
Software Design, Modeling, and Analysis in UML

<http://swt.informatik.uni-freiburg.de/teaching/WS2012-13/sdmauml>

Exercise Sheet 2

Early submission: Monday, 2012-11-19, 12:00 Regular submission: Tuesday, 2012-11-20, 10:00

Exercise 1 **(5/20 Points)**

Consider the Rhapsody example model of the automated rail cars system. The (composite) class `AutomatedRailCarsSystem` includes classes `Terminal` and `Car`.

Provide the signature which corresponds to the following part of the system: classes `Terminal` and `Car`, for each of the two classes, about three interesting basic type attributes of your choice, and the associations between the two classes, (5)

Hints:

- To use Rhapsody, you want to connect to `archithor.informatik.uni-freiburg.de` with some RDP client.
- The model of the automated rail cars system is located in `C:/Program Files/Telelogic/Rhapsody 7.4/Samples/CppSamples/Cars`
- The host can (for limited number of licences) only run a limited number of parallel instances of Rhapsody. If you don't get a license, please try again later. If the problem persists, tell me.
- In a Rhapsody model, classes and their structural relationships are specified by object model diagrams. For the purpose of the task, please disregard irrelevant "instance-related" information, i.e., the number and the object name in the first compartment in the boxes.

Exercise 2 **(5+5/20 Points)**

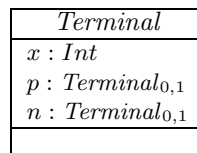


Figure 1: Class diagram for Exercise 2.

Consider the class diagram \mathcal{CD} in Figure 1.

- (i) Assume that the intention of the class diagram is to model lists of terminals that are doubly linked and located on a two-way circular path. (3)

Provide a brief but adequate (textual) explanation of this intention and use object diagrams of system states of \mathcal{CD} to reasonably illustrate the text. (3)

Hint: you decide, what a "reasonable illustration" is, e.g. whether you use one or more object diagrams, whether you announce that they're partial or complete, etc.

- (ii) Give an object diagram of \mathcal{CD} which illustrates a case that is not intended. (2)

- (iii) Can you formalise this intention?

(By any means provided by the lecture? By any means?) (+5)

Exercise 3

(5/20 Points)

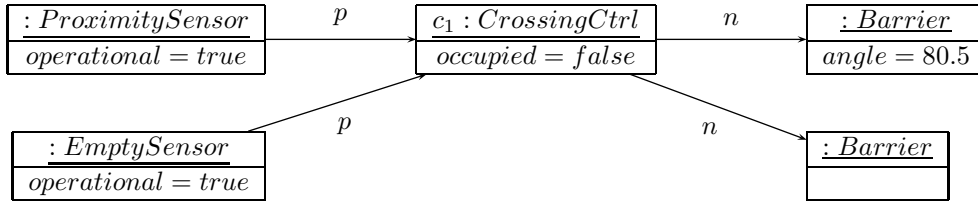


Figure 2: Object Diagram for Exercise 3.

Figure 2 shows an object diagram G for a railway crossing system.

- (i) Provide a Rhapsody class diagram and a structure \mathcal{D} such that G becomes an object diagram wrt. \mathcal{S} (as defined by the class diagram) and \mathcal{D} .

Explain your proposal.

(3)

- (ii) Consider the following OCL expression $expr$:

context *CrossingCtrl* inv : *occupied* = false implies *n* -> forAll(*it* | *it.angle* > 80.0)

Does G satisfy $expr$? If yes, explain the reason; otherwise, provide a counterexample in form of a system state.

(2)

Exercise 4

(5/20 Points)

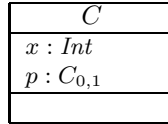


Figure 3: Class diagram for Exercise 4.

Consider the class diagram \mathcal{CD} in Figure 3.

- (i) Show that $expr := self.p.x$ is well-typed, i.e. derive

$$A, C \vdash self.p.x > 0 : \tau$$

with $A = self : \tau_C$ in the type-system from the lecture.

(3)

- (ii) By the lecture's convention, x is public in C . Now assume x is changed to be private in C , is $expr$ still well-typed after the change? (Briefly explain your answer.)

(2)