

Exercise Sheet 3

Problem 1: Parikh Image

Let $N = (S, T, \mathbb{F}, \mathbb{B})$ be a Petri net with connectivity matrix \mathbb{C} and $M_1, M_2 \in \mathbb{N}^{|S|}$, $\sigma \in T^*$ such that $M_1[\sigma \rangle M_2$. Prove that $M_2 = M_1 + \mathbb{C} \cdot p(\sigma)$, where $p(\bullet)$ is the *Parikh image* function.

Problem 2: Boolean Programming

Consider a simple Boolean program P using the following commands:

- $l : z = x \text{ and } y \text{ goto } l'$
- $l : z = x \text{ or } y \text{ goto } l'$
- $l : z = \text{neg } x \text{ goto } l'$
- $l : \text{if } (x = \text{false}) \text{ goto } l_1 \text{ else goto } l_2$

Give a construction of a Petri net program NP_P that simulates P .

Problem 3: Coverability Reduction

Reduce the coverability problem to the reachability problem.

Problem 4: Connectivity Matrix

Let $N = (S, T, \mathbb{F}, \mathbb{B})$ be a Petri net with connectivity matrix \mathbb{C} and let $M \in \mathbb{N}^{|S|}$. Prove that there is a marking $M_1 \in \mathbb{N}^{|S|}$ with $M_1 + M \in R(M_1)$ if and only if $M = \mathbb{C} \cdot x$ has a solution in $\mathbb{N}^{|T|}$.