ESC201A Assignment 9

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Topics

Truth Tables, Boolean Expressions, Minimization

Questions

1. Show that the Boolean expression $x + \bar{x}.y$ is equivalent to $x + y$ using basic postulates and theorems of Boolean algebra.

2. Reduce the following expressions to a minimum number of literals using basic postulates and theorems of Boolean algebra.
   (a) $f = (x + y).(\bar{y} + \bar{x})$
   (b) $f = ABCD + \bar{A}BD + AB\bar{C}D$

3. Consider four-input function F(A, B, C, D) that outputs 1 whenever an odd number of its inputs are 1, (a) construct the truth table (b) write down the Boolean expressions, present an implementation of the function using two-input XOR gate

4. Four switches operate a lamp as follows: the lamp lights up if switches 1,3 and 4 are closed and switch 2 is open, or if 2, 4 are closed and 3 is open, or if all the switches are kept closed. Express this as a boolean function in a standard sum of product form and solve it using k- map. (Use bit '1' when switch is closed and bit '0' when switch is open).

5. Obtain the truth table for the following function: $(x.y + z)(y + x.z)$ and write it as sum of products (SOP) and product of sums (POS).

6. Simplify the following 4-variable functions into sum-of-products form using K-map.
   a. $\Sigma(1,5,6,7,14)$
   b. $\Sigma(0,4,6,8)$
   c. $\Sigma(0,1,4,6,8,9,14)$
   d. $\Sigma(1,4,7,11,13,14)$

7. Simplify the following 4-variable functions into product-of-sums form using K-map
   a. $\Pi(1,3,5,7,13,15)$
   b. $\Pi(1,3,6,9,11,12,14)$
   c. $\Pi(1,3,5,7,9,11,12,13,14,15,)$
   d. $\Pi(0,1,3,4,5,7,12,13,15)$

8. Design a combinational circuit with 3 inputs and 1 output
   (a) The output is 1 when the binary value of the inputs is less than 3. The output is 0 otherwise
   (b) The output is 1 when the binary value of inputs is an odd number.