CS 462 Group Problem-Solving Session
Winter 2018
Session 3

1. Is the following language regular? $\{xwx^R \ : \ x, w \in \{0,1\}^+\}$.

2. Is the following language regular? $\{xx^R w \ : \ x, w \in \{0,1\}^+\}$.

3. Find an expression for the perfect shuffle of two languages L_1 and L_2 in terms of operations like morphism, inverse morphism, and intersection. Hint: one approach is to modify the expression we found for ordinary shuffle. Conclude that if L_1, L_2 are regular then so is the perfect shuffle of L_1 and L_2.

4. Define
$$\min(L) = \{x \in L \ : \ \text{no proper prefix of } x \text{ is in } L\ \}.$$
Find an expression for $\min(L)$ in terms of operations like quotient, complement, etc. Conclude that if L is regular, so is $\min(L)$.

5. Define
$$\max(L) = \{x \in L \ : \ x \text{ is not a proper prefix of any } y \in L\}.$$
Find an expression for $\max(L)$ in terms of operations like quotient, complement, etc. Conclude that if L is regular, so is $\max(L)$.

6. If x and y are binary strings, by $x \vee y$ we mean the bitwise "or" of x and y. Thus, for example, $0011 \vee 1010 = 1011$. Show that if L_1 and L_2 are regular languages over a binary alphabet, that $L_1 \vee L_2 = \{x \vee y \ : \ x \in L_1, y \in L_2, |x| = |y|\}$ is regular.

7. Suppose L is regular. Is the language
$$\{xz \ : \ \text{there exists } y \text{ such that } xyz \in L \text{ and } |x| = |y| = |z|\}$$
regular?