Transition systems

A transition system is a tuple $\mathbb{S} = (W, D, dom, I, T)$, where

1. W is a finite set of state variables.
2. D is a non-empty set, called the domain. Elements of D are called values.
3. dom is a mapping from W to the set of non-empty subsets of D. For each state variable $w \in W$, the set $dom(w)$ is called the domain for w.
4. I is a set of states, called initial states.
5. T is a finite set of transitions.

Transition systems

A transition t is applicable to a state s if there exists a state s' such that $(s, s') \in t$.

The transition relation of $\mathbb{S}$, denoted by $Tr_{\mathbb{S}}$, is the set of pairs of states $\bigcup_{t \in T} t$.

$\mathbb{S}$ is deterministic if for every state s there exists at most one state s' such that (s, s') belongs to the transition relation of $\mathbb{S}$.

$\mathbb{S}$ is finite-state if its set of states is finite.

Vending machine

1. The vending machine contains a drink storage, a coin slot, and a drink dispenser. The drink storage stores drinks of two kinds: beer and coffee. We are only interested in whether a particular kind of drink is currently being stored or not, but not interested in the amount of it.
2. The coin slot can accommodate up to 3 coins.
3. The drink dispenser can store at most one drink. If it contains a drink, this drink should be removed before the next one can be dispensed.
4. A can of beer costs two coins. A cup of coffee costs one coin.
5. There are two kinds of customers: students and professors. Students only drink beer, professors only drink coffee.
6. From time to time the drink storage can be recharged.

Formalization

1. Boolean state variables st_coffee and st_beer signalling whether the corresponding drink is currently stored in the drink storage.
2. Boolean state variables disp_coffee and disp_beer signalling whether the corresponding drink is currently in the drink dispenser.
3. A state variable coins denoting the current number of coins in the slot. Its possible values are $0, 1, 2, 3$.
4. A state variable customer denoting the current customer. The domain for this variable contains three values $student, prof, none$.

Transitions

1. $Recharge$ which results in the drink storage having both beer and coffee.
2. $Customer\_coming$, after which a customer appears at the machine.
3. $Customer\_going$, after which the customer leaves.
4. $Coin\_put$, when the customer puts the coin in the machine.
5. $Dispense\_beer$, when the customer presses the button to get a can of beer.
6. $Dispense\_coffee$, when the customer presses the button to get a cup of coffee.
7. $Take\_drink$, when the customer removes a drink from the dispenser.