Homework Assignment #5
Due: October 18, 2023 at 7:00 p.m.

1. Let $B(n)$ be the binary representation of the natural number n.
Let $ADD = \{B(n_1)\texttt{\#}B(n_2)\texttt{\#}B(n_3) : n_1 + n_2 = n_3\}$.
For example, the string `1101#110#10011` is in ADD because `1101` is $B(13)$, `110` is $B(6)$, `10011` is $B(19)$ and $13 + 6 = 19$.
Is ADD regular? Prove your answer is correct.

2. If L is a language over the alphabet Σ, let $EXTRA(L)$ be the set of all strings obtained by inserting exactly one extra character into any one of the strings in L. More formally, $EXTRA(L) = \{xay : x, y \in \Sigma^* \text{ and } a \in \Sigma \text{ and } xy \in L\}$.
For example, if $\Sigma = \{\texttt{a},\texttt{b}\}$ and $L = \{\varepsilon, \texttt{ba}\}$ then $EXTRA(L) = \{\texttt{a, b, aba, baa, bba, bab}\}$.
Prove that for every regular language L, $EXTRA(L)$ is also regular.