

ECE 465—Spring 2003, Instructor: Prof. Shantanu Dutt

Quiz 1 : Tue, Jan. 21, Time: 1 hr.

1. Consider the function $f(a, b, c, d) = \sum_m(1, 5, 6, 7, 12, 13, 14, 15)$. Give definitions of a *minterm*, a *prime implicant*, a *prime implicate*, and an *essential prime implicant*. Also, illustrate each of these definitions using a K-map for the above function f (give a product/sum term derived from the K-map as an example of each of the terms). **10**

2. Minimize the function $f = ab + \bar{a}e + \bar{b}e + \bar{a}\bar{b}d + acd + \bar{b}cd$. **using algebraic minimization theorems/rules only**. Show all steps clearly and state the theorem/rule used in each step from the attached sheet of algebraic theorems. **10**

3. Consider a *coefficient multiplier* defined as follows. The input is a 3-bit number $N = A, B, C$ where A is the MSB and C the LSB. The output of the circuit is the number $M = 3N$.
 - a. Determine the number of bits required to represent the output number and write the TT for all output bits (use just one TT for this purpose with the different output bits forming different columns of the TT). **10**
 - b. Using K-Maps obtain the minimized SOP expressions for the MSB and the LSB of M . **10**
 - d. Implement the circuits for the MSB and the LSB of M using only NAND gates; assume NAND gates with any number of inputs that you need are available and also assume that all variables are also available at the input in their uncomplemented as well as complemented forms (e.g., A as well as \bar{A} are available). **5**