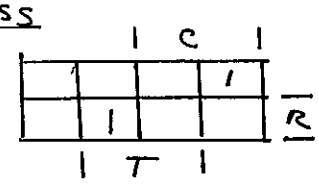
3.25

R RELAY	C CKT	T <15ms	P PASS
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

PASS

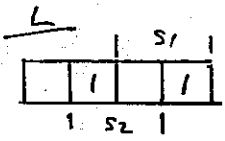


$P = R'CT' + RC'T$

3.26

S1	S2	L
0	0	0
0	1	1 ← 1 = "ON"
1	0	1
1	1	0

L

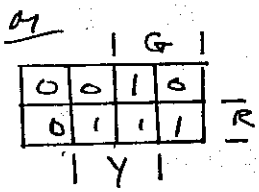


$L = S_1 \text{ XOR } S_2$

3.27

R	G	Y	Malfunction
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

M



$M = RG + RY + GY$

Chapter 4

Combinational Mixed Logic Circuits

04

X	q
L	H
H	L

02

X	y	q
L	L	H
L	H	L
H	L	L
H	H	L

00

X	y	q
L	L	H
L	H	H
H	L	H
H	H	L

4.1

X	y	Xa	ya	q
H	H	L	L	H
H	L	L	H	L
L	H	H	L	L
L	L	H	H	L

$\Rightarrow$

++ X	++ y	++ q
H	H	H
H	L	L
L	H	L
L	L	L

$q = x \cdot y$

4.2 00 table

Xa	ya	S
L	L	H
L	H	H
H	L	H
H	H	L

$\Rightarrow$

X	y	q
H	H	H
H	L	H
L	H	H
L	L	L

$\Rightarrow$

++ X	++ y	++ q
1	1	1
1	0	1
0	1	1
0	0	0

$q = x + y$

4.3 OR TABLE

x_a	y	g
L	L	L
L	H	H
H	L	H
H	H	H

⇒

x	y	g
H	L	L
H	H	H
L	L	H
L	H	H

⇒

++ x	++ y	-- g
1	0	1
1	1	1
0	0	1
0	1	0

$g = x + y'$

4.4 3Z TABLE

x_a	y	g
L	L	H
L	H	H
H	L	H
H	H	H

⇒

x	y	g
H	L	H
H	H	H
L	L	H
L	H	H

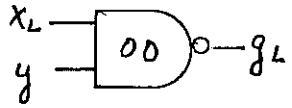
⇒

++ x	++ y	-- g
1	0	1
1	1	0
0	0	0
0	1	0

$g = xy'$

4.5 00 TABLE

A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L



-- x	++ y	-- g
1	0	0
1	1	0
0	0	0
0	1	1

$g = x'y$

4.6

-- x	++ y	++ g
1	0	1
1	1	1
0	0	1
0	1	0

$g' = x'y$

$g = x + y'$

4.7

++ x	-- y	-- g
0	1	0
0	0	0
1	1	0
1	0	1

$g = xy'$

4.8

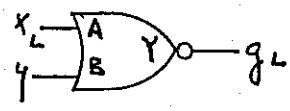
++ x	-- y	++ g
0	1	1
0	0	1
1	1	1
1	0	0

$g' = xy'$

$g = x' + y$

4.9 O2 TABLE

A	B	Y
L	L	H
L	H	L
H	L	L
H	H	L



-- X	++ y	-- g
1	0	0
1	1	1
0	0	1
0	1	1

$g' = xy'$

$g = x' + y$

4.10

-- X	++ y	++ g
1	0	1
1	1	0
0	0	0
0	1	0

$g = xy'$

4.11

++ X	-- y	-- g
0	0	1
0	1	1
1	0	1
1	1	1

$g' = x'y$

$g = x + y'$

4.12

++ X	-- y	++ g
0	0	0
0	1	0
1	0	0
1	1	0

$g = x'y$

4.13

$g_0 = x \oplus y$

$g_2' = x' \oplus y$

$g_2 = (x' \oplus y)'$

$= x \oplus y$

$= g_0$

4.14

$g_1' = x \oplus y'$

$g_1 = (x \oplus y')'$

$= x \oplus y$

$= g_2$

4.15

$g_4' = x \oplus y$

$g_4 = (x \oplus y)'$

$= x' \oplus y$

or $= x \oplus y'$

$= g_5$

4.16

$g_6 = x' \oplus y$

$g_7' = x' \oplus y'$

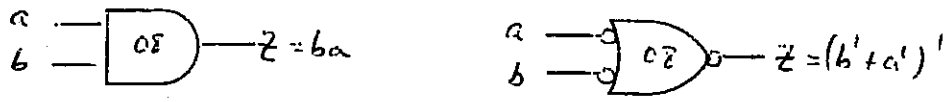
$g_7 = (x' \oplus y')'$

$= x' \oplus y$

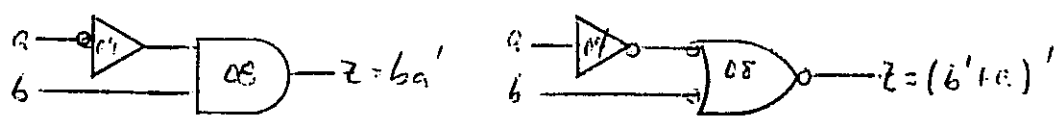
$= g_6$

4.21

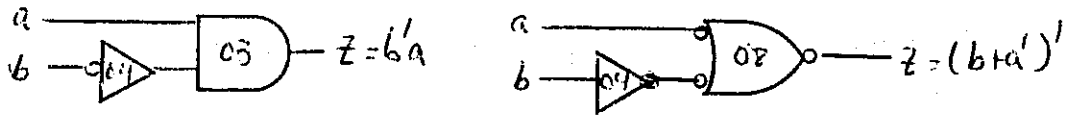
(a)



(b)

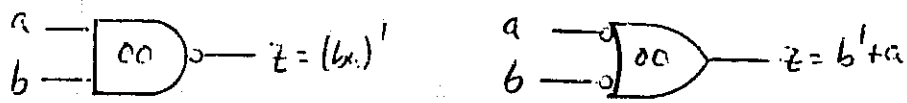


(c)

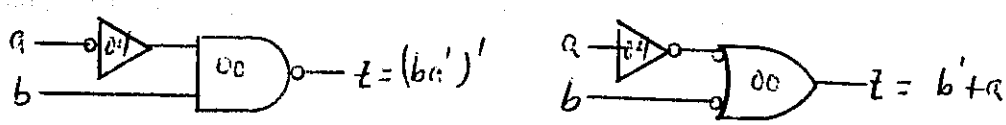


(d)

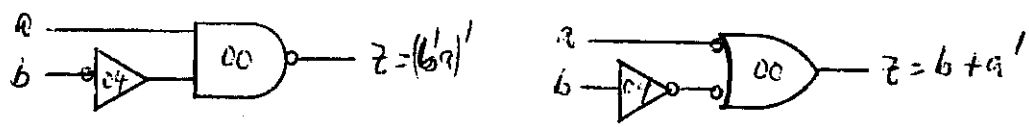
(e)



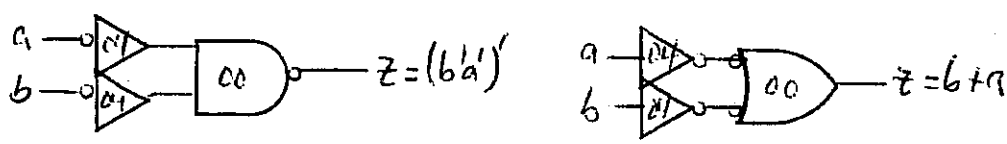
(f)



(g)



(h)



4.17 prove: $x \oplus 0 = x$

$x \oplus 0 = x0' + x' \cdot 0$
$= x$

$x \oplus 1 = x'$

$x \oplus 1 = x \cdot 1' + x' \cdot 1$
$= x'$

4.18 $x \oplus y = z$

$x \oplus z = x \oplus x \oplus y = 0 \oplus y = y$ qed

$y \oplus z = y \oplus x \oplus y = y \oplus y \oplus x = 0 \oplus x = x$ qed

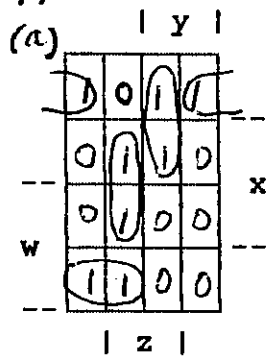
$x \oplus y \oplus z = x \oplus y \oplus y \oplus x = x \oplus 0 \oplus x = x \oplus x = 0$ qed

4.19 $x \oplus y = xy' + x'y$ (definition)
$= m_1 + m_2$
$= M_0 M_3 = (x+y)(x'+y')$ qed

4.20 $x \oplus y' = x(y')' + x'y' = xy + x'y'$
$= x \odot y$ (definition)

4.22

(a)

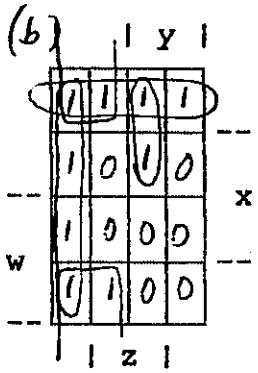


← zeros-map of g'

$g' = wy + xz' + w'x'y'z$

→ ONES - $g = wx'y' + xy'z + w'yz + w'x'z'$

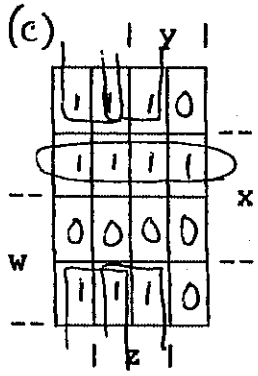
(b)



← $g' = wy + xy'z + xyz'$

→ $g = w'x' + yz' + x'y' + w'yz$

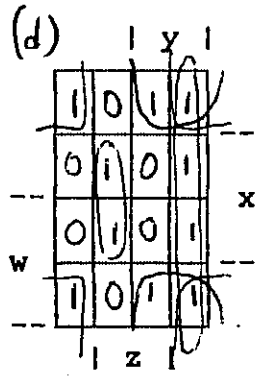
(c)



← $g' = wx + x'yz'$

→ $g = w'x' + yz' + x'y' + w'yz$

(d)

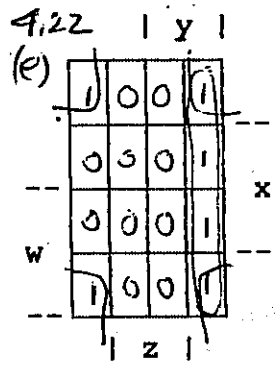


← $g' = xyz + xy'z' + x'y'z$

→ $g = yz' + x'y + x'z' + xy'z$

4.22

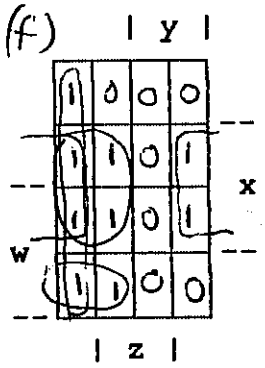
(e)



$\leftarrow g' = xy' + z$

$\rightarrow g = yz' + x'z'$

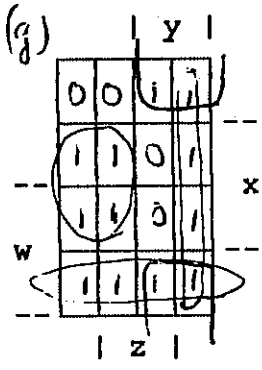
(f)



$\leftarrow g' = w'x'z + x'y + yz$

$\rightarrow g = y'z' + xy' + xz' + wx'y'$

(g)

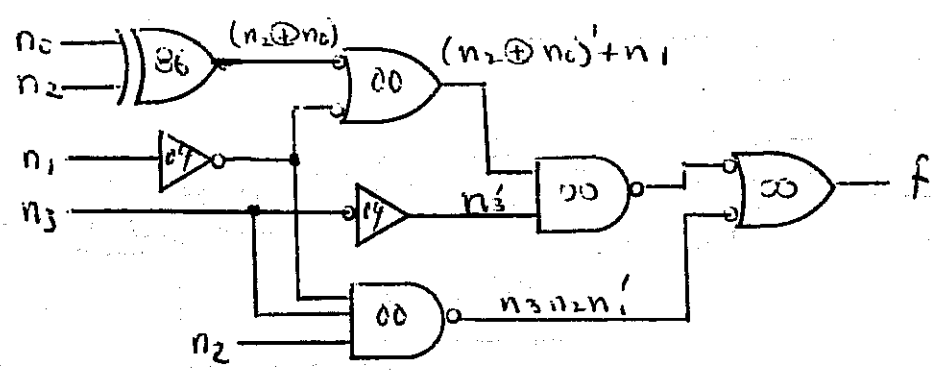


$\leftarrow g' = w'x'y' + xyz$

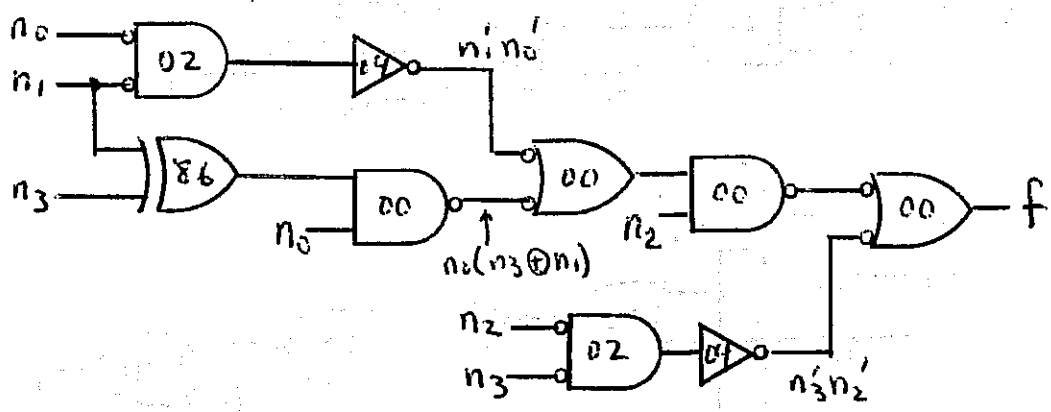
$\rightarrow g = yz' + xy' + wx' + x'y$

4.23

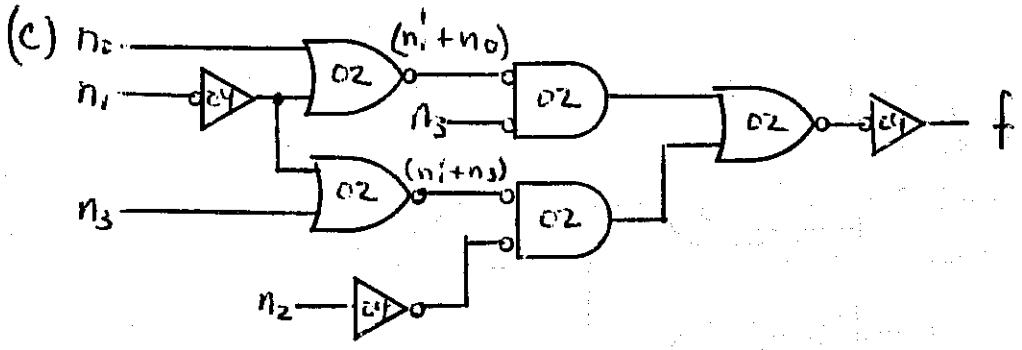
(a)


n_0
n_2
86
$(n_2 \oplus n_0)$
00
$(n_2 \oplus n_0)' + n_1$
n_1
04
n_3
14
n_3'
00
00
f
00
$n_3 n_2 n_1'$
n_2

(b)

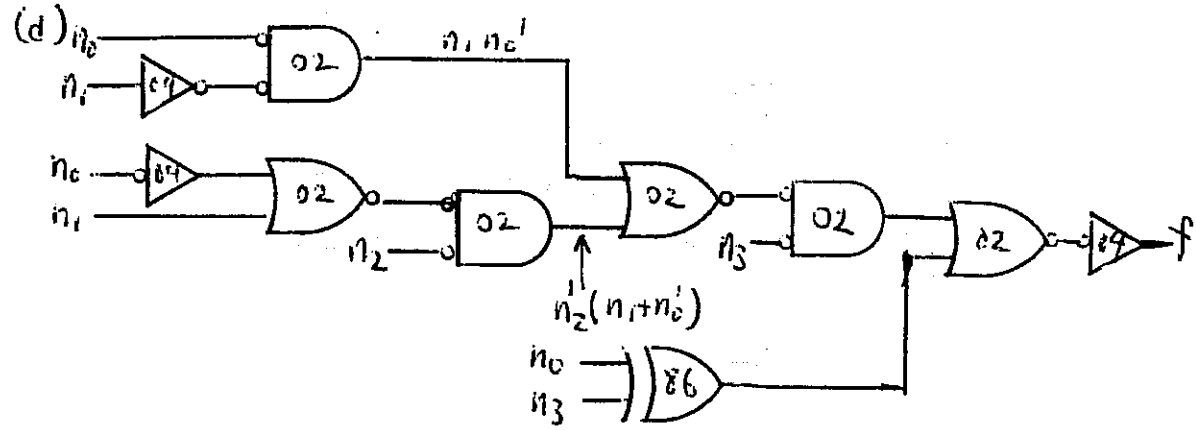

n_0
02
$n_1'n_0'$
n_1
14
n_3
86
00
00
00
00
f
n_0
$n_2(n_3 \oplus n_1)$
n_2
n_2
02
04
n_3
$n_3'n_2'$

(c)

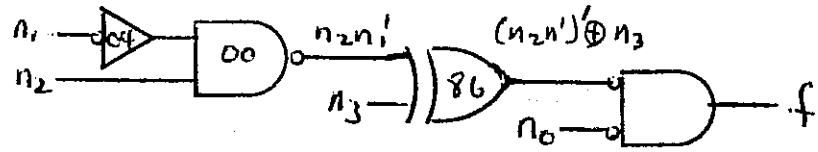

n_0
$(n_1' + n_0)$
02
n_1
24
n_3
02
02
02
01
f
$(n_1' + n_3)$
n_3
02
02
n_2
21

4.23

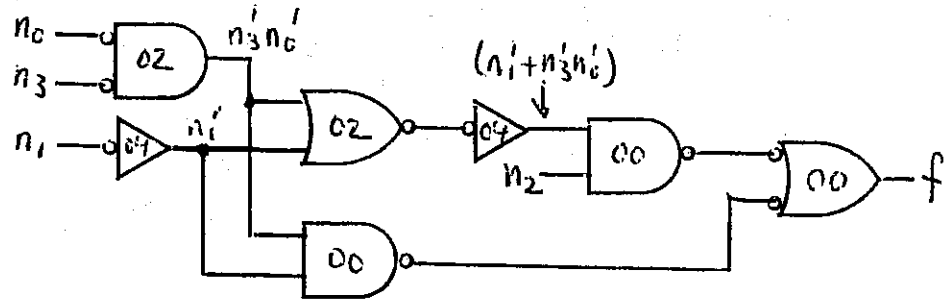
(d)



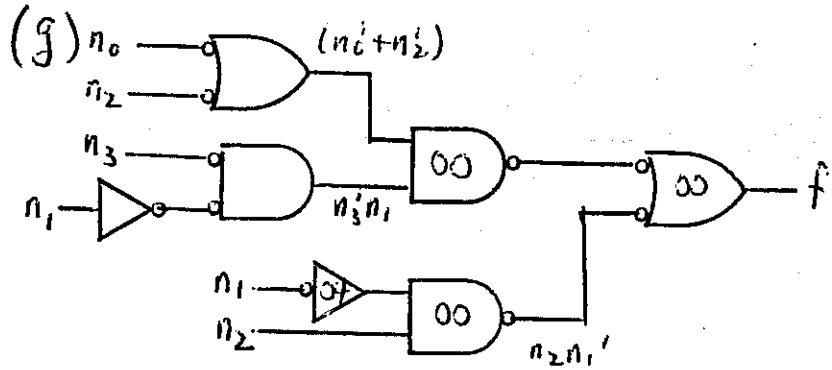
(e)



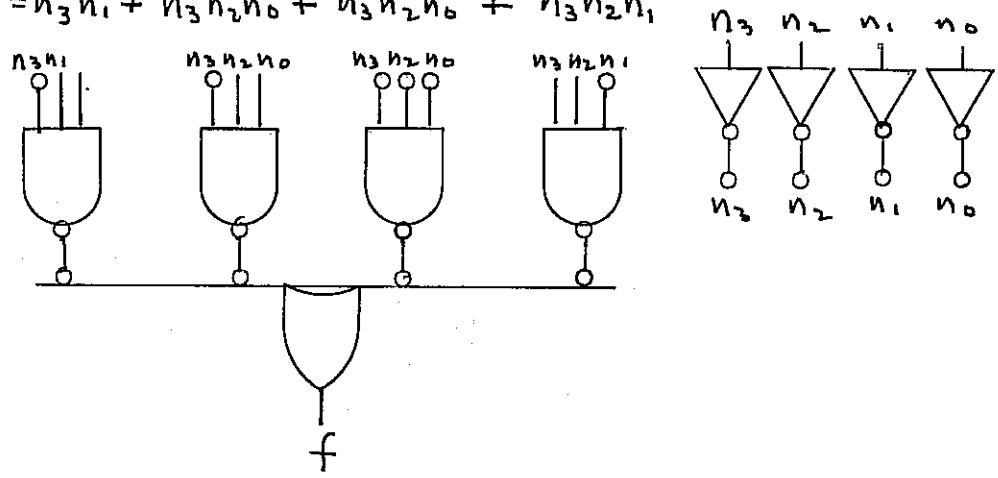
(f)



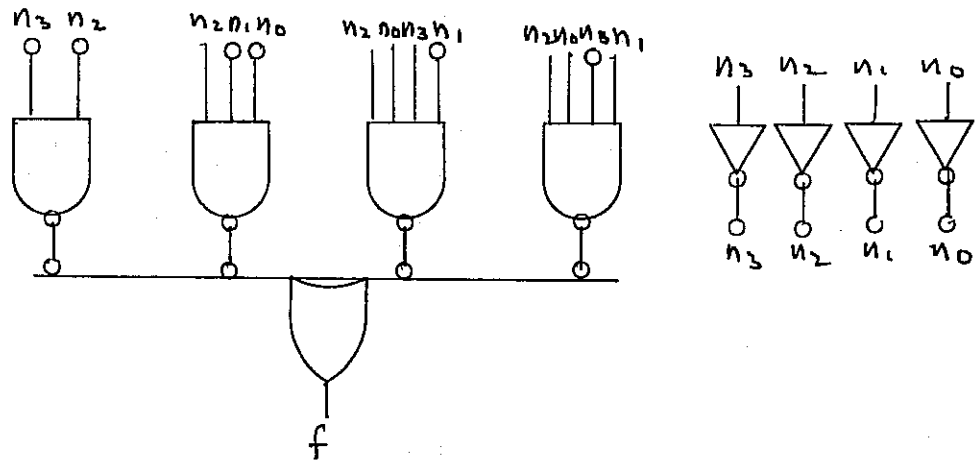
(g)



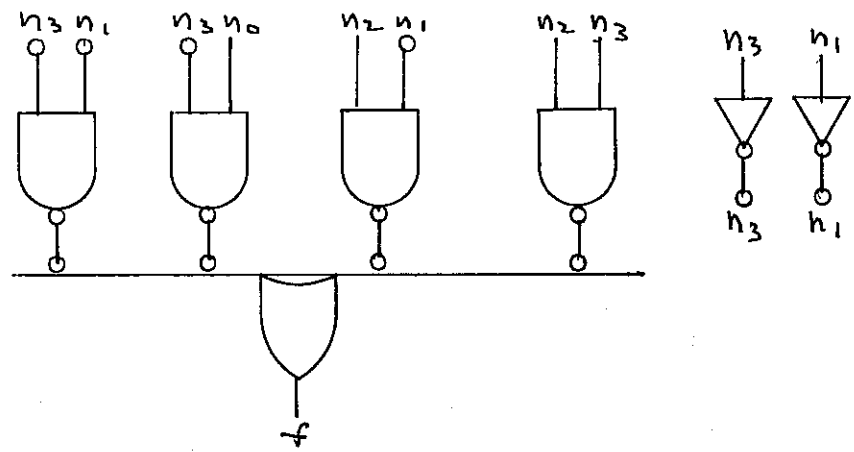
4.24 (a) $f = n_3'n_1 + n_3'n_2n_0 + n_3'n_2'n_0' + n_3n_2n_1'$



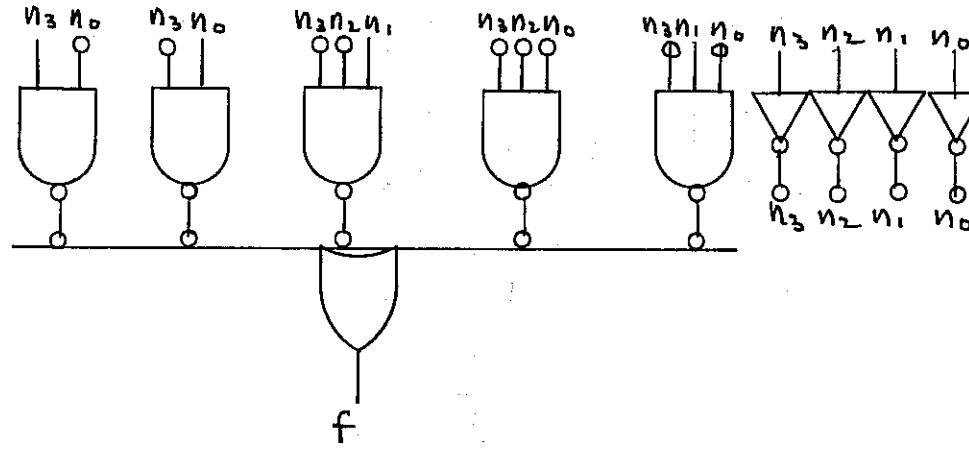
4.24 (b) $f = n_3'n_2' + n_2n_1'n_0' + n_2n_0n_3n_1' + n_2n_0n_3'n_1$



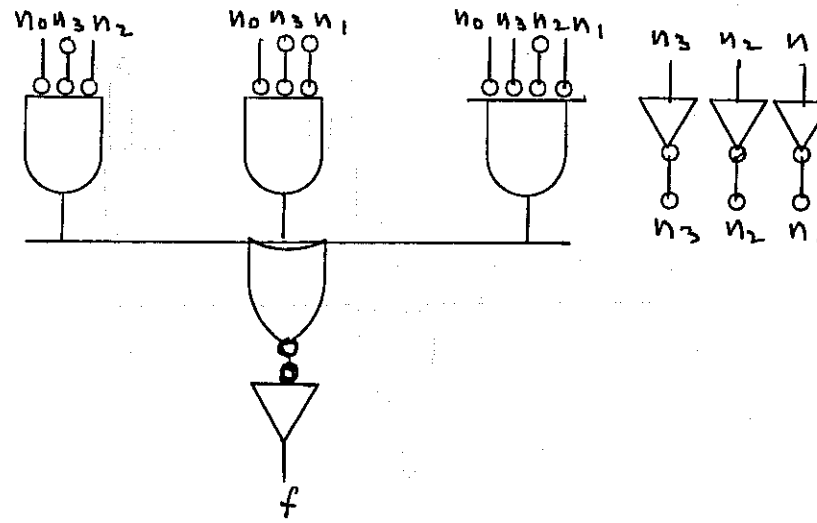
4.24 (c) $f = n_3'n_1' + n_3'n_0 + n_2n_1' + n_2n_3$



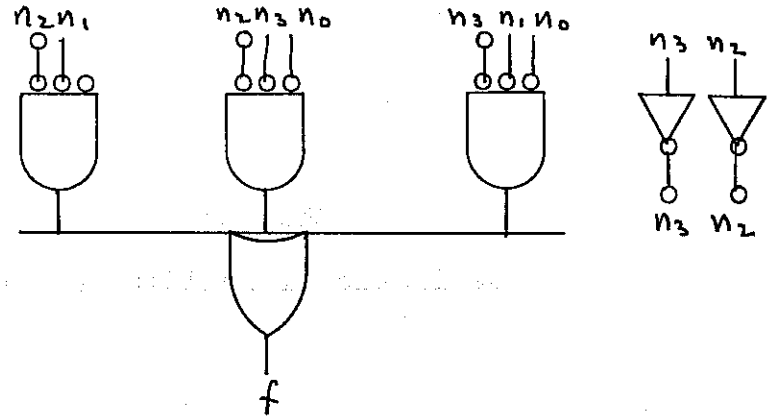
4.24 (d) $f = x_3x_0' + x_3'x_0 + x_3'x_2'x_1 + x_3'x_2'x_0' + x_3'x_1'x_0'$



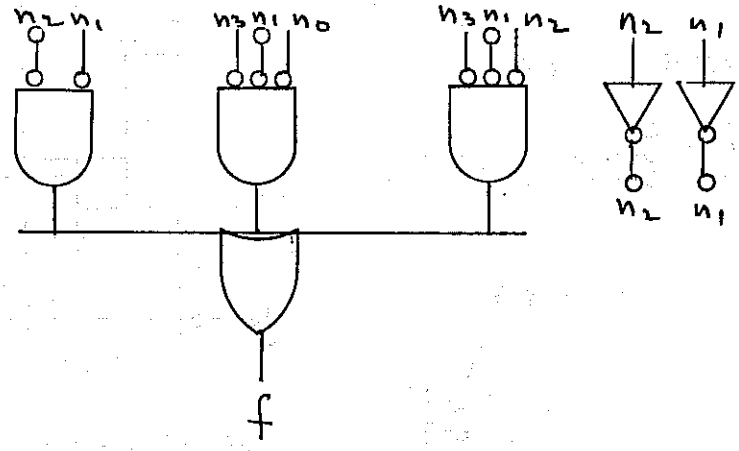
4.25 (e) $f = x_0'x_3x_2' + x_0'x_3x_1 + x_0'x_3'x_2x_1'$



4.25 (f) $f = n_2 n_1' + n_2 n_3' n_0' + n_3 n_1' n_0'$



4.25 (g) $f = n_2 n_1' + n_3' n_1 n_0' + n_3' n_1 n_2'$



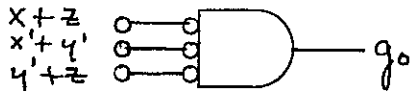
Chapter 5

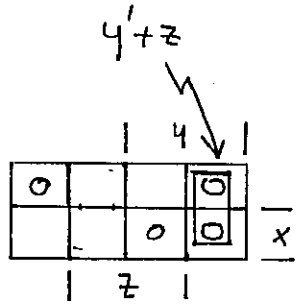
Combinational Building Blocks

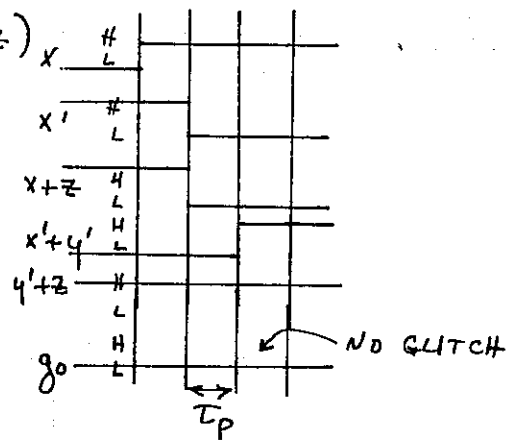
5.1 $g_0 = (x+z)(x'+y')$

$= (x+z)(x'+y')(y'+z)$

let $z=0$, $y=1$







$g_0 = M_0 M_2 M_6 M_7$

$= m_1 + m_3 + m_4 + m_5$