Assignment 1 Consider the linear recursive specification

$$\begin{array}{rcl} S & = & a.T + a.U \\ T & = & a.S + \mathbf{1} \\ U & = & a.S + b.U \end{array}$$

a) Construct, by transformation of the underlying recursive specification, a total and deterministic automaton that is language equivalent to the automaton $\mathcal{M}(S)$. (15 pts.)

b) For $IA_\tau(\mathcal{N})$ we have the following result: If $x \approx y \cdot x + z$ then $x \approx y^* \cdot z$. Use the result to calculate an iteration expression for $\mathcal{L}(S)$. (Hint: It may be handy to first solve for U.) (15 pts.)

Assignment 2

a) Give the additional operational rules for the parallel operator $\|$ and encapsulation operator $\partial_p(\cdot)$ of the process algebra $CA_\tau(\mathcal{N})$. (10 pts.)

b) Prove the law

$$a.x \parallel b.y \leftrightarroweq a.(x \parallel b.y) + b.(a.x \parallel y)$$

for two actions a and b such that $\{a, b\} \neq \{p!d, p?d\}$ for every port name (channel) p and data element d, in the context of the process algebra $CA_\tau(\mathcal{N})$, by showing a suitable relation R on $CA_\tau(\mathcal{N})$ to be a (strong) bisimulation relation. (15 pts.)

Assignment 3

a) Formulate the Pumping Lemma for push-down languages. (10 pts.)

b) Prove, using the Pumping Lemma for push-down languages, that the language L given by

$$L = \{\, ww \mid w \in \{a, b\}^* \,\}$$

is not a push-down language. (15 pts.)

Assignment 4 Let the domain $D \subseteq \{\, 0,\ 1,\ + \,\}^*$ be given by

$$D = \{\, w{+}v \mid w, v \in \{0,1\}^n,\ |w| = |v| \,\}$$

Construct a Turing machine that computes binary addition on D, i.e. the function outputs the binary number representing $w + v$, where w and v are interpreted as binary numbers with an equal number of digits. (20 pts.)

The end mark is the total of accredited points divided by 10.