1) Simplify the following expressions using Boolean Algebra.
   a. \( Z = A + (A \cdot B) \)
   b. \( Y = C \cdot (C + 0) \)
   c. \( X = E + (D \cdot D' + E \cdot 1) \)

2) List the truth table for the following Boolean Functions
   a. \( W = F \cdot G + F \cdot G' + G' \cdot H \)
   b. \( V = I \cdot K + J'K \) (No operator between variables implies AND)
   c. \( U = LM' + L'M \)

3) Design Problem:

   The Surelock 2009, version 2, is shown in Figure 1. Design the combinational logic for this system. The block diagram in Figure 2 is intended to help you understand the context of your design.

   ![Figure 1: Picture of the safe.](image1)
   ![Figure 2: Block diagram of the system.](image2)
Safe Specifications:

- Buttons A, B, and C are active high
- Button D is active low and is hidden on the bottom of the safe. It is pushed when the safe is sitting on a flat surface.
- The door lock is active low (0 = unlocked)
- The speaker driver is active high (1 = annoying sounds)

Task:

- Design combinational logic to unlock the door and turn on the speaker when the blue, green, and hidden buttons are pushed.
  1. Write out the truth table for the combinational logic.
  2. Write out the $\pi$ or $\Sigma$ canonical expression for Z.
  3. Write out the $\pi$ or $\Sigma$ canonical expression for Y.
  4. Draw the gates needed to implement the design.