

Homework #4

PROBLEMS in approved textbook (note 1) following Appendix A

{1} Prove the following identities algebraically and then by perfect induction using a truth table.

$$B + AC = (A + B + C)(A + B + C)(A + B + C)$$

$$AD + CD + AB = ACD + ACD + ABC + ABC + ACD$$

$$D(A + B + C + D)(A + B + C + D) = (D + AC + AC)(AC + BD + AC)$$

Draw a 2-level NAND-NOR implementation of identity in part (c), given that the inputs A,B,C and D are provided

[35]

{2} Reduce the following functions by using rules of Boolean algebra

(a) $T = [(ab).a].[(ab).b]$

(b) $T = (a + b + c)(ab + cd) + (bcd)$

(c) $T = (abc + bcd) + (acd + bcd + bcd)$

[30]

{3} The truth table for a circuit that has 3 inputs x, y and z to give outputs A and B is provided:

| x | y | z | A | B |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 |

(d) Write the canonical SOP and POS forms of the Boolean equation for each of the outputs.

(e) Use factorization to yield an expression for A of the form $A = z.F(x, y) + z.G(x, y)$, where F(x, y) and G(x, y) are logical expressions containing the input variables x and y only. Hint: In the expression of A, you should find that F(x, y) and G(x, y) are complements of each other.

[20]

{4} Question A.11 from the textbook

[5]

Computer Organization and Assembly Language Programming (CMSC 313)
Section 0102 Fall 2003

{5} A datasheet for the 74LS00 is provided.

- (f) Determine the number of other 74LS00 inputs that a 74LS00 gate can drive.
- (g) Sketch the input and output voltage threshold limit windows for this gate.

[10]

Total

[100]

Notes: (1) Approved textbook: "Principles of Computer Architecture" M J Murdocca & V P Heuring Prentice Hall 2000 ISBN 0-201-43664-7