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Software Design, Modeling, and Analysis in UML

http://swt.informatik.uni-freiburg.de/teaching/WS2013-14/sdmauml

Exercise Sheet 1

Early submission: Monday, 2013-10-28, 12:00 Regular submission: Wednesday, 2013-10-30, 10:00

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 (4/20 Points)

Choose one of the following three tasks:

(i) Find an alternative, reasonable definition of *model* which is different from the two ones shown in the lecture. (Does maybe the Object Management Group (OMG) have one?)

Cite it correctly (i.e., give accurate references) and discuss: Why is your choice adequate for this exercise? How does it relate to the two definitions from the lecture?

(ii) In, for instance, propositional logic, a satisfying valuation of the propositions is called a *model* of a formula.

Discuss the relation of this notion of model to the notion of model we use in the lecture.

(iii) Discuss whether

- the natural language description of a product in an advertisement,
- a project plan in form of a Gantt chart,
- the sentence

  "identifiers in the program must not contain any uppercase letter (A-Z)"

is a model in the sense of the course.

Exercise 2 – Signature, System State (4/20 Points)

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

- knows the address of zero or one *master*,
- knows the addresses of a number *slaves*,
- has a received signal strength indication (*RSSI*) value of integer type.

Provide a basic object signature and structure suitable to model WSN. Explain your model, in particular using exemplary system states.
Hint: we can model "knows the address of" by links.

Exercise 3 – System States (12/20 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 RSSI value ranges from 0 to 10." (3)

(ii) "Node n_1 is master of node n_2 if and only if n_2 is slave of n_1." (3)

(iii) "The RSSI values of all slaves of one master do not differ by more than 2." (3)

(iv) "There is exactly one object with no master and no slave and RSSI value 7."
Please provide one positive example. Is this positive example unique? (3)

Hint: decide whether 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.