

Tutorial 2

1. Given $f(a, b, c) = b + a'c$, $g(a, b, c, d) = ac + bd' + a'c'd + ab'cd + a'b'cd'$.

- (a) Express f as a minterm expansion (use m notation).
- (b) Express g as maxterm expansion (use M notation).
- (c) Express g' as a minterm expansion (use m notation).
- (d) Express f' as a maxterm expansion (use M notation).

2. Given $F1 = \prod M(0, 4, 5, 6)$ and $F2 = \prod M(0, 3, 4, 6, 7)$, find the maxterm expansion for $F1F2$.

State a general rule for finding the maxterm expansion of $F1F2$ given the maxterm expansions of $F1$ and $F2$. Prove your answer by using the general form of the maxterm expansion.

3. Find the minimum sum-of-products expression for each function.

- (a) $f(a, b, c, d) = \sum m(0, 1, 2, 4, 6, 7, 8, 9, 13, 15)$
- (b) $f(a, b, c, d) = \prod M(1, 2, 4, 9, 11)$

5. Find the minimum sum-of-products expression for each function.

- (a) $f(a, b, c, d) = \sum m(1, 2, 4, 15) + \sum d(0, 3, 14)$
- (b) $f(a, b, c, d) = \prod M(0, 2, 4, 6, 8) \cdot \prod D(12, 9, 15)$

6. Given $F = \sum m(0, 1, 3, 7, 8, 9, 13, 15) + \sum d(2, 11)$.

- (a) Find all of the prime implicants.
- (b) Find all of the essential prime implicants and tell why each one is essential.
- (c) Find a minimum sum-of-products expression for F .

7. Simplify the following Boolean functions, using K maps & express it in SOP as well as POS :

- (a) $F(w, x, y, z) = \sum(2, 3, 12, 13, 14, 15)$
- (b) $F(A, B, C, D) = \prod(1, 3, 6, 9, 11, 12, 14)$

8. Using the map-entered variable method find the minimum SOP expression for the function

$$Z(A, B, C, D, E, F, G) = \sum m(0, 3, 13, 15) + \sum d(1, 2, 7, 9, 14) + E(m_6 + m_8) + F m_{12} + G m_5$$

Here the minterms corresponds to the variables A, B, C and D

9. Simplify the following functions. and implement them with two-level NAND gate circuits:

- (a). $F(A, B, C, D) = AB + A'BC + A'BC'D$
- (b). $F(A, B, C) = (A' + B' + C')(A' + B')(A' + C')$