

Problem Set 3

Due: Tue, 9/25/07.

Reading: Chapter 1.2.

1. problem 1.32 in textook (roughly, proving that checking addition of binary numbers is a regular language).
2. Problem 1.16 (b) in textbook (NFA to DFA conversion).
3. In the following problems you are asked to apply the constructions we saw for proving that the class of regular languages is closed under the regular operations.
 - (a) 1.8(a) in textbook
 - (b) 1.9(b) in textbook
 - (c) 1.10(b) in textbook

4. For languages L_1 and L_2 over alphabet Σ , define the shuffle operation as follows:

shuffle $(L_1, L_2) = \{w \mid w = a_1 \circ b_1 \circ \dots \circ a_n \circ b_n \text{ such that } a_1 \circ \dots \circ a_n \in L_1 \text{ and } b_1 \circ \dots \circ b_n \in L_2, \text{ and each string } a_i, b_i \in \Sigma^*\}.$

Show that the class of regular languages is closed under the shuffle operation.

Hint: Given DFAs $M_1 = (Q_1, \Sigma, \delta_1, q_1, F_1)$ for L_1 and $M_2 = (Q_2, \Sigma, \delta_2, q_2, F_2)$ for L_2 , construct an NFA $N = (Q, \Sigma, \delta, q_0, F)$ for **shuffle** (L_1, L_2) by setting $Q = Q_1 \times Q_2$ (with appropriately chosen δ, q_0, F).