Sequential CSS - syntax

(A)

$$P \ni P, Q ::= K \mid \alpha.P \mid P+Q \mid 0 \mid P[f] \mid P \setminus L$$

where

$\alpha \in N \cup \{\tau\}$ is an action

K is a collection of process names or process constants

$L \subseteq N$ is a set of labels

f is a function that renames actions s.t. $f(\tau) = \tau$

Notation → $[f] = [a_1 \mapsto b_1, \ldots, a_n \mapsto b_n]$

Exercise: Which are NOT syntactically correct? Why?

(1) $a.b.A + B$

Through $P+Q$ we have $P = a.b.A$ and $Q = B$. Q is made valid by K. P is made valid by $\alpha.P'$ two times, by the use of two consecutive channels.

R: Correct

(2) $(a.0 + b.A) \setminus \{a,b,c\}$

Through $P \setminus L$, we have $P = a.0 + b.A$ and $L = \{a,b,c\}$. $L \subseteq N$, which checks out. $a.0 + b.A$ is split through $P+Q$ rule, where $P = a.0$ and $Q = b.A$. P is made valid by applying $\alpha.P$, where $\alpha = a$ and $P = 0$ and Q is valid through $\alpha.P$ and K, where $\alpha = b$ and $P = K = A$.

R: Correct

(3) $(a.0 + b.A) \setminus \{a, \tau\}$

For $L = \{a, \tau\}$, it doesn't apply the fact that $L \subseteq N$ and $\tau \notin N$.

R: False

(4) $a.B + [b \mapsto a]$

$[b \mapsto a]$ should be applied to a certain P.

R: False

(5) $\tau.\tau.B + 0$

$P = \tau.\tau.B$ → valid because τ is an action and B is a process name or constant. This way, $\alpha.P$ applies.

$Q = 0$, trivial.

R: Correct

(6) a.(a+b).A

a+b is not allowed.

R: False

(7) (a.B + b.B) [a ↦ a, τ ↦ b]

Valid, through P[f], P+Q, α.P and K.

R: Correct

(8) (a.B + τ.B) [b ↦ a, a ↦ a]

Same as (7).

R: Correct.

(9) (a.b.A + b.0).B

Not valid, because (a.b.A + b.0) is not an action.

R: False.

(10) (a.b.A + b.0) + B

Valid through P+Q twice, α.P, K and 0.

R: Correct

Building a transition system

(act)

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

(sum-1)

$$\frac{P_1 \xrightarrow{\alpha} P_1'}{P_1 + P_2 \xrightarrow{\alpha} P_1'}$$

(sum-2)

$$\frac{P_2 \xrightarrow{\alpha} P_2'}{P_1 + P_2 \xrightarrow{\alpha} P_2'}$$

(res)

$$\frac{P \xrightarrow{\alpha} P' \quad \alpha \notin L}{P \setminus L \xrightarrow{\alpha} P' \setminus L}$$

(rel)

$$\frac{P \xrightarrow{\alpha} P'}{P[f] \xrightarrow{f(\alpha)} P'[f]}$$

Initial states: the process being translated.

Final states: all states are final

Language: possible sequence of actions of a process

Exercise: Build derivation trees

1. $(a.A + b.B) \xrightarrow{b} B$

$$\dfrac{\dfrac{}{b.B \xrightarrow{b} B}\ (act)}{(a.A + b.B) \xrightarrow{b} B}\ (sum\text{-}2)$$

2. $(a.b.A + (b.a.B + c.a.C)) \xrightarrow{b} a.B$

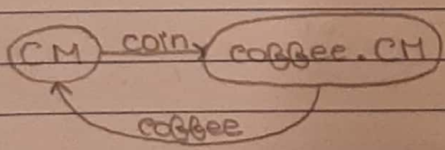
$$\dfrac{\dfrac{\dfrac{}{b.a.B \xrightarrow{b} a.B}\ (act)}{b.a.B + c.a.C \xrightarrow{b} a.B}\ (sum\text{-}1)}{(a.b.A + (b.a.B + c.a.C)) \xrightarrow{b} a.B}\ (sum\text{-}2)$$

3. $((a.B + b.A)[a \mapsto c]) \setminus \{a,b\} \xrightarrow{c} (B[a \mapsto c]) \setminus \{a,b\}$

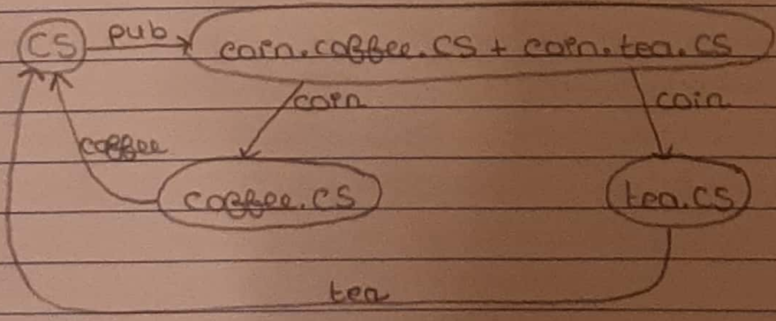
$$\dfrac{\dfrac{\dfrac{\dfrac{}{a.B \xrightarrow{a} B}\ (act)}{a.B + b.A \xrightarrow{a} B}\ (sum\text{-}1)}{(a.B + b.A)[a \mapsto c] \xrightarrow{c} B[a \mapsto c]}\ (rel)\ c = f(a)}{((a.B + b.A)[a \mapsto c]) \setminus \{a,b\} \xrightarrow{c} (B[a \mapsto c]) \setminus \{a,b\}}\ (res)\ c \notin \{a,b\}$$

Exercise: Draw the automata

CM = coin. coffee. CM



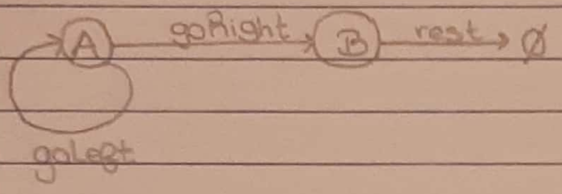
CS = pub. (coin. coffee. CS + coin. tea. CS)



Exercise: What is the language of the process A?

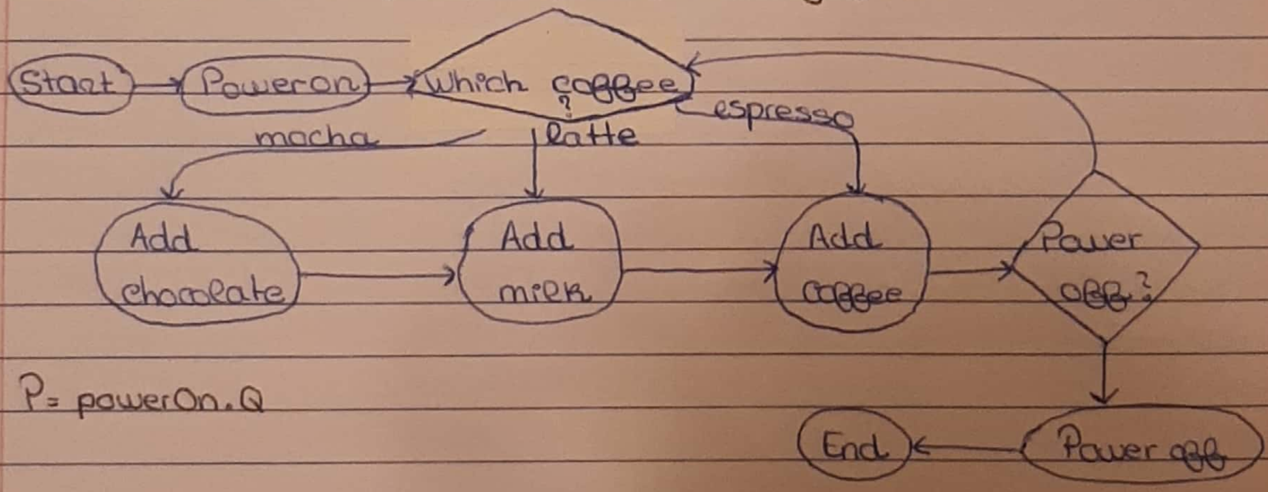
$A = goLeft.A + goRight.B$

$B = rest.0$



The automata shows the possible actions of process A, a.k.a, its language.

Exercise: Write the process of the following flowchart.



$P = powerOn.Q$

$Q = seeMocha.addChocolate.Mk + seeLatte.Mk + seeEspresso.Ac$

$Mk = addMilk.Ac$

$Ac = addCoffee.Po$

$Po = (repeat.Q + powerOff.0)$