Homework 2

January 15, 2015

Exercise 1 (Ex 3.1.2, page 91)**.** *Write regular expressions for the following languages:*

a) The set of strings of 0's and 1's such that every pair of adjacent 0's appears before any pair of adjacent 1's.

b) The set of strings of 0's and 1's whose number of 0's is divisible by five.

Exercise 2 (Ex 3.1.3, page 92)**.** *Write regular expressions for the following languages:*

a) The set of all strings of 0's and 1's not containing 101 as a substring.

b) The set of all strings with an equal number of 0's and 1's, such that no prefix has two more 0's than 1's, nor two more 1's than 0's.

c) The set of strings of 0's and 1's whose number of 0's is divisible by five and whose number of 1's is even.

Exercise 3 (Ex 4.1.2, page 132)**.** *Prove that the following are not regular languages.*

a) $\{0^n : n$ *is a perfect square*$\}$.

b) $\{0^n : n$ *is a perfect cube*$\}$.

c) $\{0^n : n$ *is a power of 2*$\}$.

d) The set of strings of 0*'s and* 1*'s whose length is a perfect square.*

e) The set of strings of 0*'s and* 1*'s that are of the form* ww*, that is, some string is repeated.*

f) The set of strings of 0*'s and* 1*'s that are of the form* ww^R*, that is, some string followed by its reverse.*

g) The set of strings of 0*'s and* 1*'s of the form* $w\overline{w}$*, where* $\overline{w}$ *is formed from* w *by replacing all* 0*'s by* 1*'s and vice verse; e.g.,* $\overline{011} = 100$*, and* 011100 *is an example of a string in the language.*

h) The set of strings of the form $w1^n$*, where* w *is a string of* 0*'s and* 1*'s of length* n*.*

Exercise 4 (Ex 4.3.4, page 155)**.** *Give an algorithm to tell whether two regular languages* L_1 *and* L_2 *have at least one string in common.*

Exercise 5 (Ex 4.3.5, page 155)**.** *Give an algorithm to tell, for two regular languages* L_1 *and* L_2 *over the same alphabet* Σ*, whether there is any string in* Σ^* *that is in neither* L_1 *nor* L_2*.*

Exercises are from the book "Automata Theory, Language, and Computation", 3rd edition, by John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman, published by Addison-Wesley.