Problem 1

(Boolean Simplification) Consider the function:

\[ f(A,B,C,D) = (AD + \overline{A}C)\overline{B}(C + B\overline{D}) \].

(a) Draw its schematic using AND, OR, and NOT gates.
(b) Using Boolean algebra, put the function into its minimized form and draw the resulting schematic.

Problem 2

(Gate Logic) Draw the schematics for the following functions using NOR gates and inverters only:

(a) \[ \overline{X + (Y + Z)} \]
(b) \[ \overline{[(\overline{X} + \overline{Y}) + (\overline{X} + \overline{Z})]} \]

Problem 3

(Laws and Theorems of Boolean Algebra) Use DeMorgan’s law to compute the complement of the following Boolean expressions:

(a) \( A(B + CD) \)
(b) \( ABC + B(\overline{C} + \overline{D}) \)
(c) \( \overline{X + Y} \)
(d) \( X + Y\overline{Z} \)
(e) \( (X + Y)Z \)
(f) \( X + (Y\overline{Z}) \)
(g) \( X(Y + Z\overline{W} + \overline{V}S) \)
Problem 4
(Laws and Theorems of Boolean Algebra) Using Boolean algebra, verify that the schematic of Figure Ex. 2.12 implements an XOR function.

![Logic diagram](image)

*Figure Ex. 2.12 XOR implemented by NAND gates.*

Problem 5
(Karnaugh Map Method) Use K-maps on the expressions. Find the minimized sum-of-products form. Show your work in K-map form.

(a) \( W(A,B,C) = \overline{ABC} + \overline{ABC} + A\overline{BC} + A\overline{B}C \)

(b) \( X(A,B,C) = \overline{ABC} + \overline{ABC} + A\overline{BC} + ABC \)

(c) \( Y(A,B,C,D) = \overline{ABCD} + \overline{ABCD} + A\overline{BCD} + \overline{ABCD} + \overline{ABCD} + A\overline{BCD} \)