Prof. Dr. A. Podelski, Dr. B. Westphal
Ch. Herrera

Wintersemester 2014/15

Software Design, Modeling, and Analysis in UML

http://swt.informatik.uni-freiburg.de/teaching/WS2014-15/sdmauml

Exercise Sheet 6

Early submission: Monday, 2015-01-26, 12:00 Regular submission: Tuesday, 2015-01-27, 8:00

Exercise 1 (10/20 Points)

In the Exercise 1 of Exercise Sheet 5, the task was to analyse the behaviour of the UML model given by Figure 1 from the system configuration shown in Figure 2.

(i) Provide a Rhapsody model corresponding to Figure 1. (5)

(ii) Explore the behaviour of your Rhapsody model using Rhapsody's animation feature.

Discuss:

a) How do your observations relate to the formal analysis of the model as done for the previous exercise sheet? (I.e., can the Rhapsody simulation reproduce none/some/all computation paths from the formal analysis? Do you obtain Rhapsody animation results which do not correspond to the formal analysis?)

Do you have a hypothesis how to explain the differences? (3)

Hint: you may use recorded sequence diagrams in order to document your exploration.

b) In Tutorial 5, we observed that our Rule (iv), "Environment Interaction", can at each point in time, "flood" the event pool with environment events which the system never processes.

Do you see something corresponding to Rule (iv) and its consequences in Rhapsody's animation? Explain.

Are there any consequences if the generated code is deployed on a real-world controller, e.g., for traffic-lights? (2)

Exercise 2 (5/20 Points)

Consider the UML model given by Figure 3.

(i) How can the system configuration given by Figure 3(d) evolve according to the lecture? (2)

(ii) How can the system configuration given by Figure 3(d) evolve in Rhapsody?
Please provide at least one sequence diagram.

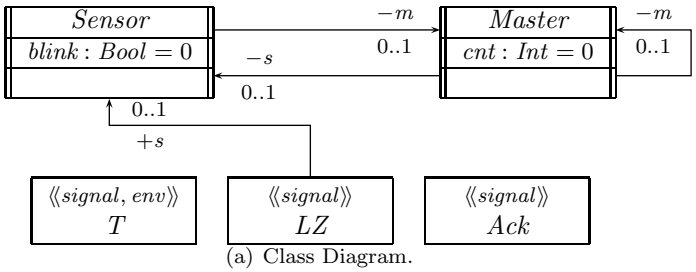
Discuss. (3)

Exercise 3 (5 Bonus)

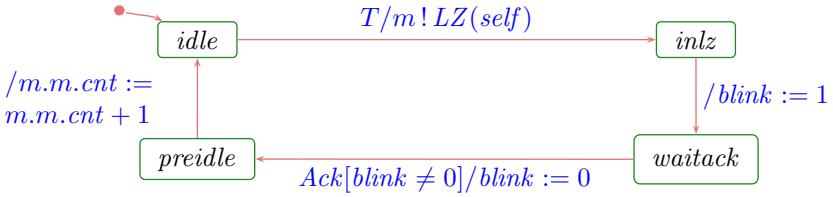
Consider the Statemachine from the last exercise sheet as given by Figure 4.

According to the lecture, there is a non-deterministic choice in state s_2 when an F is ready. What would you expect to happen in Rhapsody's animation? What does happen to the non-determinism in s_2 in Rhapsody? Explain! (5)

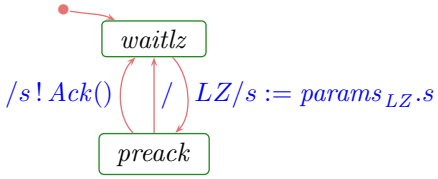
Hints: The generated C++ code does not bite.



(a) Class Diagram.



(b) State machine of *Master*.



(c) State machine of *Sensor*.

Figure 1: UML model for Exercise 1.

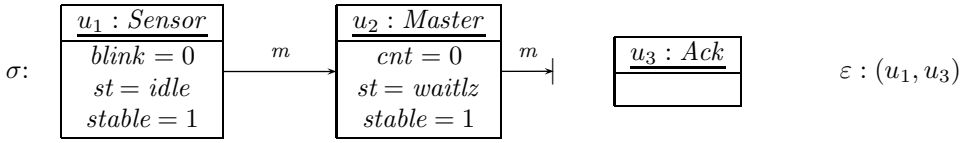
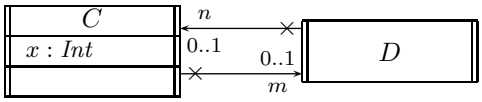
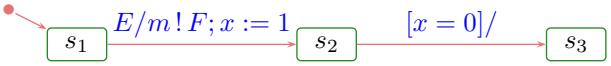


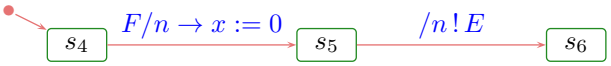
Figure 2: (Complete) system configuration for Exercise 1.



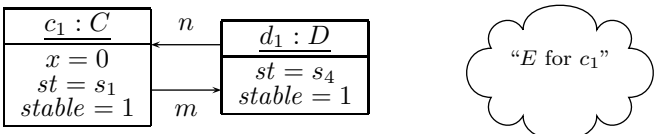
(a) Class diagram.



(b) State machine of C.



(c) State machine of D.



(d) System configuration.

Figure 3: UML model for Exercise 2.

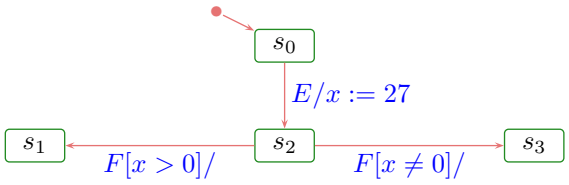


Figure 4: State machine for Exercise 3.

Exercise 4 (5/20 Points)

Consider the hierarchical state machine shown in Figure 5.

(i) Provide the mathematical representation of Figure 5. (3)

(ii) Point out an example of a basic, composite, OR-, AND-, initial, and final state. (2)

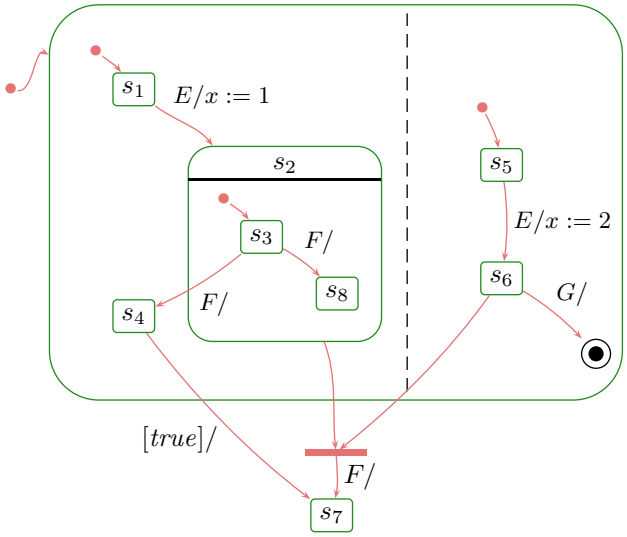


Figure 5: Hierarchical State Machine.