Concurrency Theory (WS 2011/12) Out: Tue, Jan 24 Due: Mon, Jan 30

Exercise Sheet 13

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Problem 1: π-calculus and Structural Semantics

Consider the following π-calculus process modelling a server together with two clients that send instructions a and b to it:

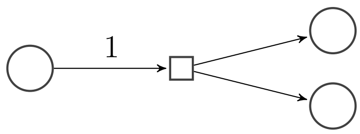
$$s(i).i(y) \mid \nu ip_1.\overline{s}\langle ip_1\rangle.\overline{ip_1}\langle a\rangle \mid \nu ip_2.\overline{s}\langle ip_2\rangle.\overline{ip_2}\langle b\rangle$$

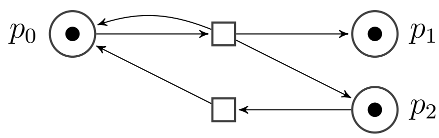
(a) Compute its structural semantics.

(b) Extend the server $s(i).i(y)$ so that it reacts to the instruction. If $y = a$, the server should behave like process P. If $y = b$, the server becomes Q. Explain your idea.

Problem 2: π-calculus and Communication-free Petri Nets

In a communication-free Petri net (cfPN), every transition has a single place in its preset. Moreover, as illustrated in the Petri net below (left), the arc from the place to the transition is weighted one.





(a) Define a translation of cfPN N into π-Calculus process $P[\![N]\!]$ as follows. Every place $s \in S$ yields a process identifier K_s. The transitions leaving this place are encoded by non-deterministic choice. Give the process $P[\![N]\!]$ and the defining equation for each identifier K_s.

(b) Apply the translation to the Petri net given in the picture above (right).

Problem 3: Structural Semantics of π-calculus Processes

Apply the method presented in class to determine the net $\mathcal{N}[\![P]\!]$ for the following process:

$$\begin{aligned} P = {} & a(x).x(y) + a(x).\overline{x}\langle a\rangle + \overline{a}\langle b\rangle \\ & \mid a(x).x(y) + a(x).\overline{x}\langle a\rangle + \overline{a}\langle b\rangle \\ & \mid b(x).\overline{a}\langle x\rangle + \nu n.\overline{a}\langle n\rangle.a(z).n(l) \end{aligned}$$

Problem 4: Structural Semantics of Closed Processes

Compute $N[\![P]\!]$ for $\nu a.K\lfloor a\rfloor$ where $K(x) := K\lfloor x\rfloor \mid \nu a.\big(\overline{a}\langle a\rangle \mid a(x).\nu b.K\lfloor b\rfloor\big) \mid \nu c.\big(\overline{c}\langle c\rangle \mid c(y)\big)$.

What is special about such processes and their corresponding nets?