Exercise 33

a) Define the semantics of the boolean operators ¬, ∧, ∨, →, and ↔ in HML analogously to the semantical definitions of the modal operators and boolean constants (see lecture slide 53).

b) Referring to the semantical rules of HML, explain in detail why formula [a] 1 is always true and formula ⟨a⟩ 0 is always false.

c) Draw an LTS L such that \( L \models ⟨a⟩(⟨a⟩ 1 → ⟨a⟩ ⟨a⟩ 1) \) but \( L \not\models ⟨a⟩ ⟨a⟩ ⟨a⟩ 1 \).

Exercise 34

Given LTS L as shown below. For each state s of L, determine which of the following formulae hold in s.

1. \( ⟨y⟩ 1 \)
2. \([x] 0\)
3. \([y] [y] 0\)
4. \([y] ⟨x⟩ 1\)
5. \(⟨x⟩([y] 0 ∧ ⟨x⟩ 1)\)

Exercise 35

Same as Exercise 34, but with the following formulae:

1. \( (((⟨x⟩ ⟨x⟩ 1) ∨ (⟨x⟩ [y] 0))\)
2. \( (((⟨y⟩ 1) → (⟨x⟩ ⟨y⟩ 1))\)
3. \( (((⟨y⟩ ⟨y⟩ 1) ↔ (⟨x⟩ [x] 0))\)
4. \([y] [x] ⟨y⟩ 1\)
Exercise 36

Given LTS $L$ as shown on the right.

a) List all different infinite traces in $L$, using $\omega$-notation, e.g. $abab\cdots = (ab)^\omega$.

b) Find 6 equivalences between traces from part a), using notation $\pi^i$, e.g. $\pi_2 = \pi_1^1$ for $\pi_1 = xyz$ and $\pi_2 = yz$. 