CprE 281 HW02

ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Boolean algebra, AND/OR/NAND/NOR gates

Assigned Date: Second Week

Finish by Sep. 8, 2021

P1. (10 points) Use algebraic manipulation to prove the following:

A. $AB + BC + \bar{A}C = AB + \bar{A}C$

B. $(X + Y)(X + \bar{Y}) = X$

P2. (10 points) Use Boolean algebra to simplify the following logic expressions:

A. $S_1S_3 + S_2\bar{S_3} + S_2S_3 + S_1\bar{S_3}$

B. $XY\bar{Z} + XYZ + XYW$

P3. (15 points) Considering the following functions, write the canonical SOP expression, then simplify it.

A. $f(x_1, x_2, x_3) = \sum m(0, 3, 7)$

B. $f(x_1, x_2, x_3) = \sum m(1, 3, 5, 6, 7)$

P4. (15 points) Considering the following functions, write the canonical POS expression, then simplify it.

A. $f(x_1, x_2, x_3) = \prod M(0,\ 2, 5)$

B. $f(x_1, x_2, x_3) = \prod M(1, 3, 6, 7)$

P5. (15 points) Draw the following function using only NAND gates:

A. $f = \bar{A}C + A\bar{C} + B$

P6. (15 points) Draw the following function using only NOR gates:

A. $f = (A + B)(B + C)\ D$

P7. (20 points) Consider the logic function $f(a, b, c) = \bar{a}\bar{b}\bar{c} + a\bar{b}c + a\bar{b}c + \bar{a}bc + a\bar{b}\bar{c}$

A. Draw the logic circuit for the function given above.

B. Let the cost of a logic circuit be the total number of gates plus the total number of inputs to all gates in the circuit. What is the cost of the circuit in A?

C. Simplify *f* using Boolean algebra as much as possible.

D. Draw the logic circuit for the simplified version of *f* in C.

E. What is the cost of the circuit in D?