

Solutions for Exercise sheet 3

Exercise 1 – Requirements Elicitation

i Explicitly different situations represented in the following questions.

ii

Question 1:

With 'The game' is there meant to be collected information about the game (and or it's mechanics) or about the application? Is the to-be-collected information supposed to reflect in-game status or general information like CPU-usage, RAM-usage, execution time or bandwidth?

Answer 1:

The collected statistics should be game-related. That is, the game should collect statistics about its behavior and mechanics. But we like your idea of displaying the ping and currently used bandwidth. Besides the in-game statistics, this should also be displayed.

Result 1:

Collect from within the game useful information for the player.

Question 2:

Is 'The game' supposed to save the collected information or is it okay to begin anew each start?

Answer 2:

That depends on the kind of statistics.

Result 2:

Save user-created situation data, but forget (on the long run) environmental information (such as ping, CPU load or other physically dependent unnecessary information).

Question 3:

Does 'displaying' mean that the statistics is somehow available for the player or might it only be supposed for developers through a (debug) console or the like? Display in what form, e.g. 'raw' data in a table or does it have to be a nice-looking graphic?

Answer 3:

The statistics should always be available for the player to view. Otherwise, collecting statistics doesn't make much sense. We are not interested in the development process. If the developers need to display some internal data for themselves, they very well may do that, but don't bother the player with that internal gibberish.

Result 3:

An interface for displaying statistics in a good-looking way to the player is required. This does not have to be centralized, but accessible and understandable.

Question 4:

Should the statistics differ in their topic, eg. should they be closely related or cover broader area? How many of them should relate to the player's individual activity, and how many different statistics are we (the developers) allowed to collect?

Answer 4:

You (the developers) must collect at least 5 different statistics. The statistics should be sensible and not too arbitrary. That is, the player should be able to retrieve information useful to him to evaluate his gameplay. Therefore, the "topic" or "broader area" depends on the type of game and the possibly collectible statistics.

Result 4:

The information collected should be of help for the user to evaluate his gameplay, or help him in some other sense. Depending on the game different values might be of interest.

Question 5:

The statistics could be saved as a chronological list of events which allows us to have a clear understanding of when and what things happened and provide easier support if the player experiences. Or we could save them in a tabularized way which would allow us to compare the different metrics. For player-related statistics we recommend the second option. Which option would you like us to implement?

Answer 5:

Yes, the first part is a good idea. What is being collected is dependent on the kind of statistics. This could, e.g. be a replay function where the player can review the entire game and evaluate his gameplay. The second one could also make sense if the collected statistics allow for displaying them in a tabular fashion. This could be overall time spent, built units, used resources, etc. Depending on what the game provides to collect. We like both ideas. Realize them both if it helps the player to understand the implications of the data for his game better.

Result 5:

Collecting gameplay information is mostly useful for the user and thus should be collected and (displayed in a nice fashion). Different ways of displaying them might be required depending on the type of statistics.

Before, those interpretations seemed all plausible:

Here are three different Interpretations of the sentence:

The game must collect and display at least 5 different statistics.

Interpretation 1:

The game collects statistics about the users progress and behaviour, and will make them available through either showing it in-game or through sharing it on facebook or other social media.

Interpretation 2:

There will be collected a lot of information about the behavior of the application, like memory usage or CPU-utilisation, effective multicore-usage or GPU-load and settings.

Interpretation for the Originality Challenge:

We consider, that the statistics to be collected is a questionnaire with several questions (at least 5), which have to be answered by every player. The questions should ask for how much the player liked the game and (maybe) some (private) information about him if he wants to share. Those statistics would then be send to the developers and might be displayed in a nice fashion for them (within their part of the game).

Exercise 2 – Analysis of Decision Tables

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(i) T is complete, when $F = \bigvee_{r \in T} F_{pre}(r)$

Table 1:

$$F(R_1) = C_1 \wedge \neg C_2 \wedge 1 = C_1 \wedge \neg C_2$$

$$F(R_2) = \neg C_1 \wedge 1 \wedge \neg C_3 = \neg C_1 \wedge \neg C_3$$

$$F(R_3) = 1 \wedge C_2 \wedge 1 = C_2$$

$C_1 C_2 C_3$	$\neg C_1 \wedge \neg C_3$	$C_1 \wedge \neg C_2$	f	$\neg(\neg C_1 \wedge \neg C_2)$
0 0 0	1	0	1	0
0 0 1	0	0	0	0
0 1 0	1	0	1	1
0 1 1	0	0	1	1
1 0 0	0	1	1	1
1 0 1	0	1	1	1
1 1 0	0	0	1	1
1 1 1	0	0	1	1

$$f = (C_1 \wedge \neg C_2) \vee (\neg C_1 \wedge \neg C_3) \vee C_2 \text{ - not a Tautology}$$

f without $\neg(\neg C_1 \wedge \neg C_2)$ is not complete,

but with $\neg(\neg C_1 \wedge \neg C_2)$ condition it is complete \Rightarrow

\Rightarrow Table 1 is complete.

Table 2.

$$F(R_1) = C_2$$

$$F(R_3) = \neg C_1 \wedge \neg C_2 \wedge \neg C_3$$

$$F(R_2) = \neg C_2 \wedge C_3$$

$$F(R_4) = C_1 \wedge \neg C_2 \wedge C_3$$

$f = C_2 \vee (\neg C_2 \wedge C_3) \vee (\neg C_1 \wedge \neg C_2 \wedge \neg C_3) \vee (C_1 \wedge \neg C_2 \wedge C_3)$ - is a tautology.

$C_1 C_2 C_3$	$\neg C_2 \wedge C_3$	$\neg C_1 \wedge \neg C_2 \wedge \neg C_3$	$C_1 \wedge \neg C_2 \wedge C_3$	f
0 0 0	0	1	0	1
0 0 1	1	0	0	1
0 1 0	0	0	0	1
0 1 1	0	0	0	1
1 0 0	0	0	1	1
1 0 1	1	0	0	1
1 1 0	0	0	0	1
1 1 1	0	0	0	1

Table 2 is complete

(ii) Deterministic: $\forall r_1 \neq r_2 \in T \models (F_{pre}(r_1) \wedge F_{pre}(r_2))$

Table 1: not deterministic, because:

$\models \neg (\neg C_1 \wedge C_3) \wedge C_2$ - not a tautology

Table 2:

R_1 and R_2 : $\models \neg (\neg C_2 \wedge \neg C_2 \wedge C_3)$ - Tautology

R_1 and R_3 : $\models \neg (C_2 \wedge \neg C_1 \wedge C_2 \wedge \neg C_3)$ - tautology

R_1 and R_4 : $\models \neg (C_2 \wedge \neg C_2 \wedge \neg C_3 \wedge C_1)$ - tautology

R_2 and R_3 : $\models \neg (\neg C_2 \wedge C_3 \wedge \neg C_1 \wedge \neg C_2 \wedge \neg C_3)$ - tautology

R_2 and R_4 : $\models \neg (\neg C_2 \wedge C_3 \wedge C_1 \wedge \neg C_2 \wedge \neg C_3)$ - tautology

R_3 and R_4 : $\models \neg (\neg C_1 \wedge \neg C_2 \wedge \neg C_3 \wedge C_1 \wedge \neg C_2 \wedge \neg C_3)$ - tautology

\Rightarrow Table 2 is deterministic

(iii) Is: Strictly speaking there are no useless rules

in Table 3, because according to the Def. a rule is useless if its premise is implied by another rule and if its effect is the same as another rule's effect. In Table 3 all the effects are different. But we assume that rule 1 never occurs and for that reason rule 1 is basically useless.

T2: No useless rules: no rules, that are implied by another and also no same actions.

(iv) Table 3 is consistent with respect to conflicting actions, because there are no rules, that are inconsistent with $\frac{1}{2}$.
 (no conflicting actions in its effect.)

Exercise 3 – Creation of Decision Tables

- i 1. For small packages, the shipping costs depend on the weight of the items in the shopping cart, there is a fixed price for the first 2kg and a variable fee for each additional kg:

Type	First kg.	Additional kg.
Metropolitan	3.00	1
Intermediate	5	1.5
Rural	10.00	2.5

2. The parcel shipping costs for the first kilogram and additional kilograms are given on the following table:

Type	First kg.	Additional kg.
Metropolitan	1.00	0.75
Intermediate	2.25	1.25
Rural	5.00	2.75

3. If the shipping address is in the same city as the online shop, a charge on delivery (COD) shipping option should be offered, for a fixed price of 10 Euro.

4. There is a special offer: For rural areas, small but heavy packages (volumetric weight less than 5kg but more than 5kg actual weight) pay the price of intermediate cities.

DT: Price calculations	r1 (1.1)	r2 (1.2)	r3 (1.3)	r4 (4)	r5 (3)	r6 (2.1)	r7 (2.2)	r8 (2.3)
effective weight \leq 5kg	x	x	x	x	*	-	-	-
effective weight $>$ 5kg	-	-	-	-	*	x	x	x
metropolitan	x	-	-	-	*	x	-	-
intermediate	-	x	-	-	*	-	x	-
rural	-	-	x	x	*	-	-	x
same city as shop	*	*	*	*	x	*	*	*
actual weight $>$ 5kg	*	*	-	x	*	*	*	*
display COD option	-	-	-	-	x	-	-	-
price calculation	3+w -1	2.25 +1.25w -1.25	5 +2.75w -2.75	2.25 +1.25w -1.25	-	1 +0.75w -0.75	2.25 +1.25w -1.25	5 +2.75w -2.75

conflict axioms:

The address is either metropolitan, intermediate or rural, so no other combination (e.g. *metropolitan* \wedge *rural*) cannot happen:

$$\varphi_{conf} = (\text{metropolitan} \oplus \text{rural} \oplus \text{intermediate}) \Leftrightarrow (c3 \oplus c4 \oplus c5)$$

The effective weight can be exclusively either less than or more than 5 kg:

$$\psi_{conf} = (c1 \wedge c2) \vee (c1 \wedge c2)$$

- ii shipping to the **rural** area Niederaichbach, (so **not in the same city** where the shop is located) with the dimensions 29.7cm × 21cm × 20cm and a weight of 6.25kg gives us an effective weight of 5,9896 kg (> **5 kg**) (a small package).
So we can only use the rule **r4**, which give us a price of $2.25 \cdot 1.25 \cdot 5.9896 - 1.25 \approx 8.49$
- iii The requirements for the text are not consistent/free from contradictions:
The points three and four would be in conflict with the ninth point if one does not assume that they are only valid for small packages.

The table is consistent because the interpreting function is a tautology, it has a rule for every possible combination of conditions:

$$\begin{aligned}
& c1 \wedge c2 \wedge c3 \wedge c4 \wedge c5 \wedge true \wedge true \\
& \vee c1 \wedge c2 \wedge c3 \wedge c4 \wedge c5 \wedge true \wedge true \\
& \vee c1 \wedge c2 \wedge c3 \wedge c4 \wedge c5 \wedge true \wedge c7 \\
& \vee c1 \wedge c2 \wedge c3 \wedge c4 \wedge c5 \wedge true \wedge c7 \\
& \vee c1 \wedge c2 \wedge c3 \wedge c4 \wedge c5 \wedge true \wedge true \\
& \vee c1 \wedge c2 \wedge c3 \wedge c4 \wedge c5 \wedge true \wedge true \\
& \vee c1 \wedge c2 \wedge c3 \wedge c4 \wedge c5 \wedge true \wedge true \\
& \vee true \wedge true \wedge true \wedge true \wedge true \wedge c6 \wedge true \\
& \vee (c3 \oplus c4 \oplus c5) \\
& \vee (c1 \wedge c2) \vee (c1 \wedge c2) \\
\\
& \Leftrightarrow c2 \wedge c3 \wedge c4 \wedge c5 \\
& \vee c2 \wedge c3 \wedge c4 \wedge c5 \\
& \vee c2 \wedge c3 \wedge c4 \wedge c5 \wedge c7 \\
& \vee c2 \wedge c3 \wedge c4 \wedge c5 \wedge c7 \\
& \vee c2 \wedge c3 \wedge c4 \wedge c5 \\
& \vee c2 \wedge c3 \wedge c4 \wedge c5 \\
& \vee c2 \wedge c3 \wedge c4 \wedge c5 \\
& \vee c6 \\
& \vee (c3 \oplus c4 \oplus c5) \\
& \vee (c1 \wedge c2) \vee (c1 \wedge c2)
\end{aligned}$$

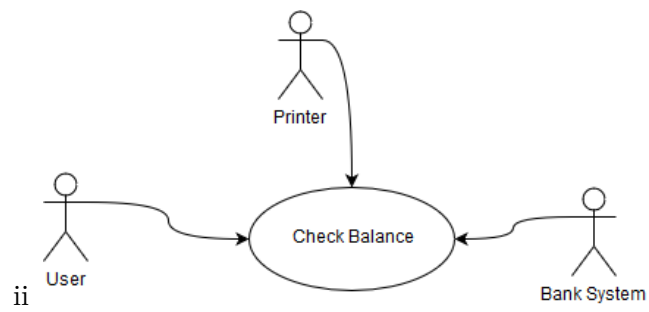
$$\begin{aligned}
&\Leftrightarrow c2 \wedge c3 \wedge c4 \wedge c5 \\
&\vee c2 \wedge c3 \wedge c4 \wedge c5 \\
&\vee c2 \wedge c3 \wedge c4 \wedge c5 \wedge \textit{true} \\
&\vee c2 \wedge c3 \wedge c4 \wedge c5 \\
&\vee c2 \wedge c3 \wedge c4 \wedge c5 \\
&\vee c2 \wedge c3 \wedge c4 \wedge c5 \\
&\vee c6 \\
&\vee (c3 \oplus c4 \oplus c5) \\
&\vee (c1 \wedge c2) \vee (c1 \wedge c2)
\end{aligned}$$

$$\begin{aligned}
&\Leftrightarrow c2 \wedge c3 \wedge c4 \wedge c5 \\
&\vee c2 \wedge c3 \wedge c4 \wedge c5 \\
&\vee c2 \wedge c3 \wedge c4 \wedge c5 \\
&\vee c2 \wedge c3 \wedge c4 \wedge c5 \\
&\vee c2 \wedge c3 \wedge c4 \wedge c5 \\
&\vee c2 \wedge c3 \wedge c4 \wedge c5 \\
&\vee c6 \\
&\vee (c3 \oplus c4 \oplus c5) \\
&\vee (c1 \wedge c2) \vee (c1 \wedge c2)
\end{aligned}$$

because of ψ_{confl} (and common sense) we can conclude that $c1 = c2$ and get rid of the first (or second) row in the table ($c1$ or $c2$ in the interpreting function). The third and the fourth line differ in only one variable, so can be reduced to one line without $c7$.

Exercise 4 – Use Cases

name	Chack Balance
goal	Show specific information about the latest transactions
pre-condition	User Authenticated, showing Main Menu, ATM is operational
post-condition	showing Main Menu, Maybe printed Summary
post-condition in exception-case	withholding/returning card and return to authentication screen
actors	client (main actor), bank system, printer
open questions	none
normal case	1. User Presses 'Balance'-Button 2. get balance-information from bank-system 3. ATM shows Balance-Summary screen 4. User presses confirm 5. returns to Main screen
normal case 2	1. User Presses 'Balance'-Button 2. get balance-information from bank-system 3. ATM shows balance-summary screen 4. User presses print-button 5. disable print-button 6. balance summary will be printed 7. Success-Message appears on screen 8. User pushes confirm button 9. returns to Main screen
exc. case 0a	User not responding for 30sec 0.1 withhold card 0.2 return to authentication screen
exc. case 0b	Weird sensory data 0b.1 withhold card 0b.2 return to authentication screen
exc. case 2a	No connection to bank system could be established 2a.1 show error message 2a.2 show Authentication screen 2a.3 return card
exc. case 6a	Printer cannot print 6a.1 Message about not workign printer appears on screen 6a.2 (continue with default point 8)



This use-case diagram only contains the use-case names and the actors.