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Softwaretechnik/Software Engineering

http://swt.informatik.uni-freiburg.de/teaching/SS2020/swtvl

Exercise Sheet 1

Early subm.: Mon, 2020-05-25, 14:00 Regular subm.: Tue, 2020-05-26, 14:00

In a regular semester... we would have had one round of exercise sheet submission, tutorial session, and tutor feedback before this exercise sheet. In the tutorial session and with the feedback, the tutors would have elaborated on the practice of exercise sheets in our course. This is not a regular semester, so here is a short explanation.
Software Engineering is a lot about reflecting back to other people the own understanding of a task, and describing the own proposal for a solution while making clear the own assumptions. For this reason, some exercises are intentionally ambiguous or open. Meaning, they may allow multiple different interpretations and multiple (equally good) solutions.
Hence working on the exercises in general includes clarifying (and writing down) the own understanding of the task, writing down the own solution proposal, and arguing why the proposed solution is a good solution. If you like, think of each tasks as a tiny little scientific work (like a bachelor project (like a bachelor thesis)); they all need the same skills of scientific writing.

Exercise 1 – Analysis of Decision Tables (12/20 Points)

Consider the decision tables shown in Figure 1.

(i) Are decision tables "DT2" and "DT3" *complete*?
Which of these decision tables are complete *without* considering the conflict axiom? (2)

(ii) Are decision tables "DT2" and "DT3" *deterministic without* considering the conflict axiom? (2)

(iii) Do decision tables "DT1" and "DT2" have *useless rules without* considering the conflict axiom? (2)

(iv) Does decision table "DT1" have a *vacuous rule*? (2)

(v) Is decision table "DT3" *consistent* with respect to *conflicting actions*? (2)

(vi) Extending on Task (iii), which of the decision tables "DT1" and "DT2" have useless rules (now considering the conflict axiom)? (2)

Note: In the lecture we have not defined when a decision table has *useless rules considering the conflict axiom*. Write down the definition that you used.

Justify your answers with proofs or counterexamples.

Hint: Properties of Decision Tables are defined in terms of the DT semantics using propositional logic. Hence proof techniques from propositional logic, such as truth tables or the calculus of propositional logic, may apply.

DT1	**R1**	**R2**	**R3**	**R4**
C1	×	–	*	×
C2	–	×	–	*
C3	×	*	×	–
A1	×	–	×	–
A2	×	×	×	–
¬ [C1 ∧ ¬ C2 ∧ C3]				

(a) Decision table DT1.

DT2	**R1**	**R2**	**R3**
C1	*	*	×
C2	×	–	×
C3	–	*	×
A1	×	×	–
A2	–	–	–
¬ [C2 ∧ C3]			

(b) Decision table DT2.

DT3	**R1**	**R2**	**R3**	**R4**
C1	×	×	×	–
C2	–	*	×	*
C3	*	×	–	*
A1	×	–	–	×
A2	×	–	×	–
¬ [C1 ∧ ¬ C2 ∧ C3]				

Conflicting actions: A1 ↯ A2

(c) Decision table DT3.

Figure 1: Decision tables.

Exercise 2 – Creation of Decision Tables (8/20 Points)

Consider the following transcription of the interview with the customer who is looking for a software system to manage the lending management of a crowd-sourced book rental company.

- The company is in possession of a number of books. Some of them are owned by the company, and some are owned by clients.
- The business model is to lend the books to clients. If the book is owned by another client, this client receives 0,50 € per lending transaction.
- The current primary goal of the company is market growth in the number of clients. To be attractive for more clients, the secondary goal is to increase the number of books offered.
- Clients are classified into three different groups, based on the number of books they offer: *newcomer (0–5)*, *supporter (6–50)*, and *professional (>50)*.
- With each order, a *supporter* receives a 3 % discount, and a *professional* receives a 5 % discount.
- Clients can only borrow one book per transaction.
- Clients can buy a *premium* membership. Orders are distributed to premium members with priority. A premium membership costs 2 € per month.
- Clients are rated whenever they return a book with a new defect (e.g., a page is ripped out). Clients with a bad rating are not entitled to any discounts, even if they are premium members.
- After receiving three bad ratings, the client is not allowed to borrow new books anymore.
- The customer hopes to get a new client base among students. Hence every student receives an extra 5 % discount with the first five orders.
- Every book has a base price assigned, but this price may change (e.g., due to demands, promotional campaigns, etc.).

Here are two examples of a client dealing with the company:

· Charlotte is a student who owns 33 of the books possessed by the company. So far she does not have any bad ratings. She wants to borrow "Das Kapital" as her fifth book. Altogether, she should get a 3 % discount plus another 5 % discount on top.

· After one month, Charlotte has added another 20 books to the company's possession. Now she wants to borrow the book "La Peste" by Albert Camus. This time she should get a 5 % discount.

Formalise the informal requirements above on borrowing refusal and discount computation using a decision table (in the standard (i.e., not in the collecting) semantics).

(i) Create conditions and actions as necessary and make appropriate use of environment assumptions and conflict axioms. Specify the rules necessary to tell if a transaction must be refused, and, if not, to indicate the discount factor. (7)

(ii) Consider again the example with Charlotte from above. After another month, Charlotte has received two bad ratings. Now she wants to borrow "The mythical man-month."

What is the output according to your decision table in this case? (1)