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 \( A = a_1a_0 \) with the 2-bit number \( B = b_1b_0 \) and with the carry-in \( c_{in} \) to form the 2-bit sum \( S = s_1s_0 \) 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.
9. Prob. 5.25.