

### Formal Language Selected Homework Chapter 4.1

2. Use the construction in Theorem 4.1 to find nfa's that accept

(a)  $L((a + b)a^*) \cap L(baa^*)$ .

7. The *nor* of two languages is

$$\text{nor}(L_1, L_2) = \{w : w \notin L_1 \text{ and } w \notin L_2\}.$$

Show that the family of regular languages is closed under the *nor* operation.

★12. Suppose we know that  $L_1 \cup L_2$  is regular and that  $L_1$  is finite. Can we conclude from this that  $L_2$  is regular?

14. If  $L$  is a regular language, prove that the language  $\{uv : u \in L, v \in L^R\}$  is also regular.

16. Show that if the statement “If  $L_1$  is regular and  $L_1 \cup L_2$  is also regular, then  $L_2$  must be regular” were true for all  $L_1$  and  $L_2$ , then all languages would be regular.

18. The *head* of a language is the set of all prefixes of its strings, that is,

$$\text{head}(L) = \{x : xy \in L \text{ for some } y \in \Sigma^*\}.$$

Show that the family of regular languages is closed under this operation.

26. Let  $G_1$  and  $G_2$  be two regular grammars. Show how one can derive regular grammars for the languages

(a)  $L(G_1) \cup L(G_2)$ .

(b)  $L(G_1)L(G_2)$ .

(c)  $L(G_1)^*$ .