

# DEVELOPMENT OF DIGITAL SYSTEMS

Midterm Examination  
07. 12. 2012

1. Determine the Sheffer representation (NAND operator only) of a given function  $f$  using Boolean algebra.

$$f(x_1, x_2, x_3) = (x_1 + x_2) \cdot (\overline{x_2} + \overline{x_3}) \cdot x_3$$

2. A linear function can be expressed in a form:

$$f(x_1, x_2, x_3, x_4) = k_0 \oplus k_1 \cdot x_1 \oplus k_2 \cdot x_2 \oplus k_3 \cdot x_3 \oplus k_4 \cdot x_4$$

Incompletely specified function  $f$  is given below in SOP (sum-of-products) form with redundancies ( $X$ ). Determine the redundancies of function  $f$  in such a manner that it will become linear. Calculate the linearity coefficients  $k_0, k_1, k_2, k_3, k_4$ .

$$f(x_1, x_2, x_3, x_4) = V(0, 5, 6, 9, 10, 12) \text{ in } V_x(3, 15)$$

3. Implement the incompletely specified function  $f$  in POS (product-of-sums) form using a single 4/1 multiplexer using Shannon expansion theorem.

$$f(x_1, x_2, x_3, x_4) = \&(1, 2, 5 - 7, 9, 10, 14) \text{ in } \&_x(0, 4, 11, 13)$$

4. Convert the number  $197_{10}$  ( $11000101_2$ ) into BCD representation using "double dabble" algorithm.

Examination duration is 60 minutes. Each assignment is worth 10 points.

Please sign your answer sheet using your enrollment number. Solutions will be published on the course web page. Examination results will be announced on the course web page.