Assignment 1

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1 Problem

Draw the Logic Circuit for the following Boolean Expression:
$$\left(\mathbf{X}' + \mathbf{Y}\right).\mathbf{Z} + \mathbf{W}'$$

2 Explanation

First we will simplify the given Boolean expression as below, so that NAND or NOR logic gates are used for designing logic circuit.
Using De Morgan's Law

$$
\begin{aligned}
\left(\overline{X} + Y\right).Z + \overline{W} &= \left(\overline{X} + \overline{\overline{Y}}\right).Z + \overline{W} \\
&= \overline{\overline{X}.\overline{Y}}.Z + \overline{W} \\
&= \left(\overline{\overline{\overline{X}.\overline{Y}.Z}}\right) + \overline{W}
\end{aligned}
\tag{2.0.1}
$$

$$
\implies \left(\overline{X} + Y\right).Z + \overline{W} = \overline{\left(\overline{\overline{X}.\overline{Y}.Z}\right).W}
\tag{2.0.2}
$$

Now we will draw logic circuit according to the above simplified expression.

X

Y

Z

W

$\overline{Y}$

$\overline{X.\overline{Y}}$

$\overline{\overline{X.\overline{Y}}.Z}$

$\overline{\left(\overline{\overline{X.\overline{Y}}.Z}\right).W}$