TH2 - Übung 4

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1 CSP Laws

1.1 SCP Laws beweisen

a) $a \to (P_1 \sqcap P_2) =_T (a \to P_1) \sqcap (a \to P_2)$

Gleichheit von Prozessen im Trace-Modell:

$\to$ zu zeigen: $traces(a \to (P_1 \sqcap P_2)) = traces((a \to P_1) \sqcap (a \to P_2))$

$$
\begin{aligned}
traces(a \to (P_1 \sqcap P_2)) &= \{\langle\rangle\} \cup \{\langle a\rangle ^\frown tr \mid tr \in traces(P_1 \sqcap P_2)\} && \text{Prefixing, 6.10}\\
&= \{\langle\rangle\} \cup \{\langle a\rangle ^\frown tr \mid tr \in traces(P_1) \cup traces(P_2)\} && \text{Choice, 6.16}\\
&= \{\langle\rangle\} \cup \{\langle a\rangle ^\frown tr \mid tr \in traces(P_1)\} && \text{Vereinigung von Mengen}\\
&\quad \cup \{\langle a\rangle ^\frown tr \mid tr \in traces(P_2)\}\\
&= \{\langle\rangle\} \cup \{\langle a\rangle ^\frown tr \mid tr \in traces(P_1)\} && \text{Idempotenz von Mengen}\\
&\quad \cup \{\langle\rangle\} \cup \{\langle a\rangle ^\frown tr \mid tr \in traces(P_2)\}\\
&= traces(a \to P_1) \cup traces(a \to P_2) && \text{Prefixing, 6.10}\\
&= traces((a \to P_1) \sqcap (a \to P_2)) && \text{(Internal-)Choice, 6.16}
\end{aligned}
$$

$\square$

b) $Skip \triangle P =_T Skip \sqcap P$

Gleichheit von Prozessen im Trace-Modell:

$\to$ zu zeigen: $traces(Skip \triangle P) = traces(Skip \sqcap P)$

$$
\begin{aligned}
traces(Skip \triangle P) &= traces(Skip) \cup \{tr_1 \frown tr_2 \mid tr_1 \in traces(Skip) \wedge \checkmark \notin \sigma(tr_1) && \text{Interrupt, 6.53}\\
&\qquad\qquad \wedge\, tr_2 \in traces(P)\}\\
&= \{\langle\rangle, \langle\checkmark\rangle\} \cup \{tr_1 \frown tr_2 \mid tr_1 \in \{\langle\rangle, \langle\checkmark\rangle\} \wedge \checkmark \notin \sigma(tr_1) && \text{Skip, 6.4}\\
&\qquad\qquad \wedge\, tr_2 \in traces(P)\}\\
&\mid NB_1 : tr_1 \in \{\langle\rangle, \langle\checkmark\rangle\} \wedge \checkmark \notin \sigma(tr_1) \quad \Leftrightarrow \quad tr_1 = \{\langle\rangle\}\\
&\mid NB_2 : \{a \frown b\} = \{b\} \Leftrightarrow a = \{\langle\rangle\}\\
&= \{\langle\rangle, \langle\checkmark\rangle\} \cup \{\langle\rangle \frown tr_2 \mid tr_2 \in traces(P)\} && NB_1, NB_2\\
&= \{\langle\rangle, \langle\checkmark\rangle\} \cup traces(P) && NB_2\\
&= traces(Skip) \cup traces(P) && \text{Skip, 6.4}\\
&= traces(Skip \sqcap P) && \text{Choice, 6.14}
\end{aligned}
$$

□

1.2 CSP Laws anwenden

$P1 = ((a \to c \to Skip) \square (b \to c \to Skip))$
$P2 = (d \to Skip)$
$P3 = c \to d \to Skip$

zu zeigen: $(P1;\ P2) \setminus \{a, b\} =_T P3$

$$
\begin{aligned}
(P1;\ P2) \setminus \{a, b\} &= (((a \to c \to Skip) \square (b \to c \to Skip));\ (d \to Skip)) \setminus \{a, b\}\\
&=_T ((a \to c \to Skip) \sqcap (b \to c \to Skip);\ (d \to Skip)) \setminus \{a, b\} && \text{choice-equiv}_T\text{, 8.15}\\
&= (a \to c \to Skip) \setminus \{a, b\} \sqcap (b \to c \to Skip) \setminus \{a, b\}; && \sqcap\text{-hide-dist}_T\text{, 8.81, NB}\\
&\quad (d \to Skip) \setminus \{a, b\}\\
&= (c \to Skip) \setminus \{a, b\} \sqcap (c \to Skip) \setminus \{a, b\}; && \text{3 x hide-step}_1\text{, 8.79}\\
&\quad d \to Skip \setminus \{a, b\}\\
&= c \to Skip \setminus \{a, b\} \sqcap c \to Skip \setminus \{a, b\}; && \text{2 x hide-step}_1\text{, 8.79}\\
&\quad d \to Skip \setminus \{a, b\}\\
&= (c \to Skip) \sqcap (c \to Skip);\ d \to Skip && \text{3 x hide-term, 8.85}\\
&= c \to Skip;\ d \to Skip && \square\text{-idem, 8.16}\\
&= c \to d \to Skip && \text{;-unit-l, 8.94}\\
&= P3
\end{aligned}
$$

□

2 Failures Semantik

2.1 Stable Failures in Transitionsgraphen

$$R_{11} = \{\} \tag{2.1}$$

$$R_{12} = \{a, b, e, f\} \tag{2.2}$$

$$R_{13} = \{\} \tag{2.3}$$

$$R_{14} = \{\} \tag{2.4}$$

$$R_{15} = \{a, b, c, e, f\} \tag{2.5}$$

$$R_{16} = \{c, d, e, f\} \tag{2.6}$$

$$R_{17} = \{a, b, c, d, e, f\} \tag{2.7}$$

$$R_{18} = \{f\} \tag{2.8}$$