並行分散計算特論 (5)

Shoji Yuen

2011/11/1

Reaction rules

$$\tau.P + M \to P$$

$$(a.P + M)|(\overline{a}.Q + N) \to P|Q$$

$$\frac{P \to P'}{P|Q \to P'|Q} \qquad \frac{P \to P'}{\text{new } a\ P \to \text{new } a\ Q}$$

$$\frac{P \to P'}{Q \to Q'} \quad \text{where} \quad P \equiv Q \quad and \quad P' \equiv Q$$

Transition by inferences

$$\cfrac{\cfrac{\overline{\overline{b}.\overline{c}|b.0 \to \overline{c}.B|0}}{b.A|\overline{b}.\overline{c}.B|b.0 \to b.A|\overline{c}.B|0}}{b.A|\overline{b}.\overline{c}.B|b.0 \to b.A|\overline{c}.B|0}$$

new prevents unintentional communications together with the structural congruence

$$\cfrac{\cfrac{\cfrac{\overline{b.A|\overline{b}.\overline{c}.B \to A|\overline{c}.B}}{\text{new } b\ (b.A|\overline{b}.\overline{c}.B) \to \text{new } b\ (A|\overline{c}.B)}}{\text{new } b(b.A|\overline{b}.\overline{c}.B)|b.0 \to \text{new } b(A|\overline{c}.B)|b.0}}{\text{new } b(b.A|B)|B' \to \text{new } b(A|\overline{c}.B)|B'}$$

Concurrency

Concurrency is modelled in $P|Q$

$$P|Q \to P'|Q \qquad Q|P \to Q|P'$$

when $P \to P'$

Asynchrony between P and Q

Concurrency = interleaving + rendesvouz

Synchronization when P communicates with Q

Example:Lottery

Specifiction

$$Lotspec \stackrel{def}{=} \tau.b_1.Lotspec + \cdots + \tau.b_n.Lotspec$$

N agents to rotate a token to be selected

$$\begin{array}{lcl} A(a,b,c) & \stackrel{def}{=} & \overline{a}.C(a,b,c) \\ B(a,b,c) & \stackrel{def}{=} & b.C \\ C(a,b,c) & \stackrel{def}{=} & \tau.B(a,b,c) + c.A(a,b,c) \end{array}$$

$$\begin{array}{lcl} A_i & \stackrel{def}{=} & A(a_i, b_i, a_{i \oplus_n 1}) \\ B_i & \stackrel{def}{=} & B(a_i, b_i, a_{i \oplus_n 1}) \\ C_i & \stackrel{def}{=} & C(a_i, b_i, a_{i \oplus_n 1}) \end{array}$$

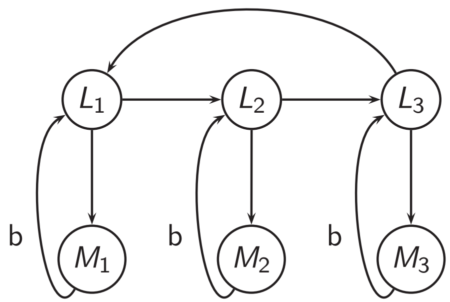
$$x \oplus_n 1 = \begin{cases} x+1 & \text{if } x < n \\ 1 & \text{otherwise} \end{cases}$$

$$\text{new } \vec{a}\ (C_1 | A_2 | \cdots | A_n)$$

Example:Lottery

if n=3

$$\begin{array}{ll} L_1 & = \text{new } a_1a_2a_3(C_1|A_2|A_3) \\ L_2 & = \text{new } a_1a_2a_3(A_1|C_2|A_3) \\ L_3 & = \text{new } a_1a_2a_3(A_1|A_2|C_3) \end{array}$$



Lotspec differs from new $\vec{a}(C_1|A_2|\cdots|A_n)$ in the number of $\longrightarrow$.

Relation between $\stackrel{\tau}{\longrightarrow}$ and $\longrightarrow$