Northwestern University
Electrical and Computer Engineering
ECE459: VLSI Algorithmics, Winter 02
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Feb. 20, 2002
Handout #4
Due: Feb. 27

Homework 4

You may discuss the assignments with your classmates but need to write down your solutions independently. Be careful with your handwriting. Unclear solutions will be assumed to be wrong.

1. (20 pts) Construct the ROBDDs for the following functions f and g and use the procedure presented in class to build up the ROBDD for $f + g'$.

$$f = x_1(x_2' x_4 + x_3) \quad g = x_2 x_3 + x_1' x_4$$

2. (20 pts) Use the exact method to optimize the following function

$$f = x_1' x_2 x_3 + x_1 x_2' x_3 x_4 + x_1 x_2 x_4 + x_2 x_3' x_4 x_5$$

3. (20 pts) We say a variable x is in the support of a Boolean function f provided $f_x \neq f_{x'}$. How many Boolean functions of three variables have three variable in their support? Note that a Boolean formula involving three variables does not necessarily imply that all three variables are in the support of the function denoted by the formula.

4. (20 pts) Prove the following properties of cofactor.
   (a) $(f+g)_x = f_x + g_x$
   (b) $(fg)_x = f_x g_x$
   (c) $(f')_x = (f_x)'$

5. (20 pts) The function $f = x_1 x_2 x_3 + x_4 x_5 x_6 + \cdots + x_{3n-2} x_{3n-1} x_{3n}$ has $3n$ variables in its support and is called the *Achilles Heel* function. How many cubes does the minimum irredundant SOP expression for f' have?