Exercise Sheet 2

Exercise 1 (5/20 Points)

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

Provide the signature which corresponds to the following part of the system: classes \texttt{Terminal} and \texttt{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:

- \texttt{To use Rhapsody, you want to connect to archithor.informatik.uni-freiburg.de with some RDP client.}
- \texttt{The model of the automated rail cars system is located in C:/Program Files/Telelogic/Rhapsody 7.4/Samples/CppSamples/Cars}
- \texttt{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.}
- \texttt{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)

Consider the class diagram \texttt{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.

Provide a brief but adequate (textual) explanation of this intention and use object diagrams of system states of \texttt{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 \texttt{CD} which illustrates a case that is not intended.

(2)

(iii) Can you \textit{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.

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

Explain your proposal. \( \text{\hspace{1cm}} \) (3)

(ii) Consider the following OCL expression \( \text{expr} \):

\[
\text{context CrossingCtrl} \quad \text{inv} : \text{occupied} = \text{false} \implies \forall \text{it} \mid \text{it.angle} > 80.0
\]

Does \( G \) satisfy \( \text{expr} \)? If yes, explain the reason; otherwise, provide a counterexample in form of a system state. \( \text{\hspace{1cm}} \) (2)

Exercise 4

(5/20 Points)

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

(i) Show that \( \text{expr} := \text{self.p.x} \) is well-typed, i.e. derive

\[
A, C \vdash \text{self.p.x} > 0 : \tau
\]

with \( A = \text{self : } \tau_C \) in the type-system from the lecture. \( \text{\hspace{1cm}} \) (3)

(ii) By the lecture’s convention, \( x \) is public in \( C \). Now assume \( x \) is changed to be private in \( C \), is \( \text{expr} \) still well-typed after the change? (Briefly explain your answer.) \( \text{\hspace{1cm}} \) (2)