

2005 Paper 7 Question 11

Topics in Concurrency

(a) You are reminded that the logic CTL has assertions of the form

$$\mathbf{EX} A , \mathbf{EG} A , \mathbf{E}[A_0 \mathbf{U} A_1] .$$

Explain their semantics in terms of paths. Describe their translation into the modal μ -calculus with a single action label. [6 marks]

(b) Give a finite assertion A in Hennessy–Milner logic with the following property

$$p \models A \text{ iff } p \text{ is strongly bisimilar to the CCS process } a.\mathbf{nil} ,$$

for any CCS process p with actions restricted to being within the set $\{a, b\}$. [7 marks]

(c) A simulation between CCS terms is a binary relation S between CCS terms such that whenever $(t, u) \in S$, for all actions a and terms t'

$$t \xrightarrow{a} t' \Rightarrow \exists u'. u \xrightarrow{a} u' \ \& \ (t', u') \in S .$$

Define $t \leq u$ iff there is a simulation S with $(t, u) \in S$.

Exhibit two CCS terms t and u for which $t \leq u$ and $u \leq t$ and yet where t and u are not strongly bisimilar. Briefly justify your answer. [7 marks]