Problem Set 4 — Due April 29, 2004

Problem 1. Consider applying the product construction to NFAs \( M_1 = (Q_1, \Sigma, \delta_1, q_1, F_1) \) and \( M_2 = (Q_2, \Sigma, \delta_2, q_2, F_2) \) in order to show that the NFA-acceptable languages are closed under symmetric difference.

Part A. Formally specify the product machine \( M = (Q, \Sigma, \delta, q_0, F) \).

Part B. Does the construction work—that is, is \( L(M) = L(M_1) \oplus L(M_2) \)?

Problem 2. Let \( \alpha \) and \( \beta \) be regular expressions. Prove that there exists a number \( N \), algorithmically computable given \( \alpha \) and \( \beta \), such that \( L(\alpha) = L(\beta) \) whenever \( L(\alpha) \cap \{0, 1\} \leq N = L(\beta) \cap \{0, 1\} \leq N \).

Problem 3. Page 86, Exercise 1.17, parts b and c.

Problem 4. Page 88, Problem 1.23, parts a and d.