

# Digital Design and Computer Architecture (E85)

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## Problem Set 2

### 1) Textbook Problems

Do problems 1.87, 2.1(c), 2.2(c), 2.8(a,b), (first minimize the equations using Boolean Algebra), 2.23.

### 2) Boolean Algebra

Minimize your equations from problems 2.1(c) and 2.2(c) using Boolean algebra.

### 3) Overflow

Design a circuit that detects if the addition of two 4-bit two's complement numbers results in overflow. The inputs to the adder are the two 4-bit numbers  $A[3:0]$  and  $B[3:0]$ . The outputs to the circuit are the 4-bit sum,  $Sum[3:0]$ , and the carry out,  $Cout$ . You can use any of these signals to create the Overflow output, but your circuit should be as simple as possible. **Hint:** before doing anything, think about how you would detect it by looking at the numbers.

Write the function of your circuit as a Boolean equation ( $Overflow = \dots$ ) and sketch your overflow circuit.

### 4) Transistors

Design an AOI (and-or-invert) gate. Its function is:  $Y = NOT(AB + C)$ . Use no more transistors than necessary.

### 5) Time

Please indicate how many hours you spent on this problem set. This will not affect your grade, but will be helpful for calibrating the workload for next semester's class.