

ECE 223 – Assignment #3

- 1 Find the minimum sum of products (fewest gates) for F defined below. Indicate the essential prime implicants.

$$F(a,b,c,d) = S(0,1,4,6,7,9,11,13,14) + d(2,5,12)$$

- 2 Given the function F where

$$F(a,b,c,d) = \Sigma(0, 1, 3, 7, 8, 9, 13, 15) + d(2, 11)$$

- (a) Find all the prime implicants
(b) Find all the essential prime implicants and indicate why each one is essential
(c) find a minimum number of gates sum of products expression for F
3. Complete the following problems:

- 3-2** Simplify the following Boolean expressions using three-variable maps:

(a) $xy + x'y'z' + x'yz'$

(b) $x'y' + yz + x'yz'$

(c) $A'B + BC' + B'C'$

- 3-3** Simplify the following Boolean functions using four-variable maps:

(a) $F(A, B, C, D) = \Sigma(4, 6, 7, 15)$

(b) $F(w, x, y, z) = \Sigma(2, 3, 12, 13, 14, 15)$

(c) $F(A, B, C, D) = \Sigma(3, 7, 11, 13, 14, 15)$

- 3-9** Simplify the following Boolean functions in product of sums:

(a) $F(w, x, y, z) = \Sigma(0, 2, 5, 6, 7, 8, 10)$

(b) $F(A, B, C, D) = \Pi(1, 3, 5, 7, 13, 15)$

(c) $F(x, y, z) = \Sigma(2, 3, 6, 7)$

(d) $F(A, B, C, D) = \Pi(0, 1, 2, 3, 4, 10, 11)$

- 3-10** Simplify the following expressions in (i) sum of products and (ii) products of sums:

(a) $x'z' + y'z' + yz' + xy$

(b) $AC' + B'D + A'CD + ABCD$

(c) $(A' + B' + D')(A + B' + C')(A' + B + D')(B + C' + D')$

- 3-12** Simplify the following expressions and implement them with two-level NAND gate circuits:

(a) $AB' + ABD + ABD' + A'C'D' + A'BC'$

(b) $BD + BCD' + AB'C'D'$

3-23 Simplify the Boolean function F together with the don't-care conditions d in (i) sum of products and (ii) product of sums.

(a) $F(w, x, y, z) = \Sigma(0, 1, 2, 3, 7, 8, 10)$

$d(w, x, y, z) = \Sigma(5, 6, 11, 15)$

(b) $F(A, B, C, D) = \Sigma(3, 4, 13, 15)$

$d(A, B, C, D) = \Sigma(1, 2, 5, 6, 8, 10, 12, 14)$

3-27 Simplify the following Boolean functions by means of the tabulation method:

(a) $P(A, B, C, D, E, F, G) = \Sigma(20, 28, 52, 60)$

(b) $P(A, B, C, D, E, F, G) = \Sigma(20, 28, 38, 39, 52, 60, 102, 103, 127)$

(c) $P(A, B, C, D, E, F) = \Sigma(6, 9, 13, 18, 19, 25, 27, 29, 41, 45, 57, 61)$