

EC262 Problem Set 6 (Solutions)

Due: Friday 14 September 2012

Complete the following problems from the textbook *Digital Design with an Introduction to the Verilog HDL*, Mano and Ciletti, Fifth Edition.

Chapter 3

Problems: 5(b,d), 6(b,c), 9(b,d), 15(b,d).

Additional Problems

Exercise 1: Find the minimum SOP expression and the minimum POS expression using K-maps.

a. $f(A,B,C,D) = \Sigma m(1,4,5,6,7,9,11,13,15)$

SOP expression	POS expression
 $f = A'B + C'D + AD$	 $f' = B'D' + A'B'C + AD'$ $f = (B + D)(A + B + C')(A' + D)$

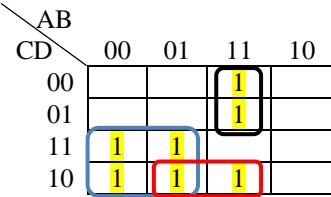
b. $f(w,x,y,z) = \Sigma m(0,4,6,9,10,11,14) + \Sigma d(1,3,5,7)$

SOP expression	POS expression
 $f = x'z + wxyz' + w'x + w'y'$	 $f = w'x'y + xz + wy'z'$ $f = (w + x + y')(x' + z')(w' + y + z)$

Chapter 3

Problem 5: Simplify the Boolean functions using 4-var k-maps

b. $F(A,B,C,D) = \Sigma(2,3,6,7,12,13,14)$

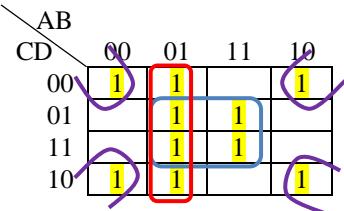


$$F = A'C + ABC' + BCD'$$

Or

$$F = A'C + ABC' + ABD'$$

d. $F(A,B,C,D) = \Sigma(0,2,4,5,6,7,8,10,13,15)$



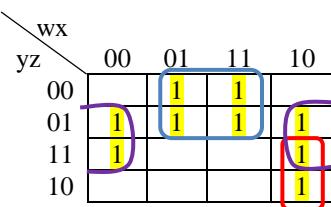
$$F = B'D' + BD + A'B$$

Or

$$F = B'D' + BD + A'D'$$

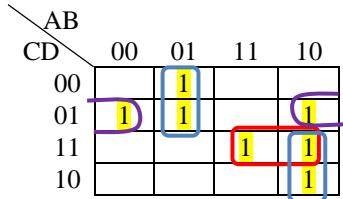
Problem 6: Simplify the Boolean expressions using 4-var k-maps

b. $x'z + w'xy' + w(x'y + xy') = x'z + w'xy' + wx'y + wxy'$



$$F = wx'y + x'z + xy'$$

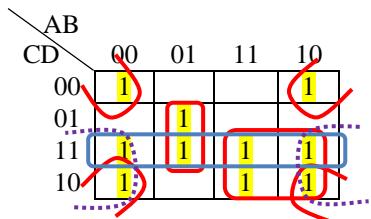
c. $A'B'C'D + AB'D + A'BC' + ABCD + AB'C$



$$F = ACD + A'BC' + AB'C + B'C'D$$

Problem 9: Find all the prime implicants, and determine which are essential.

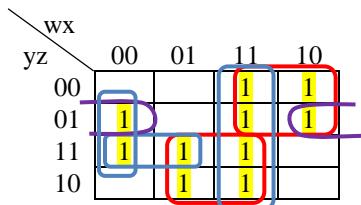
b. $F(A,B,C,D) = \Sigma(0,2,3,5,7,8,10,11,14,15)$



Prime implicants:

- $B'D'$ (essential)
- $A'BD$ (essential)
- AC (essential)
- CD
- $B'C$

d. $F(w,x,y,z) = \Sigma(1,3,6,7,8,9,12,13,14,15)$



Prime implicants:

- xy (essential)
- wy' (essential)
- $w'yz$
- $w'x'z$

$$\begin{matrix} x'y'z \\ wx \end{matrix}$$

Problem 15: Simplify the following Boolean function, and express the simplified function in sum-of-minterms form.

b. $F(A,B,C,D) = \Sigma(0,6,8,13,14)$
 $d(A,B,C,D) = \Sigma(2,4,10)$

		AB	00	01	11	10
CD	00	1	X		1	
		01		1		
11	10	X	1	1	X	
	10					

$$F = ABC'D + B'D' + CD' = \Sigma(0,2,6,8,10,13,14)$$

d. $F(A,B,C,D) = \Sigma(2,4,7,10,12)$
 $d(A,B,C,D) = \Sigma(0,6,8)$

		AB	00	01	11	10
CD	00	X	1	1	X	
		01		1		
11	10	1	X			
	10					

$$F = A'BC + B'D' + C'D' = \Sigma(0,2,4,6,7,8,10,13,14)$$