COMPUTER SCIENCE TRIPOS Part II – 2016 – Paper 8

14 Topics in Concurrency (JMH)

(a) Define the *token game* for basic Petri nets. [3 marks]

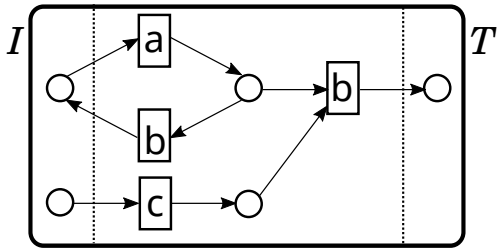
(b) When is a basic Petri net *safe* from an initial marking? [2 marks]

(c) An LB-net is a basic Petri net $(B, E, pre, post)$ accompanied by

- a labelling function $\lambda : E \to Act$ from its events to a set of actions Act
- subsets of conditions $I \subseteq B$ and $T \subseteq B$. The initial conditions I are marked when the process starts and the terminal conditions T are marked when the process has terminated.

LB-nets are drawn with labels inside events and boxes surrounding the initial and terminal conditions.

(i) Draw the labelled transition system of the following LB-net. The initial state should correspond to the initial conditions I being marked and labels on the transitions should correspond to actions, not events. [4 marks]



(ii) Ignoring the particular sets that states represent, is there an LB-net with an *injective* labelling function λ that gives rise to the same labelled transition system? Justify your answer briefly. [2 marks]

(iii) A simple process language has the following syntax.

$$p ::= \alpha \mid p + p' \mid p \parallel p' \mid p; p'$$

where $\alpha \in Act$. As in CCS, $+$ represents the nondeterministic sum of processes and $\parallel$ represents the parallel composition. The process $p; p'$ represents the sequential composition of p and p.

Draw diagrams to describe the inductive definition of an LB-net semantics for this fragment. [7 marks]

(iv) An iteration operator p^* is proposed with LB-net semantics such that its sets of initial and terminal conditions are equal: $I = T$. Discuss briefly how this affects the semantics you gave in part (c)(iii). [2 marks]