Prof. Dr. A. Podelski, Dr. B. Westphal Wintersemester 2014/15

Software Design, Modeling, and Analysis in UML

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

Exercise Sheet 1

Early submission: Monday, 2014-11-03, 12:00 Regular submission: Tuesday, 2014-11-04, 8:00

Regarding the form of submission, we have the following preferences:

- *perfect*: a PDF by mail
- *fine*: any other common document format (such as ODF or DOC) by mail
- *kind*: a scanned version of the handwritten proposal by mail — there is a magic print-copy-scan-machine in the pool room which can send the scan to you by mail
- *tolerated*: paper submission

Exercise 1 – Model (5/20 Points)

Discuss (using the definitions from the lecture) whether

- the natural language description of the UML course on the homepage,
- a wiring diagram for an electronic component,
- the sentence

  "program statements must be followed by a semicolon"

is a model in the sense of the course.

Exercise 2 – Signature, System State (10/20 Points)

Assume we want to model a *wireless sensor network* (WSN) and its tree topology.
Each *device* (or *node*) in the considered network

- knows the address of zero or one *master*,
- knows the addresses of a number *slaves*,
- has a sensor reading value of float type.

Provide a basic object signature and structure suitable to model WSN. Explain your model, in particular using exemplary system states.

Exercise 3 – System States (5/20 Points)

Consider the basic object signature and structure for WSN from Exercise 2.
Consider the following (natural language) requirements on system states. For (i)–(iii), provide two system states σ_1, σ_2 such that σ_1 is a positive example, i.e. a system state which satisfies the requirement, and σ_2 is a negative example, i.e. a system state which does not satisfy the requirement.

(i) "The sensor reading ranges from 0.0 to 10.0." (1)

(ii) "Node n_1 is master of node n_2 if and only if n_2 is slave of n_1." (1)

(iii) "The sensor readings of all slaves of one master do not differ by more than 3." (1)

(iv) "There is exactly one object with no master and no slave and sensor reading value 7."
Please provide one positive example. Is this positive example unique? (2)

Explain your proposal, i.e., convince the reader that your respective system states σ_1 and σ_2 are actually positive and negative examples for the considered requirement.
Hint: Maybe you want to work on the Bonus Exercise first.

Bonus Exercise – Representing System States (5 Bonus)

Writing down system states as functions, i.e. as sets of $\mapsto$-pairs is tedious. Propose a convenient alternative representation: describe the syntax of your representation and explain how one can derive a unique system state as such (i.e. in the function notation) from your representation of a system state.