ENS DE LYON

TD de Sémantique et Vérification

I– Modelling Concurrent Systems

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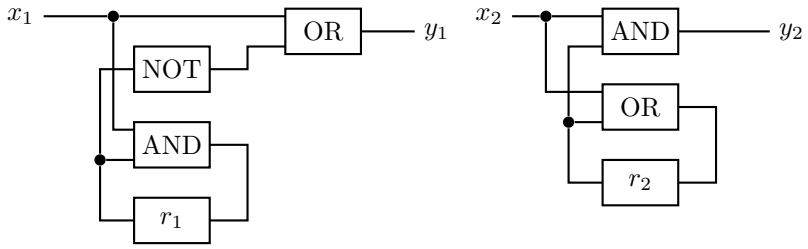
Exercise 1.

Consider the following two sequential hardware circuits:



1. Assuming that the initial values of the registers are $r_1 = 0$ and $r_2 = 1$, give the transition systems of both hardware circuits.
2. Determine the reachable part of the interleaving of these transition systems.

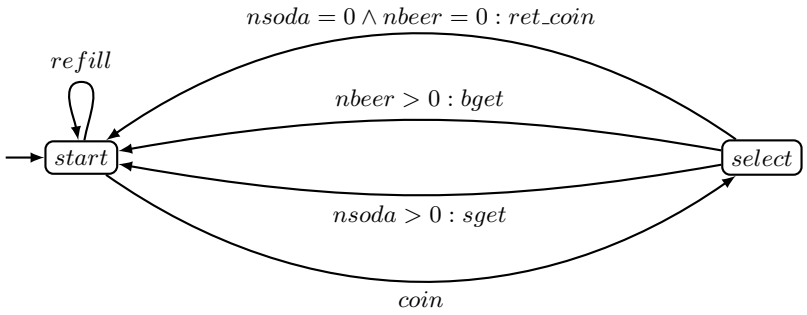
Exercise 2.

Consider the following Program Graph for a beverage vending machine with internal variables $\text{Var} := \{nsoda, nbeer\}$ with domain $\{0, 1, ..., max\}$:

$$PG := \langle \text{Loc}, \text{Act}, \text{Effect}, \hookrightarrow, \text{Loc}_0, g_0 \rangle$$

$$\text{Loc} := \{start, select\} \qquad \text{Act} := \{bget, sget, coin, ret\_coin, refill\}$$
$$\text{Loc}_0 := \{start\} \qquad g_0 := (nsoda = max \wedge nbeer = max)$$

$$\text{Effect}(bget, \eta) := \eta[nbeer \leftarrow nbeer - 1] \qquad \text{Effect}(coin, \eta) := \eta$$
$$\text{Effect}(sget, \eta) := \eta[nsoda \leftarrow nsoda - 1] \qquad \text{Effect}(ret\_coin, \eta) := \eta$$
$$\text{Effect}(refill, \eta) := \eta[nsoda \leftarrow max, nbeer \leftarrow max]$$



Give the reachable part of the transition system associated with PG, when $max = 2$.

Exercise 3.

Consider a stack of nonnegative integers with capacity n (for some fixed n).

1. Give a transition system representation of this stack. You may abstract from the values on the stack and use the operations *top*, *pop*, and *push* with their usual meaning.
2. Sketch a transition system representation of the stack in which the concrete stack content is explicitly represented.

Exercise 4.

Show that the handshaking operator $\|$ that forces two transition systems to synchronise over a subset of their common actions is associative. That is, show that

$$(TS_1 \parallel TS_2) \parallel TS_3 = TS_1 \parallel (TS_2 \parallel TS_3)$$

where TS_1, TS_2, TS_3 are arbitrary transition systems.