

6.111 Problem Set 1 Solutions

Problem 2

1. Truth Table

a	b	c	d	out
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

2. Truth Table

a	b	c	d	out
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

MSP K-MAP

$$\text{MSP} = \overline{c}d + \overline{b} + a/d$$

cd\ab	"00"	"01"	"11"	"10"
"00"	1	0	1	1
"01"	1	1	1	1
"11"	1	0	0	1
"10"	1	0	1	1

MPS K-MAP

$$\text{MPS} = (\overline{b} + \overline{c} + \overline{d}) * (a + \overline{b} + d)$$

cd\ab	"00"	"01"	"11"	"10"
"00"	1	0	1	1
"01"	1	1	1	1
"11"	1	0	0	1
"10"	1	0	1	1

MSP	K MAP			
cd/ab	"00"	"01"	"11"	"10"
"00"	1	1	1	1
"01"	0	1	1	0
"11"	0	0	1	0
"10"	0	0	1	0

$$MSP = /c/d + ab + b/c$$

MPS K-MAP

cd/ab	"00"	"01"	"11"	"10"
"00"	1	1	1	1
"01"	0	1	1	0
"11"	0	0	1	0
"10"	0	0	1	0

$$MPS = (a+c)*(b+c)*(b+d)$$

3. Truth Table

w	x	y	z	Out
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

yz\wx	"00"	"01"	"11"	"10"
"00"	0	0	0	0
"01"	1	0	0	0
"11"	1	1	0	0
"10"	1	1	1	1

$$MSP = v/z + /wv + /w/xz$$

$$MPS = (y + z) * (/x + y) * (/w + /z)$$

yz\wx	"00"	"01"	"11"	"10"
"00"	0	0	0	0
"01"	1	0	0	0
"11"	1	1	0	0
"10"	1	1	1	1

Problem 3.

1. MSP Groupings

cd\ab	"00"	"01"	"11"	"10"
"00"	0	0	X	1
"01"	0	0	1	1
"11"	0	0	0	0
"10"	0	0	1	1

MSP = $a/c + a/d$
 Unique? Yes

MPS Groupings

cd\ab	"00"	"01"	"11"	"10"
"00"	0	0	X	1
"01"	0	0	1	1
"11"	0	0	0	0
"10"	0	0	1	1

MPS = $a * (/c + /d)$
 MSP = MPS? yes

2. MSP Groupings

cd\ab	"00"	"01"	"11"	"10"
"00"	0	1	0	0
"01"	0	1	1	0
"11"	0	X	0	0
"10"	0	X	0	0

MSP = $/ab + b/cd$
 Unique? = yes

MPS Groupings

cd\ab	"00"	"01"	"11"	"10"
"00"	0	1	0	0
"01"	0	1	1	0
"11"	0	X	0	0
"10"	0	X	0	0

MPS = $b * /c * (/a + d)$
 MSP = MPS? no

Problem 4.

Part 1 = $/a + /b + /c$
 Part 3 = 0

Part 2 = $/a + b + /c$

Problem 5.

-- p1 = $/a*b + /b*(a+/c)$ p2 = $a*b*d + b* /c* /d + a * b* c + /a* /b* /c$

library ieee;

use ieee.std_logic_1164.all;

-- entity

entity p5 is

port (a1, b1, c1, a2, b2, c2, d2 : in std_logic;
 o1, o2 : out std_logic);

-- inputs

-- outputs

end p5;

-- p1 architecture

architecture comp of p5 is

begin

o1 <= ((not a1) and b1) or ((not b1) and (a1 or (not c1)));
o2 <= (a2 and b2) or ((not a2) and (not b2) and (not c2)) or (b2 and (not c2)\
and (not d2));

end comp;