Homework 3

Max marks: 70

Due on September 27, 2021, 9 AM, before class.

Note that to find a "minimum-cost circuit", you must find both the SOP and POS forms and compute the cost of each, and then indicate which is best.

Problem 1 *Derive a minimum-cost circuit that implements the function* $f(x_1, \ldots, x_4) = \sum m(4, 7, 8, 11) + d(12, 15)$

Problem 2 *Derive a minimum-cost circuit that implements the function* $f(x_1, \ldots, x_4) = \sum m(4, 6, 9, 10, 15) + d(2, 3, 5, 11, 13)$

Problem 3 *Derive a minimum-cost circuit that implements the function*

$$f(x_1, \ldots, x_5) = \sum m(2, 5, 6, 7, 8, 12, 13, 15, 18, 21, 24, 26, 28, 31) + d(1, 4, 14, 23, 25, 29, 30)$$

Problem 4 *Use Quine-McCluskey method to find the minimal SOP for* $f(x, y, z) = \sum m(2, 3, 4, 5)$. *You can also implement Quine-McCluskey method in your favorite programming language as algorithm.*

Problem 5 *Use Quine-McCluskey method to find the minimal SOP for* $f(x, y, z, w) = \sum m(0, 1, 4, 5, 12, 13)$. *You can also implement Quine-McCluskey method in your favorite programming language as algorithm.*

Problem 6 *Use Quine-McCluskey method to find the minimal SOP for* $f(x, y, z, w) = \sum m(1, 5, 7, 8, 9, 13, 15) + d(4, 14)$. *You can also implement Quine-McCluskey method in your favorite programming language as algorithm.*

Problem 7 *A circuit with two outputs has to implement the following functions*

$$f(x_1, \ldots, x_4) = \sum m(0, 2, 4, 6, 7, 9) + d(10, 11) \tag{1}$$

$$g(x_1, \ldots, x_4) = \sum m(2, 4, 9, 10, 15) + d(0, 13, 14) \tag{2}$$

Design a minimum-cost SOP circuit and compare its cost with combined cost of two SOP circuits that implement f *and* g *separately. Assume the input variables in both complemented and uncomplemented forms.*