Models of Computation

Written Exam on September 3, 2010

AA031: 6 credits, Exercises 1-3, 2h:20
375AA: 9 credits, Exercises 1-4, 3h

Exercise 1 (6)

Si fornisca la semantica operazionale e denotazionale del nuovo costrutto **IMP**.

$$\begin{array}{rl} \textbf{case2} & a \quad \textbf{of} \\ n_1: & c_1 \\ n_2: & c_2 \\ \textbf{otherwise}: & c_3 \qquad\qquad \text{dove } n_1 \neq n_2 \end{array}$$

che esegue c_1, c_2 o c_3 a seconda che la valutazione di a fornisca n_1 o n_2 o un altro numero intero.

Exercise 2 (8)

Si consideri l'insieme $\mathcal{D}$ contenente tutti gli insiemi di numeri naturali composti solamente da numeri dispari. Si dimostri che $(\mathcal{D}, \subseteq)$ è un ordinamento parziale completo con bottom. Si dica inoltre quali insiemi $S \in \mathcal{D}$ di naturali possono essere il limite di qualche catena infinita.

Exercise 3 (8)

Si consideri il termine HOFL lazy

$$snd(((\lambda y.\ y)\ (((rec\ f.\ \lambda x.\ (f\ x))\ 3)\ ,\ 2))).$$

Se ne calcoli il tipo, la forma canonica e la semantica denotazionale.

Exercise 4 (8)

Consider n *transmitters* $T_0, T_1, \ldots, T_{n-1}$ connected by a token ring. At any moment, a transmitter i can be *ready* to transmit or *not ready*. It becomes ready with a private action *arrive* and a rate λ. Once ready, it stays ready until it transmits, and then it becomes not ready with an action $serve_i$ and rate μ. To resolve conflicts, only the transmitter with the *token* can operate. There is only one token K, which at any moment is located at some transmitter T_i. If transmitter T_i is not ready, the token synchronizes with it with an action $walkon_i$ and rate ω moving from transmitter T_i to transmitter $T_{i+1\ (mod\ n)}$. If transmitter T_i is ready, the token synchronizes with it with action $serve_i$ and rate μ and stays at transmitter T_i.

Write a PEPA process modeling the above system as follows: (i) define recursively all the states of $T_i, i = 0, 1, \ldots, n-1$ and of K; (ii) define the whole system by choosing the initial state where all transmitters are not ready and the token in at T_0 and composing in parallel all of them with $\bowtie_L$, with L being the set of synchronized actions. Then draw the transition system corresponding to $n = 2$, and compute the bisimilarity relation. Finally define a function f such that $f(n)$ is the number of (reachable) states for the system with n transmitters.