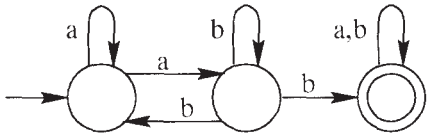
Faculteit Wiskunde en Informatica
Vrije Universiteit

Formele Talen en Automatentheorie
18 april 2000

Opgave 1

(a) Give the definition of a regular expression and of the language generated by a regular expression. [5 pnt.]

(b) Find a regular expression equivalent to the finite automaton (nfa) given below. [15 pnt.]



Opgave 2

(a) Formulate the pumping lemma for regular languages. [5 pnt.]

(b) Prove the pumping lemma for regular languages. [10 pnt.]

(c) Check whether the following languages are regular (explain the answer). [15 pnt.]

$$\begin{aligned} L_1 &= \{a^n b^m c^k \mid n, m, k \geq 0,\ n + m < k\}, \\ L_2 &= \{a^n b^m c^k \mid n, m, k \geq 0,\ k < 3\}, \\ L_3 &= L_1 \cap L_2 \,. \end{aligned}$$

Opgave 3

(a) Give the definition of a nondeterministic pushdown automaton (ndpa) and of the language accepted by a ndpa. [5 pnt.]

(b) Convert the following grammar to Greibach normal form and give an equivalent pushdown automaton. [15 pnt.]

$$\begin{aligned} S &\rightarrow aSbb \mid B \\ B &\rightarrow bB \mid b \,. \end{aligned}$$

(c) Let a regular language L_1 and a context free language L_2 be given. Show that there exists an algorithm to check whether L_1 and L_2 have a common element. [10 pnt.]

Opgave 4

(a) Give the definition of a Turing machine with stay-option and of the languages accepted by a Turing machine with stay-option. [5 pnt.]

(b) Prove that there exists a recursively enumerable language L such that the complement of L is not recursively enumerable. [15 pnt.]

The grade is equal to one tenth of the number of points scored.