Concurrent Programming - Exercícios 2

CCS sequential: CCS_0^ω

1. Solve the exercises of CCS_0 in `https://pseuco.com/#/exercises` (PseuCo.com)

2. Let $Act = \{a, b, c\}$, compute using the inference system:
   (a) $[\![a.b.0 + 0]\!]$
   (b) $[\![a.(b.0 + 0)]\!]$
   (c) $[\![a.b.c.0 + b.(0 + a.0)]\!]$

3. Consider the following definition of a coffee machine

$$CM := \text{coin.coffee.}CM$$

   (a) Compute Γ and $[\![CM]\!]_\Gamma$ and implement it in pseuco.com.
   (b) Write a process that behaves as CM but that can also steal the coin, i.e., may not give coffee after coin.
   (c) Write a process that behaves as CM but can give coffee or tea. Consider two cases: the beverage is randomlly choosen or there is a way to ask the buyer if he wants coffee or tea.
   (d) Write a process that behaves as CM but can give tea for 0.5 euros and coffee for 1 euro.
   (e) Repeat (a) for the last questions.

4. Let

$$\begin{aligned}\Gamma \;=\; & \{(P, a.P_1), (P_1, b.P + c.P), (Q, a.Q_1) \\ & (Q_1, b.Q_2 + c.Q), (Q_2, a.Q_3), (Q_3, b.Q + c.Q_2)\}\end{aligned}$$

   Write the equações defined by Γ. Using the inference system $\longrightarrow_\Gamma$, compute $[\![P]\!]_\Gamma$ e $[\![Q]\!]_\Gamma$. Draw the diagrams. Implement in pseuco.com.

5. For each expression and set of equations, indicate the set Γ and the semantics of each expression using $\longrightarrow_\Gamma$.
   (a) $[\![A]\!]_\Gamma$ being $A := a.(b.0 + b.c.A)$
   (b) $[\![B]\!]_\Gamma$ being $A := a.A + \tau.b.A$ and $B = a.A + b.A$
   (c) $[\![C]\!]_\Gamma$ being

$$\begin{aligned}C &:= c.C + D \\ D &:= 0 + c.C\end{aligned}$$

   (d) $[\![C_0]\!]_\Gamma$ being

$$\begin{aligned}C_0 &:= inc.C_1 \\ C_n &:= inc.C_{n+1} + dec.C_{n-1}, \text{ para } n \geq 1\end{aligned}$$

   (e) $[\![X]\!]_\Gamma$ and $\Gamma = \{(X, X + 0)\}$

6. Say if A and B are guarded or unguarded: $A := a.A + B$ and $B := b.B + A$.

7. Say which variables are guarded in the following equations: $C := c.C + D$, $D := 0 + c.C$ $A := b.0 + A$ e $B := b.B + a.A$.

8. Solve the exercicies in PseuCo Book (`https://book.pseuco.com/`) for sequential CCS without and with recursion.

Inference Rules CCS_0^ω

$$\text{prefix } \frac{}{\alpha.P \xrightarrow{\alpha} P}$$

$$\text{choiceL } \frac{P \xrightarrow{\alpha} P'}{P + Q \xrightarrow{\alpha} P'}$$

$$\text{choiceR } \frac{Q \xrightarrow{\alpha} Q'}{P + Q \xrightarrow{\alpha} Q'}$$

$$\text{Rec } \frac{P \xrightarrow{\alpha} P' \qquad \Gamma(X) = P}{X \xrightarrow{\alpha} P'}$$