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Softwaretechnik/Software Engineering

http://swt.informatik.uni-freiburg.de/teaching/SS2016/swtvl

Exercise Sheet 4

Early submission: Wednesday, 2016-06-22, 12:00 Regular submission: Thursday, 2016-06-23, 12:00

Exercise 1 – Live Sequence Charts (10/20)

Consider the live sequence chart for the "Print Statement" use case of the ATM example.

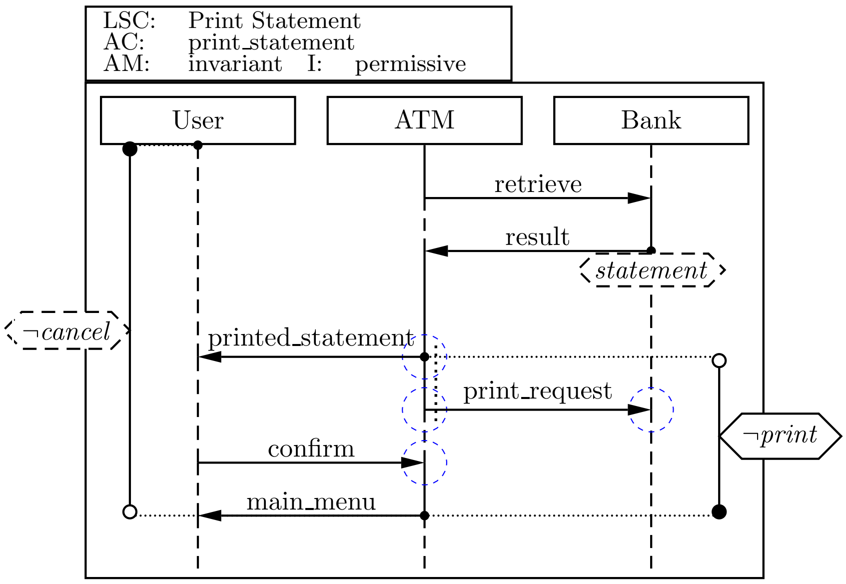

Figure 1: Live sequence chart for the "Print Statement" use case. *Note the coregion between printed_statement and print_request.*

(i) From the **abstract syntax** of the chart, write down (using the formal notation from the lecture)

a) the set of locations of the chart (also draw the names next to the location on the chart),
b) the set of instance lines $\mathcal{I}$ of the chart,
c) the partial order relation ($\preceq$) for the locations marked in blue,
d) the simultaneity relation ($\sim$) for the locations marked in blue,
e) an example of a message from the chart,
f) an example of a local invariant from the chart, including its temperature,
g) and an example of a condition from the chart, including its temperature.

(2)

(ii) Compute the **Büchi automaton** for the chart body. Show the steps of your calculation: write down the **cut** for each state and the **fired sets** for each transition. (5)

(iii) For each of the following cases, give one **example computation path** π:

a) π is accepted by the chart without taking a legal exit. (1)

b) π violates the chart. Point out why your trace violates the chart (what messages are received, which condition or invariant is not satisfied, etc.). (1)

c) π takes a legal exit, i.e. it exits legally during the traversal of the main chart body. Describe, in your own words and using your example, the intuition behind the concept of 'legal exit'. (1)

Exercise 2 – Object and Class Diagrams (10/20)

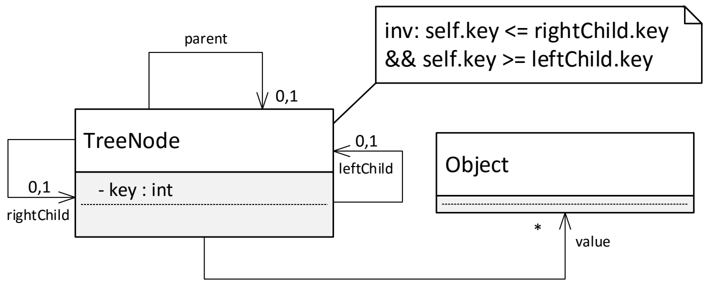

Figure 2: Class diagram for a sorted tree.

Consider the class diagram shown in Figure 2.

(i) Present the class diagram as a *signature*. Provide the **abstract syntax** of the diagram. (2)

(ii) Consider the formula

$$F := \forall\, self \in allInstances_{TreeNode} \bullet key(self) \geq key(leftChild(self)) \wedge key(self) \leq key(rightChild(self))$$

shown in Proto-OCL notation in Figure 2.

Give **system states** $\sigma_1, \sigma_2, \sigma_3$ such that

a) formula F evaluates to *true* for σ_1,

b) formula F evaluates to *false* for σ_2,

c) formula F evaluates to $\perp$ (undefined) for σ_3.

and for each system state, a (complete) **object diagram** that represents it. Also explain briefly in each case why the formula evaluates to the value you claimed. (6)

(iii) Choose one of your system states from (ii) and give a **proof**, using the interpretation function as defined in the lecture, that the formula actually evaluates to the value you claimed. (2)