University of Konstanz
Department of Computer & Information Science
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Network Dynamics
WS 2010/11

Assignment 3

Ausgabe: 17 Dec 2010 **Abgabe:** 11 Jan 2010

Problem 1: Policy Routing — 10 Points

The formal routing problem for destination node 0 was given in the lectures by

- an undirected graph $G = (V, E)$ such that $0 \in V$
- path sets P^u for each $u \in V$ such that P^u consists of the empty path ε and all paths in G starting at u and ending at 0
- total pre-orders $\succeq_u$ on P^u for each $u \in V$ such that $p \succ_u \varepsilon$ for all paths $p \in P^u \setminus \{\varepsilon\}$

Design a formal routing problem without a stable confluent state.

Problem 2: Tryptophan operon — 10 Points

Consider the state process describing the (closed) tryptophan operon as discussed in the lecture. Furthermore, consider local state dynamics specified by the corresponding set $L = \{f_1, f_2, f_3, f_4, f_5\}$ of local transitions:

$$\begin{aligned} f_1(x_1, \ldots, x_5) &=_{\text{def}} \neg x_3 \wedge \neg x_5 \\ f_2(x_1, \ldots, x_5) &=_{\text{def}} x_1 \\ f_3(x_1, \ldots, x_5) &=_{\text{def}} x_2 \wedge \neg x_3 \\ f_4(x_1, \ldots, x_5) &=_{\text{def}} \neg x_3 \wedge \neg x_5 \\ f_5(x_1, \ldots, x_5) &=_{\text{def}} x_4 \end{aligned}$$

Determine the average number of orbits in the phase spaces induced by local state dynamics (L, π) over all permutations π.

Hint: Run an appropriate computer program.

Problem 3: Canalizing Ensembles — 10 Points

Determine the number of all canalizing, ternary boolean functions $f : \{0,1\}^3 \to \{0,1\}$.

Remark: You are not allowed to use a computer program; use a combinatorial approach instead!