SOEN 342 - Sections H and II

Software Requirements and Specifications

Lab exercise of 22.09.2023

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System description

We introduce types $SATELLITE\_TYPE$ and $COUNTRY\_TYPE$. Consider the following association between satellites and their country of origin:

$satellites =$

$\{$

$\quad COSMOS2568 \mapsto russia,$

$\quad SOYUZMS23 \mapsto russia,$

$\quad COSMOS2566 \mapsto russia,$

$\quad GONETSM22 \mapsto russia,$

$\quad STARLINK30381 \mapsto usa,$

$\quad STARLINK30354 \mapsto usa,$

$\quad STARLINK30367 \mapsto usa,$

$\quad STARLINK30343 \mapsto usa,$

$\quad YAOGAN4001A \mapsto china,$

$\quad YAOGAN3901A \mapsto china,$

$\quad TIANMU110 \mapsto china,$

$\quad TIANMU107 \mapsto china$

$\}$

The requirements of the system are as follows:

1. Satellites have unique names.

2. Each satellite has a single country of origin.

3. Different satellites may share their country of origin.

There are 10 problems in this lab exercise, each with a weight of 1 mark.

Problems

1. Is variable *satellites* a binary relation? Explain.

2. Is variable *satellites* a function? Explain and reason about any and all applicable properties (total, partial, injective, surjective, bijective).

3. What is the meaning of the following expression and what is the result of its evaluation:
   $\{COSMOS\,2568, STARLINK\,30343\} \lhd satellites$

4. What is the meaning of the following expression and what is the result of its evaluation:
   $satellites \rhd \{usa\}$

5. Briefly describe what is the meaning of the following statement and, upon the statement's successful termination, what is the state of variable *satellites*.

   $satellites' =$
   $\{$
         $COSMOS\,2568,$
         $COSMOS\,2566,$
         $GONETSM\,22,$
         $STARLINK\,30354,$
         $STARLINK\,30367,$
         $STARLINK\,30343,$
         $YAOGAN\,4001A,$
         $YAOGAN\,3901A,$
         $TIANMU\,107$
   $\} \lhd satellites$

6. Briefly describe what is the meaning of the following statement and, upon the statement's successful termination, what is the state of variable *satellites*.

   $satellites' = satellites \rhd \{china\}$

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7. Consider the task of adding a **new** entry to the table. In the **absense** of any pre-condition, describe would happen to variable *satellites* if we force a) set union and b) relational override, and there already exists an entry with *satellite?*:

   - $satellites' = satellites \cup \{satellite? \mapsto country?\}$

   - $satellites' = satellites \oplus \{satellite? \mapsto country?\}$

   where *satellite?* and *country?* correspond to arguments of their corresponding types.

8. Define a precondition for the operation that adds a new $satellite? \mapsto country?$ pair.

   For problems 9 and 10, consider the task of <u>replacing</u> an existing entry where the satellite will be associated with a different country.

9. Given the precondition to the operation as
   $(satellite? \in \mathrm{dom}\ satellites) \wedge (satellite? \mapsto country? \notin satellites)$
   What does the precondition ensure?

10. Can the operation be supported by

   (a) set union? i.e. $satellites' = satellites \cup (satellite? \mapsto country?)$

   (b) relational overriding? i.e. $satellites' = satellites \oplus (satellite? \mapsto country?)$

END OF EXERCISE.