Automata Theory: Assignment 3
Due date: September 13 (Thursday)

Problem 1 (6 points)
Consider the following two languages on the alphabet $\Sigma = \{a, b\}$:

\[
\begin{align*}
    L_1 &= \{a^n : n \geq 1\} \\
    L_2 &= \{b^n : n \geq 1\}
\end{align*}
\]

Describe the languages below, using either the set notation or precise definitions in English:

\[
\begin{align*}
    L_3 &= L_1^* \\
    L_4 &= \overline{L_1} \\
    L_5 &= L_1 \cup L_2 \\
    L_6 &= L_1 L_2 \\
    L_7 &= (L_1^2)(L_2^2)(L_1^2) \\
    L_8 &= (L_1 \cup L_2)^* \\
    L_9 &= (L_1 L_2)^*
\end{align*}
\]

Problem 2 (4 points)
Consider the alphabet $\Sigma = \{a, b\}$. Is there any language $L$ on this alphabet for which $(\overline{L})^* = \overline{L}$? If yes, give an example of such a language; if no, explain why.