Tentative Homework Problems
CS 161

Languages

Cohen	Chapter 2:	1, 2, 5, 6
Linz	Chapter 1:	1, 3, 5, 6, 7, 8, 11

Definitions:

alphabet; language; word
Kleene closure (*), positive Kleene closure (+)
Kleene closed
product language
reverse, PALINDROME(X)

From Linz, Formal Languages and Automata, 6th edition, 2017. Chapter 1

EXERCISES

1. How many substrings aab are in ww^Rw, where $w = aabbab$?
2. Use induction on n to show that $|u^n| = n\,|u|$ for all strings u and all n.
3. The reverse of a string, introduced informally above, can be defined more precisely by the recursive rules

$$a^R = a,$$
$$(wa)^R = aw^R,$$

for all $a \in \Sigma$, $w \in \Sigma^*$. Use this to prove that

$$(uv)^R = v^R u^R,$$

for all $u, v \in \Sigma^+$.

4. Prove that $\left(w^R\right)^R = w$ for all $w \in \Sigma^*$.
5. Let $L = \{ab, aa, baa\}$. Which of the following strings are in L^*: $abaabaaabaa$, $aaaabaaaa$, $baaaaabaaaab$, $baaaaabaa$? Which strings are in L^4?
6. Let $\Sigma = \{a, b\}$ and $L = \{aa, bb\}$. Use set notation to describe $\overline{L}$.
7. Let L be any language on a nonempty alphabet. Show that L and $\overline{L}$ cannot both be finite.
8. Are there languages for which $\overline{L^*} = (\overline{L})^*$?
9. Prove that

$$(L_1 L_2)^R = L_2^R L_1^R$$

for all languages L_1 and L_2.

10. Show that $(L^*)^* = L^*$ for all languages.
11. Prove or disprove the following claims.
    (a) $(L_1 \cup L_2)^R = L_1^R \cup L_2^R$ for all languages L_1 and L_2.
    (b) $\left(L^R\right)^* = (L^*)^R$ for all languages L.