Homework 2

Max marks: 110

Due on September 17, 2021, 9 AM, before class.

Row	x_1	x_2	x_3	f
0	0	0	0	0
1	0	0	1	1
2	0	1	0	1
3	0	1	1	0
4	1	0	0	1
5	1	0	1	0
6	1	1	0	0
7	1	1	1	1

Table 1: Truth table for a 3-way light switch

1 Sept 10th Lecture

Problem 1 *If the SOP form for $\bar{f} = A\bar{B}\bar{C} + \bar{A}\bar{B}$, then give the POS form for f. [10 marks]*

Problem 2 *Use DeMorgan's Theorem to find f if $\bar{f} = (A + BC)D + EF$. [10 marks]*

Problem 3 *Implement the function in Table 1 using only NAND gates. [10 marks]*

Problem 4 *Implement the function in Table 1 using only NOR gates. [10 marks]*

2 Sept 13th Lecture

Problem 5 *Find the minimum-cost SOP and POS forms for the function $f(x_1, x_2, x_3) = m(1, 2, 3, 5)$. [1, Prob 2.37] [10 marks]*

Problem 6 *Find the minimum-cost SOP and POS forms for the function $f(x_1, x_2, x_3) = \sum m(1, 4, 7) + D(2, 5)$. [1, Prob 2.38] [10 marks]*

Problem 7 *Find the minimum-cost SOP and POS forms for the function $f(x_1, x_2, x_3, x_4) = \prod M(0, 1, 2, 4, 5, 7, 8, 9, 10, 12, 14, 15)$. [1, Prob 2.39] [10 marks]*

Problem 8 *Find the minimum-cost SOP and POS forms for the function $f(x_1, x_2, x_3, x_4) = \sum m(0, 2, 8, 9, 12, 15) + D(1, 3, 6, 7)$. [1, Prob 2.40] [10 marks]*

Problem 9 *Derive a minimum-cost realization of the four-variable function that is equal to 1 if exactly two or exactly three of its variables are equal to 1; otherwise it is equal to 0. [1, Prob 2.46] [10 marks]*

3 Sept 15th Lecture

Problem 10 *Find the minimum-cost SOP and POS forms for the function $f(x_1, \ldots, x_5) = \sum m(0, 1, 3, 4, 6, 8, 9, 11, 13, 14, 16, 19, 20, 21, 22, 24, 25) + D(5, 7, 12, 15, 17, 23)$. [1, Prob 2.42] [10 marks]*

References

[1] S. Brown and Z. Vranesic. *Fundamentals of Digital Logic with Verilog Design: Third Edition.* McGraw-Hill Higher Education, 2013.