Concurrency Theory

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Sheet 6

Due: Monday, 2025-12-08

Exercise 6.1

Use two separate formulas to describe the properties in Hennessey-Milner Logic with recursion.

a) There is an infinite a-labelled computation path in which all states have an outgoing b-labelled transition.

b) Every b-labelled computation path leads to a state from which an a-labelled transition is not possible.

Exercise 6.2

Consider the LTS

$$\begin{tikzcd} s & s_1 \arrow[l, "b"'] \arrow[loop above, "b"] \arrow[r, "b"] & s_2 \arrow[loop above, "a"] \end{tikzcd}$$

Compute all fixpoints of the functions

a) $[\![\langle a\rangle tt \vee [b]X]\!]$

b) $[\![\langle a\rangle tt \vee ([b]X \wedge \langle b\rangle tt)]\!]$

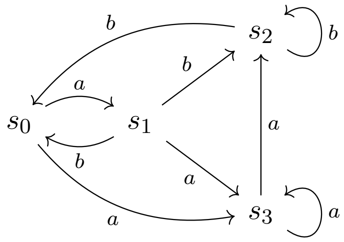
Exercise 6.3

Given a LTS $L = (S, Act, \rightarrow)$, show that $[\![F]\!] : 2^S \rightarrow 2^S$ is a monotonic function over the complete lattice $(2^S, \subseteq)$, for all formulas F, expressible in HML with recursion.

If you have questions, please post a message in the dedicated chat.

Exercise 6.4

Consider the LTS



a) Compute $[\![\langle b\rangle[a]tt \wedge \langle b\rangle[b]X]\!]\,(\{s_0, s_2\})$

b) Compute the set of processes satisfying the property

$$X \overset{\min}{=} \langle b\rangle\langle a\rangle tt \vee \langle b\rangle[b]X$$

c) Compute the sets of processes satisfying the mutual recursive equational system

$$\begin{aligned} A &\overset{\max}{=} [a]\,B \\ B &\overset{\max}{=} \langle a\rangle C \wedge [b]B \\ C &\overset{\max}{=} [b]\,B \end{aligned}$$