Exercises 6 : Interaction and Concurrency

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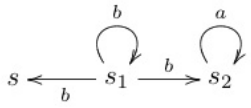
Exercise 1

Prove that

$$\mathsf{true} \;=\; \nu X \,.\, X \quad \text{and} \quad \mathsf{false} \;=\; \mu X \,.\, X$$

Exercise 2

Consider the following transition system.

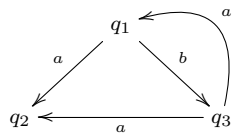


Determine all sets $S \subseteq \{s, s_1, s_2\}$ which are solutions of the following equations over $\mathcal{P}\mathbb{P}$:

$$\|X\| \;=\; \langle a \rangle\, \mathsf{true} \vee [b]\, X$$
$$\|X\| \;=\; \langle a \rangle\, \mathsf{true} \vee ([b]\, X \wedge \langle b \rangle\, \mathsf{true})$$

Exercise 3

Compute $\|[b]\, \mathsf{false} \wedge [a]\, X\|(\{q2\})$ with respect to the following transition system:



Exercise 4

A safety residence alarm is supposed to activate the alarm (event modelled by action alm) as soon as the presence of an intruder is detected (event modelled by action int).

1. Do you think that formula $[int]\,(\langle alm\rangle\,\mathsf{true}\ \wedge\ [-alm]\,\mathsf{false})$ is a rightful representation of this behaviour?
2. If not, give the correct specification.

Exercise 5

Define in μ-*calculus* the following property over a beverage dispenser machine : *The deposit of two coins leads to the acquisition of a coffee or a tea*.

Exercise 6

In an industrial assembly line, the following is an important property:

$\phi\ =$ *whenever an error occurs the system stops.*

1. Assuming action $error$ models the occurrence of an error, specify property ϕ in μ-*calculus*.
2. Recall the classes of properties mentioned in the lectures. In which classes would you incude ϕ? Why?

Exercise 7

Suppose you were given a process specifying the behaviour of a slot machine in which action $win(x)$ corresponds to the player wining x coins. It was suggested that the process should satisfy one of the following properties: propriedades:

$$\begin{aligned}\phi_1 &= \nu X\,.\,(\mu Y\,.\,(\langle win(1000)\rangle\,\mathsf{true} \vee \langle -\rangle\,Y) \wedge [-]\,X)\\ \phi_2 &= \nu X\,.\,(\mu Y\,.\,\langle -\rangle\,Y) \vee \langle win(1000)\rangle\,X\end{aligned}$$

A colleague, however, argued that ϕ_1 and ϕ_2 were equivalent.

1. Explain the meaning of both properties and discuss if they are indeed equivalent.
2. Recall the classes of properties mentioned in the lectures. In which classes would you incude ϕ_1? And ϕ_2? Justify.