# CMSC 313 Spring 2024
## Homework 2
### due Monday, February 19, 11:59pm

For every exercise, show your work. For proofs, say which theorem or identity you are using as part of each line of your simplification. Not showing complete work will result in penalties. Box your final answer.

**Exercise 1.** Write the truth table for the following functions in a <u>single table</u>. Use columns $F_1$, $F_2$, $F_3$ as distinct output columns.

- a. $F_1(w, x, y, z) = x\overline{y}(zw + \overline{x+y})$
- b. $F_2(w, x, y, z) = y\overline{zw} + \overline{y} + x$
- c. $F_3(w, x, y, z) = (y + x + \overline{x})(x + 1)(yx + z)$

**Exercise 2.** Draw the circuits of the above functions ($F_1$, $F_2$, & $F_3$) using only AND, OR and NOT gates. Draw three separate circuits labeled as a., b., and c.. Use only <u>uncomplemented</u> inputs. Use multiple input gates (more than 2 input AND and ORs) when possible. Label all inputs and outputs. Do not simplify the circuits. Failing to follow these instructions will result in penalties.

**Exercise 3.** Prove that $\overline{b}\,\overline{c} + b\,\overline{c} + a\overline{b}c + abc = a + \overline{c}$ using algebraic manipulation. Say which theorem or identity you are using as part of each line of your simplification.

**Exercise 4.** Simplify the function $G = \overline{(\overline{a} + c)c} + cb$ to fewest literals. Say which theorem or identity you are using as part of each line of your simplification.

**Exercise 5.** Is the expression $\overline{x}\,\overline{y}\,\overline{z} + \overline{x}yz + x\overline{y}z + xy\overline{z}$ self-dual? Show your work.

**Exercise 6.** Convert the expression $F(w, x, y, z) = x + \overline{y}zw$ into canonical SOP <u>algebraically</u>. Say which theorem or identity you are using as part of each line of your simplification. Use $\Sigma$ notation for your final answer. Make sure your variables are organized alphabetically when enumerating the minterms.

**Exercise 7.** Convert the expression $F(w, x, y, z) = (w + x + y)(\overline{z})$ into canonical POS <u>using a truth table</u>. Use $\Pi$ notation for your final answer. Make sure your variables are organized alphabetically when enumerating the Maxterms.