Assignment 1

CS 581
Due October 4, 2018

Problem 1 [10 points] For languages A and B, let the **perfect shuffle** of A and B be the language:

$$\{w \mid w = a_1 b_1 a_2 b_2 ... a_k b_k, \text{ where } a_1 ... a_k \in A \text{ and } b_1 ... b_k \in B, \text{ each } a_i, b_i \in \Sigma\}$$

Show that the class of Regular languages is closed under **perfect shuffle**.

Problem 2 [10 points] For languages A and B, let the **shuffle** of A and B be the language:

$$\{w \mid w = a_1 b_1 a_2 b_2 ... a_k b_k, \text{ where } a_1 ... a_k \in A \text{ and } b_1 ... b_k \in B, \text{ each } a_i, b_i \in \Sigma^*\}$$

Show that the class of Regular languages is closed under **shuffle**.

Problem 3 [10 points] For any string w, define

$$SCRAMBLE(w) = \{t \mid t \text{ contains the same symbols as } w \text{ in any order}\}$$

For any language L, define

$$SCRAMBLE(L) = \{t \mid t \in SCRAMBLE(w) \text{ for some } w \in L\}$$

Prove or disprove that the if L is a Regular language and $\Sigma = \{0, 1\}$ then $SCRAMBLE(L)$ is Regular.