	1
0	1	1	1	1	0	1	1	1	0
1	0	0	1	1	1	1	1	0	1
1	0	1	0	1	1	1	1	1	0
1	1	0	1	0	1	1	1	1	0
1	1	1	0	1	1	0	1	1	1

$$F = \overline{X\bar{Y}\bar{Z}} \qquad G = X \oplus Y \oplus Z$$

3. Problem 3–5 (page 164). (**Attention: Use the same delay assumptions mentioned in the text.**)



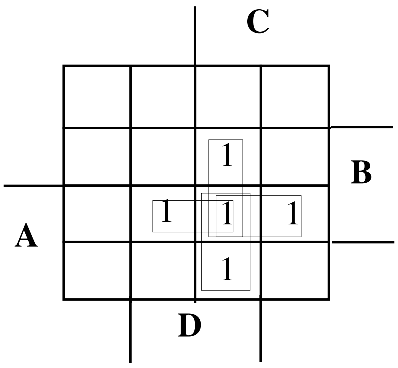


4. Problem 3–7 (page 164).

				Upper				Lower					
W	X	Y	Z	D0	D1	D2	D3	D0	D1	D2	D3	F	G
0	0	0	0	0	1	1	1	1	1	1	1	1	1
0	0	0	1	0	1	1	1	1	1	1	1	1	1
0	0	1	0	1	0	1	1	1	1	1	1	1	0
0	0	1	1	1	0	1	1	1	1	1	1	1	0
0	1	0	0	1	1	0	1	1	1	1	1	1	1
0	1	0	1	1	1	0	1	1	1	1	1	1	1
0	1	1	0	1	1	1	0	1	1	1	1	1	0
0	1	1	1	1	1	1	0	1	1	1	1	1	0
1	0	0	0	1	1	1	1	0	1	1	1	0	0
1	0	0	1	1	1	1	1	1	0	1	1	0	1
1	0	1	0	1	1	1	1	0	1	1	1	0	0
1	0	1	1	1	1	1	1	1	0	1	1	0	1
1	1	0	0	1	1	1	1	1	1	0	1	0	0
1	1	0	1	1	1	1	1	1	1	1	0	0	1
1	1	1	0	1	1	1	1	1	1	0	1	0	0
1	1	1	1	1	1	1	1	1	1	1	0	0	1

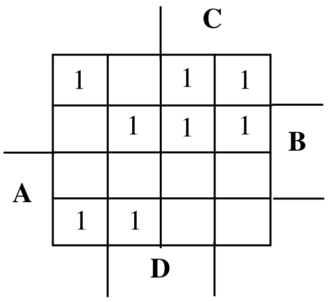
5. Problem 3–10 (page 164).

0111 #7
1011 #11
1101 #13
1110 #14
1111 #15

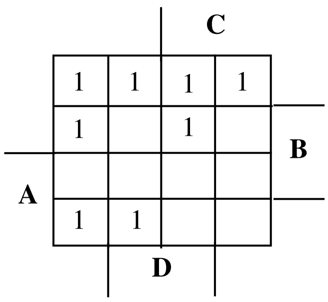


$$F = ABD + ABC + ACD + BCD$$

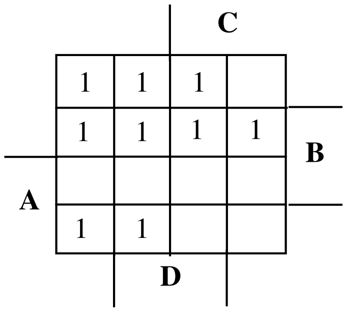
6. Problem 3–12 (a), (b), and (c) (page 166).



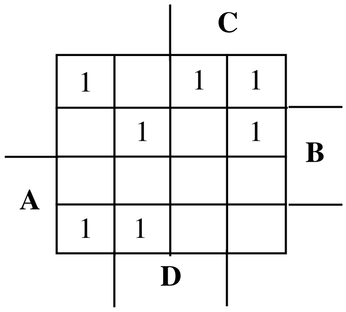
$a = \bar{A}C + \bar{A}\bar{B}\bar{D} + \bar{A}BD + A\bar{B}\bar{C}$



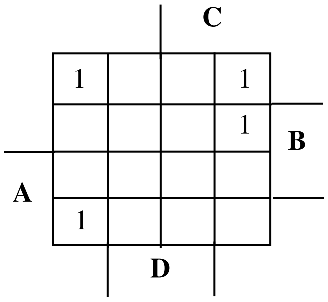
$b = \bar{A}\bar{B} + \bar{B}\bar{C} + \bar{A}\bar{C}\bar{D} + \bar{A}CD$



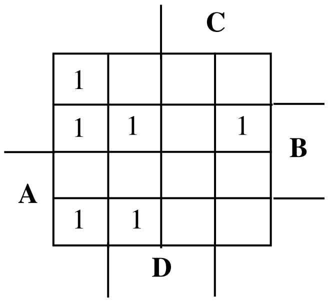
$c = \bar{A}B + \bar{B}\bar{C} + \bar{A}D$



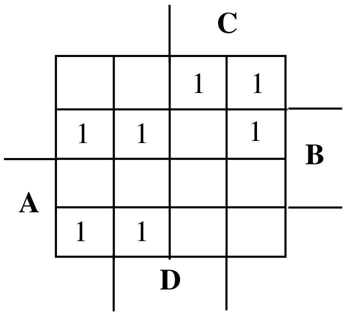
$d = \bar{A}B\bar{C}D + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{D} + \bar{A}\bar{B}C + \bar{A}C\bar{D}$



$e = \bar{B}\bar{C}\bar{D} + \bar{A}C\bar{D}$



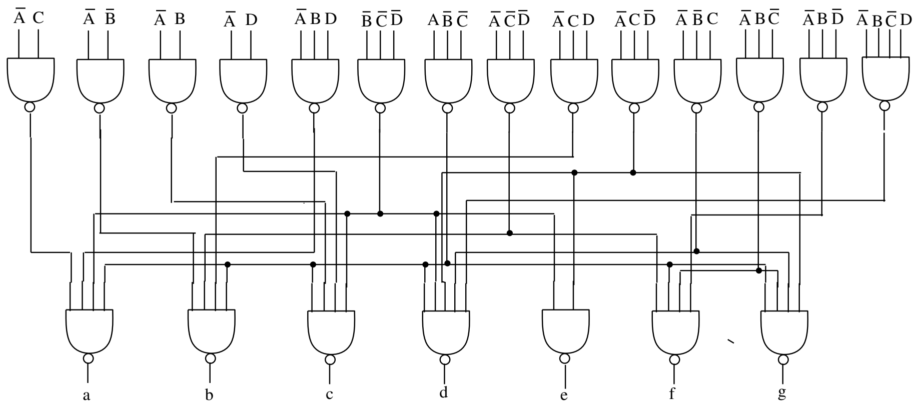
$f = A\bar{B}\bar{C} + \bar{A}B\bar{D} + \bar{A}B\bar{C} + \bar{A}C\bar{D}$



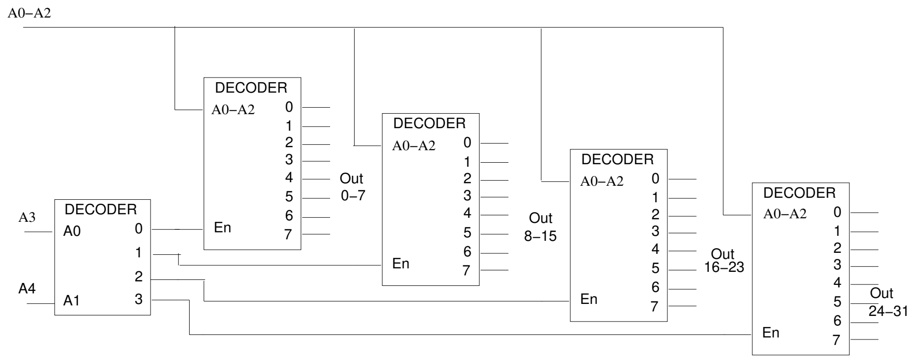
$g = A\bar{B}\bar{C} + \bar{A}B\bar{C} + \bar{A}\bar{B}C + \bar{A}C\bar{D}$

Total Gates = 7 OR + 16 AND = 23 Gates. The gate count is 2 more than for the solution presented in the book.

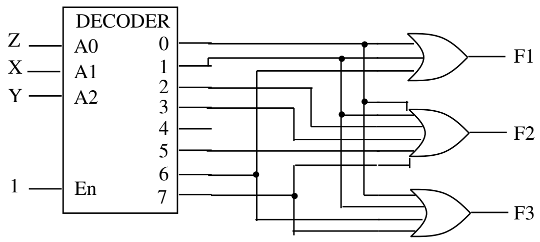
7. Problem 3–13 (page 166).



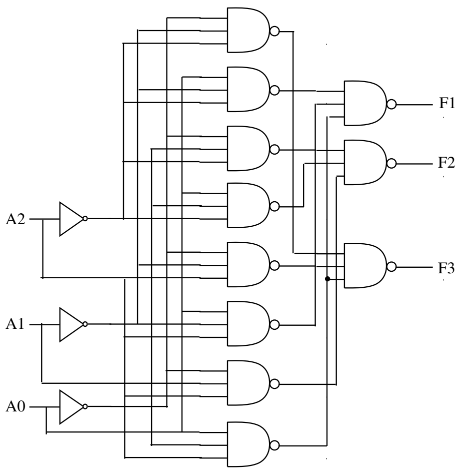
8. Problem 3–14 (page 166).



9. Problem 3–16 (page 167).



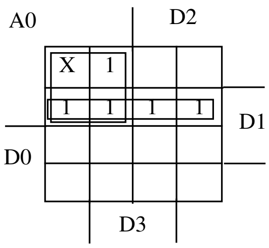
10. Problem 3–17 (page 167).

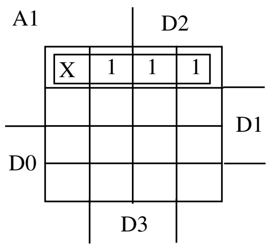


11. Problem 3–19 (page 167).

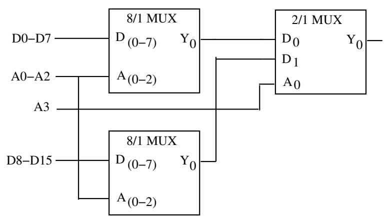
D3	D2	D1	D0	A1	A0	V
0	0	0	0	X	X	0
X	X	X	1	0	0	1
X	X	1	0	0	1	1
X	1	0	0	1	0	1
1	0	0	0	1	1	1

$$\begin{aligned} V &= D0 + D1 + D2 + D3 \\ A0 &= \overline{D0}D1 + \overline{D0}\,\overline{D2} \\ A1 &= \overline{D0}\,\overline{D1} \end{aligned}$$

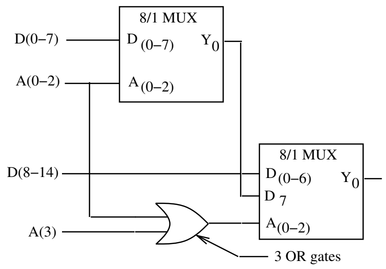




12. Problem 3–22 (page 167).

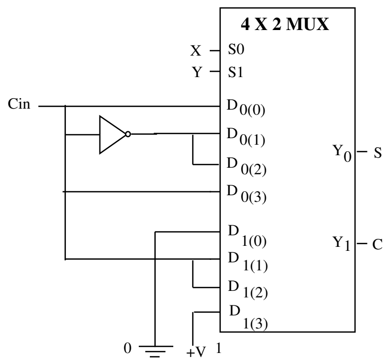


13. Problem 3–24 (page 167).



14. Problem 3–26 (page 168).

X	Y	Cin	S	C
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1



15. Problem 3–32 (page 168).

A	B	C	S5	S4	S3	S2	S1	S0
0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	1
0	1	0	0	0	0	1	0	0
0	1	1	0	0	1	0	0	1
1	0	0	0	1	0	0	0	0
1	0	1	0	1	1	0	0	1
1	1	0	1	0	0	1	0	0
1	1	1	1	1	0	0	0	1

$$
\begin{aligned}
S_0 &= C \\
S_1 &= 0 \\
S_2 &= B\bar{C} \\
S_3 &= \bar{A}BC + A\bar{B}C \\
S_4 &= A\bar{B} + AC \\
S_5 &= AB
\end{aligned}
$$

16. Problem 3–34 (a) and (c) (pages 168–169).

$$
\begin{array}{rr}
 & 11011 \\
+ & \underline{10000} \\
 & 01011
\end{array}
\qquad
\begin{array}{rr}
 & 000100 \\
+ & \underline{011000} \\
(-) & 011100
\end{array}
$$

17. Problem 3–35 (page 169).

$$
\begin{array}{rcl}
+52 &=& 0110100 \\
-17 &=& 1101111 \\
-52 &=& 1001100 \\
+17 &=& 0010001
\end{array}
\qquad
\begin{array}{rcr}
52 & & 0110100 \\
+(\underline{-17}) & + & \underline{1101111} \\
 & & 10100011 \\
= 35 & = & 0100011 \\
 & & \\
-52 & & 1001100 \\
+\underline{17} & + & \underline{0010001} \\
= -35 & = & 1011101
\end{array}
$$

18. (DIY Problem) For this problem, you are asked to design a problem set related to Sections 3.1–3.9 of the text and give a sample solution to your problem set. Grading on this problem will be based upon the *quality* of the designed problem as well as the *correctness* of your sample solution.