Problem 1
Let $L_2$ be a decidable language. Further, let $L_1$, and $L_3$ be recognizable languages. Prove that $(L_1 - L_2) \cup L_3$ is recognizable.

Problem 2
Prove that
$L = \{\langle M \rangle \mid M \text{ enters state } q_3\}$
is undecidable.

Problem 3
Consider the following two languages:
$L_1 = \{\langle M \rangle \mid M \text{ accepts at most 13 distinct inputs }\}$
$L_2 = \{\langle M \rangle \mid M \text{ accepts more than 13 distinct inputs }\}$
Are these languages decidable? Are these languages recognizable? Prove your answers.