



# Digital Design

## Sheet 3

1) Use the theorems of switching algebra to simplify each of the following logic functions:

- a)  $F = W \cdot X \cdot Y \cdot Z \cdot (W \cdot X \cdot Y \cdot Z' + W \cdot X' \cdot Y \cdot Z + W' \cdot X \cdot Y \cdot Z + W \cdot X \cdot Y' \cdot Z)$   
 b)  $A \cdot B + A \cdot B \cdot C' \cdot D + A \cdot B \cdot D \cdot E' + A \cdot B \cdot C' \cdot E + C' \cdot D \cdot E$   
 c)  $F = M \cdot N \cdot O + Q' \cdot P' \cdot N' + P \cdot R \cdot M + Q' \cdot O \cdot M \cdot P' + M \cdot R$

2) Write the truth table for each of the following logic functions:

- a)  $F = X' \cdot Y + X' \cdot Y' \cdot Z$   
 b)  $F = W' \cdot X + Y' \cdot Z' + X' \cdot Z$   
 c)  $F = W + X' \cdot (Y' + Z)$   
 d)  $F = A \cdot B + B' \cdot C + C' \cdot D + D' \cdot A$   
 e)  $F = V \cdot W + X' \cdot Y' \cdot Z$   
 f)  $F = (A' + B' + C \cdot D) \cdot (B + C' + D' \cdot E')$   
 g)  $F = (W \cdot X)' \cdot (Y' + Z)'$   
 h)  $F = (((A + B)' + C')' + D)'$   
 i)  $F = (A' + B + C) \cdot (A + B' + D') \cdot (B + C' + D') \cdot (A + B + C + D)$

3) Write the truth table for each of the following logic functions:

- a)  $F = X' \cdot Y' \cdot Z' + X \cdot Y \cdot Z + X \cdot Y' \cdot Z$   
 b)  $F = M' \cdot N' + M \cdot P + N' \cdot P$   
 c)  $F = A \cdot B + A \cdot B' \cdot C' + A' \cdot B \cdot C$   
 d)  $F = A' \cdot B \cdot (C \cdot B \cdot A' + B \cdot C')$   
 e)  $F = X \cdot Y \cdot (X' \cdot Y \cdot Z + X \cdot Y' \cdot Z + X \cdot Y \cdot Z' + X' \cdot Y' \cdot Z)$   
 f)  $F = M \cdot N + M' \cdot N' \cdot P'$   
 g)  $F = (A + A') \cdot B + B \cdot A \cdot C' + C \cdot (A + B') \cdot (A' + B)$   
 h)  $F = X \cdot Y' + Y \cdot Z + Z' \cdot X$

4) Write the canonical sum and product for each of the following logic functions:

- a)  $F = \sum_{X,Y} (1,2)$   
 b)  $F = \prod_{A,B} (0,1,2)$   
 c)  $F = \sum_{A,B,C} (2,4,6,7)$   
 d)  $F = \prod_{W,X,Y} (0,1,3,4,5)$   
 e)  $F = X + Y' \cdot Z'$   
 f)  $F = V' + (W' \cdot X)'$

5) Write the canonical sum and product for each of the following logic functions:

- a)  $F = \sum_{X,Y,Z} (0,3)$   
 b)  $F = \prod_{A,B,C} (1,2,4)$   
 c)  $F = \sum_{A,B,C,D} (1,2,5,6)$   
 d)  $F = \prod_{M,N,P} (0,1,3,6,7)$   
 e)  $F = X' + Y \cdot Z' + Y \cdot Z'$   
 f)  $F = A'B + B'C + A$