Problem 1. [Category: Design+Proof] Prove that the recursive languages are closed under the following operations:

- union
- intersection
- complement
- concatenation

Problem 2. [Category: Design+Proof] Prove that if $L_1$ and $L_2$ are recursive, then so is $\text{shuffle}(L_1, L_2) = \{w \mid w = \alpha_1\beta_1\alpha_2\beta_2\ldots\alpha_k\beta_k \text{ for some } k \geq 0 \text{ and strings } \alpha_1, \ldots, \alpha_k \text{ and } \beta_1, \ldots, \beta_k, \text{ such that } \alpha_1\alpha_2\ldots\alpha_k \in L_1 \text{ and } \beta_1\beta_2\ldots\beta_k \in L_2\}.$

Problem 3. [Category: Design+Proof] Show that if $L_1$ and $L_2$ are recursively enumerable, then so is $\text{shuffle}(L_1, L_2).$