2IW05 Final Examination – Software Specification

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Exercise 1 (15 points) Consider the following informal specification of a tool for handling Software Specification documents.

"A software specification document has a name, a date of creation and bears the date of its latest change. It also comprises one or more models; models can be added to or removed from a specification. Each model has a name and may reference (import) some models. There are three types of models: structural models, behavioral models and logical correctness specifications. Structural models by themselves have two types: Z Specifications and Alloy Specifications. A Z Specification has a list of schemas and has methods to add schemas, remove them, and to calculate their pre-conditions. Details of an Alloy specification need not further be specified."

Design a class diagram which captures the above-given specification.

Exercise 2 (25 points) Consider the following state and operation schemas which specify the state of a car dealer and the operations to buy and sell a car. Give the definition of the sequential composition $Buy \fatsemi Sell$ and simplify it as much as possible using the rules of logic.

$[Car, Price]$

ZDealer

$$showroom : \mathbb{P}\ Car$$
$$priceList : Car \pfun Price$$
$$\dom priceList = showroom$$

Sell

$$\Delta ZDealer$$
$$c? : Car$$
$$c? \in showroom$$
$$priceList' = priceList \setminus \{c? \mapsto priceList(c?)\}$$

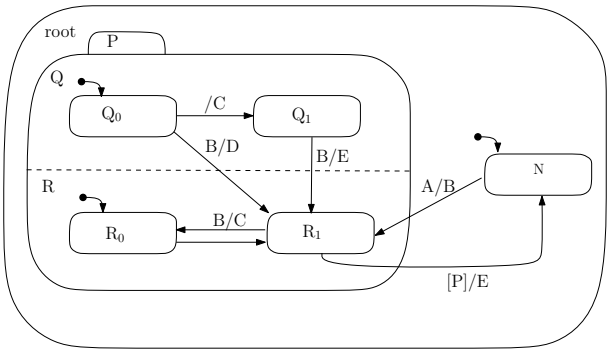
Buy

$$\Delta ZDealer$$
$$c? : Car$$
$$p? : Price$$
$$c? \notin showroom$$
$$priceList' = priceList \cup \{c? \mapsto p?\}$$

Exercise 3 (15 points) Remove the regular expressions in the following formulae and express them in the modal μ-calculus with recursionn (minimal and maximal fixed points). Explain briefly each step that you take in your calculation.

- $[enter.\overline{leave}^*.enter]false$
- $\langle enter\rangle\langle true^*.leave\rangle true$
- $\langle enter\rangle[true^*.leave]true$

Exercise 4 (25 points) Consider the following Statechart.

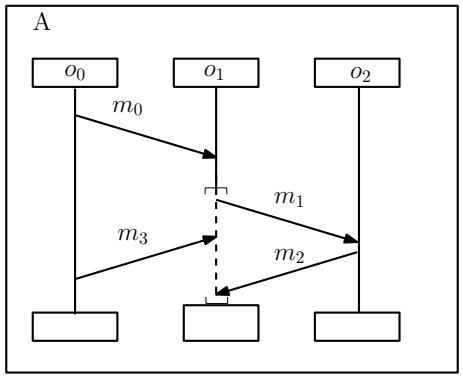


b. What are the exit and enter set of the transitions labeled B/D and $[P]/E$ with respect to the situation $(\{root, P, Q, Q_0, R, R_1\}, \{B\})$. (10 points)

c. Draw its LTS with two steps from the environment labeled respectively $\{A\}$ and $\emptyset$ interleaved with two steps from the statechart. (15 points)

In all of the above cases, only giving the final answer suffices.

Exercise 5 (20 points) Consider the MSCs given below.



1. Abstract from message m_1 in A. (10 points)
2. Combine entities o_0 and o_1 in A. (10 points)