Electrical and Computer Engineering Department
University of Maryland
College Park, MD 20742-3285

Glenn L. Martin Institute of Technology ◇ A. James Clark School of Engineering

Dr. Charles B. Silio, Jr.
Telephone 301-405-3668
FAX 301-314-9281
silio@umd.edu

ENEE 244 Problem Set 7

(Due: Mon., Mar. 31, immediately preceding Class 17, Tues., Apr. 1, 2014)

1. Design a 2-bit (binary) full adder module with 5 inputs a_1, a_0, b_1, b_0, and c_{in} and with 3 outputs c_{out}, s_1, and s_0. The module performs a binary addition of the 2-bit input $\mathrm{A} = a_1a_0$ with the 2-bit number $\mathrm{B} = b_1b_0$ and with the carry-in c_{in} to form the 2-bit sum $\mathrm{S} = s_1s_0$ and the carry-out c_{out}. Specify the truth table and specify the simplified output functions. (Note: this is a 5-variable Karnaugh map problem; so don't try to solve it by hooking together two 1-bit full adders.)

Tabular minimization, known also as the Quine-McCluskey method, proceeds in two steps: (1) find all prime implicants and then (2) use these prime implicants to find a minimal cost cover for the given function. Use tabular minimization to find simplest sum of products expressions for the following functions.

2. $f(a, b, c, d) = \Sigma 0, 1, 2, 5, 9, 13, 14, 15 + \Sigma_\phi 8, 10, 12$
3. $h(a, b, c, d, e, f, g) = \Sigma 20, 28, 52, 60$
4. $h(a, b, c, d, e, f, g) = \Sigma 20, 28, 38, 39, 52, 60, 102, 103, 127$
5. Read Givone Chapt. 4, Section 4.13, excluding Section 4.13.4 covering Quine-McCluskey and tabular minimization for multiple-output functions; then work Prob. 4.33 a.

   Now work the following problems from Givone, Chapt. 5:

6. Prob. 5.19.
7. Prob. 5.23.
8. Prob. 5.24.
9. Prob. 5.25.
10. Prob. 5.26.