

Softwaretechnik/Software Engineering

<http://swt.informatik.uni-freiburg.de/teaching/SS2019/swtv1>

Exercise Sheet 3

Early submission: Wednesday, 2019-06-05, 12:00 Regular submission: Thursday, 2019-06-06, 12:00

Exercise 1 – LSC Syntax

(6/20 Points)

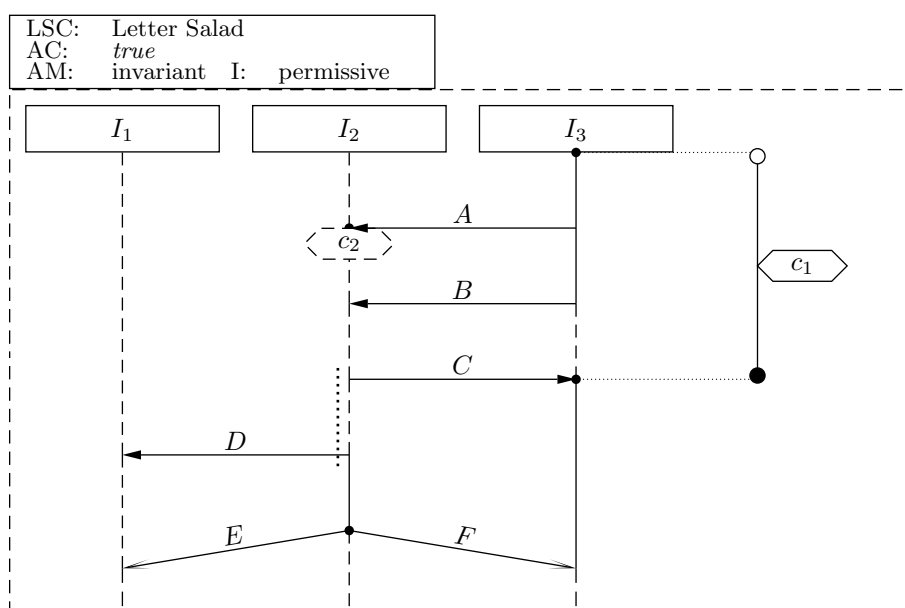


Figure 1: A Live Sequence Chart.

Consider the **abstract syntax** of the chart in Figure 1.

- (i) Provide the set of locations \mathcal{L} including their temperature (make sure to clearly indicate where in the diagram which of your locations occurs). (2)
- (ii) Give the partial order relation \preceq on the locations (only direct predecessors/successors need to be given; the full relation \preceq is then the transitive, reflexive closure). (2)
- (iii) Provide **one** example element from the simultaneity relation \sim , and **one** example element (including temperature) from each of the sets of messages Msg , local invariants LocInv , and conditions Cond . (2)

Use the formal notations from the lecture; you can indicate the temperature with colors.

Hint: Note that all locations in a coregion obtain the same temperature from the relevant instance line segment adjacent to the whole coregion.

Exercise 2 – LSC Semantics

(4/20 Points)

- (i) Compute the Büchi automaton for the body of the chart in Figure 1. (2)
- (ii) Give one example for a cold and one example for a hot cut, and one example for a fired-set of the chart. Provide the strictness conditions ψ_{strict} for one progress transition. (2)
- Prove that your three examples have the claimed property. (2)

Exercise 3 – LSC Acceptance

(3/20 Points)

- (i) Consider the following computation path π_1 .

$$\pi_1 \equiv \sigma_0 \xrightarrow{A_1^{I_3, I_2} \wedge A_7^{I_3, I_2}} \sigma_1 \xrightarrow{B_1^{I_2, I_3} \wedge B_7^{I_2, I_3}} \sigma_2 \xrightarrow{\tau} \sigma_3 \xrightarrow{\tau} \dots$$

where $\sigma_i \models c_1 \wedge \neg c_2$ for all $i \geq 0$.

Intuitively, the first event in the path is sending and receiving the message A . The second event is sending and receiving the message B . After that, no event happens ever again. During the whole computation path the condition c_1 holds and the condition c_2 is violated.

Is the path π_1 accepted by the chart or does it violate the chart? If it is accepted, does it take a legal exit or not? (1)

- (ii) Give two further **computation paths** π_2 and π_3 such that each of the following conditions is satisfied by one of the paths π_1 , π_2 , or π_3 :
- One of the paths violates the chart.
 - One of the paths is accepted and takes a legal exit.
 - One of the paths is accepted without taking a legal exit.

Use π_1 , π_2 , and π_3 to explain in your own words the intuition behind the concepts of acceptance with and without taking a ‘legal exit’, and of violation of a chart. (2)

Exercise 4 – Creating LSC

(5/20 Points)

Create **Live Sequence Charts (LSC)** to specify our requirement on the Ilias system that, in order to accept the system, it must be possible to submit via ‘Hand In’ before the set deadline has exceeded, and that it must be possible to mail the submission to the tutor after the deadline has exceeded. The situation is illustrated in Figure 3.

Available messages and conditions are shown in Figure 4. For simplicity assume that all messages are instantaneous.

For each LSC, give a brief description of the sequences that you want to cover with it, by writing down an example computation path. Also, give a brief description of how the LSCs together conform a more formal specification of the use case.

Exercise 5 – Use Cases and Use Case Diagrams

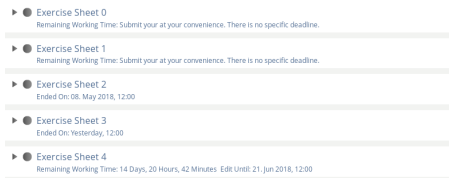
(2/20 Points)

Provide the *use case diagram* for the simple use case in Figure 2.

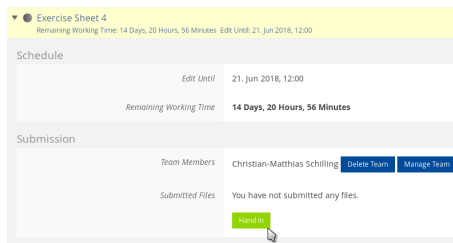
Hint: as usual, convince your tutor of the correctness of your solution.

name	exercise submission (preliminaries)
goal	exercise sheet solution uploaded
precondition	student navigated to exercise group screen in ILIAS
postcondition	student has submitted their solutions
actors	student (main actor), tutor
open questions	none
normal case	<ol style="list-style-type: none"> 1. student opens the current exercise sheet tab 2. Ilias shows ‘Hand In’ button 3. student clicks ‘Hand In’ button
exception case 1a	<p>submission deadline exceeded</p> <ol style="list-style-type: none"> 2a.1 Ilias does not show ‘Hand In’ button due to deadline 2a.2 student sends solutions to tutor via e-mail and explains why the submission is late

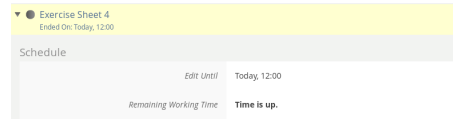
Figure 2: Example Use Case.



(a) Display before clicking on the tab “Exercise Sheet 4”.



(b) Display after clicking on the tab “Exercise Sheet 4”, within the deadline limit.



(c) Display after clicking on the tab “Exercise Sheet 4”, after the deadline expiration.

Figure 3: Ilias screen example for the “exercise submission (preliminaries)” use case.

Source	Destination	Message	Description
Student	Ilias	<i>open_tab</i>	click on exercise in the list of exercises
Ilias	Student	<i>show_submit_form</i>	display exercise screen with ‘Hand In’ button
Ilias	Student	<i>show_DL_info</i>	display exercise screen with deadline info only
Student	Ilias	<i>submit</i>	submit solution via ‘Hand In’
Student	Ilias	<i>mail_tutor</i>	mail submission to tutor

Condition	Description
<i>on_exercises_screen</i>	student is on ‘exercises’ screen in their Ilias group
<i>past_DL</i>	deadline exceeded; current system time is later than deadline

Figure 4: Messages and conditions that may be used for LSC creation.