1995 Paper 7 Question 9

Pi Calculus

Define the term *sorting*, and explain what it means to say that a term of the π-calculus *respects* a given sorting. [5 marks]

Define the basic reduction rule COMM of the polyadic π-calculus. If $R \longrightarrow R'$ is an instance of COMM, and R respects a sorting ob, show that R' also respects ob. Argue informally that this holds for any reduction $R \longrightarrow R'$ whatever. [5 marks]

A labelled binary tree (lbt) is either a *node* with two sub-lbts, or else a *tip* with a label (some value). Show how to represent lbts uniformly as π-calculus agents with no free names. What sorting does your representation respect, given a sorting for label values? [7 marks]

Translate into the π-calculus the case-switch construction

$$\begin{aligned} &\mathit{case}\ t\ \mathit{of}\ \ ?\ \ \mathit{node}(t_1 t_2) \Rightarrow P \\ &\qquad\qquad\quad ?\ \ \mathit{tip}(v) \Rightarrow Q \end{aligned}$$

so that, when interacting with an lbt T located at t, it will enter P (with t_1, t_2 bound to the locations of the sub-lbts) if T is a node, and otherwise will enter Q (with v bound to the location of the label value). [3 marks]