

CS375 Digital Systems Sample Test

1.) Simplify two of the three following algebraic expressions using theorems from Boolean algebra. Show each transformation and cite the theorem that provides it.

a.)

$$ab' + a(b+c)' + b(b+c)'$$

b.)

$$x_2x_3'x_4' + x_2x_3'x_4 + x_1x_2'x_3'$$

2.) Consider the function $f(x_1, x_2, x_3) = \sum m(0, 1, 3, 4, 5, 6)$

Write the resulting sum of products and the equivalent product of sums. Draw a circuit for each using only nand gates or only nor gates.

3.) Draw a Karnaugh map for the function in question #2. Identify the prime implicants and essential prime implicants. Write the resulting equation. Repeat the procedure for the product of sums.

- 4.) Use Venn diagrams to show that the SOP and POS from question 3 are equivalent.
- 5.) Draw the Karnaugh map, identify prime and essential prime implicants, and produce the resulting algebraic expression for the function $f(x_1, x_2, x_3, x_4, x_5) = \sum m(0, 3, 5, 6, 7, 14, 16, 19, 21, 22, 31)$
- 6.) Write the 8-bit binary representations for the following numbers in the encoding scheme specified:
- 33 (2's complement)
 - 43 (1's complement)
 - 43 (2's complement)
 - 43 (signed-magnitude)