Models of computation (MOD) 2013/14

Exam – September 4, 2014

[**Ex. 1**] Extend IMP with the command

$$\textbf{try } c_1 = c_2 \textbf{ else } c_3$$

that returns the store obtained by computing c_1 if it coincides with the one obtained by computing c_2; if they differ returns the store obtained by computing c_3; it diverges otherwise.

1. Define the operational semantics of the new command.
2. Define the denotational semantics of the new command.
3. Extend the proof of correspondence between the operational and the denotational semantics.

[**Ex. 2**] Prove that the HOFL terms:

$$t_1 \stackrel{\text{def}}{=} \textbf{rec } f.\lambda x.\ ((\lambda y.\ 1)\ (f\ x)) \qquad t_2 \stackrel{\text{def}}{=} \lambda x.\ 1$$

have the same type and the same denotational semantics.

[**Ex. 3**] Let us consider sequential CCS agents composed using only **nil**, action prefix and sum. Prove that

$$p \xrightarrow{\mu} q \quad \text{implies} \quad \varphi(p) \xrightarrow{\varphi(\mu)} \varphi(q)$$

for any permutation of action names φ. Use this result to prove that $p \simeq q$ implies $\varphi(p) \simeq \varphi(q)$, where $\simeq$ denotes bisimilarity.

[**Ex. 4**] Given the HM-logic formula:

$$\phi \stackrel{\text{def}}{=} \Diamond\alpha.\Box\beta.true \ \wedge\ \Box\alpha.\Diamond\beta.\Box\gamma.true.$$

give a CCS agent that satisfies ϕ and whose LTS has a minimal number of transitions.