

Oblig I: Modelling

In this compulsory exercise (Oblig I) you will be trained in modelling the structure and behaviour of processes and technology focusing particularly on interaction and communication. We have selected a case that should be easy to grasp without prior domain knowledge. In a later compulsory exercise (Oblig III) you will be asked to conduct a security risk assessment of the same case.

The description is underspecified, and there are many ways to do the tasks. This is intentional and reflects how things are in practise. You are free to make assumptions if they are stated explicitly by you in your solution-paper.

The solution-paper in the form of a single pdf-document should be sent to ketils@ifi.uio.no by midnight (24:00) September 25. You may work in groups of **maximum three students** or **you may work alone**. Hence, one solution may have up to three names. There should be no collaboration or copying **between different groups**. Hence, **each group should solve the exercise independently**.

You may use the tool of your preference. Some alternatives:

- <https://www.eclipse.org/papyrus/> (powerful but involves a lot to install and use)
- <https://app.diagrams.net/> (light weight)
- VISIO with UML stencil

PLEASE NOTE THE FOLLOWING REGULATIONS:

<https://www.uio.no/english/studies/examinations/compulsory-activities/mn-ifi-guidelines.html>

Sherlock Holmes service

In this compulsory exercise we consider a service for mind-reading based on short videos. It is called the “Sherlock Holmes service” due to the famous detective’s abilities in this respect. The following excerpt has been taken from “The Adventure of the Cardboard Box” demonstrates Sherlock’s abilities:

Finding that Holmes was too absorbed for conversation I had tossed aside the barren paper, and leaning back in my chair I fell into a brown study. Suddenly my companion’s voice broke in upon my thoughts:

“You are right, Watson,” said he. “It does seem a most preposterous way of settling a dispute.”

“Most preposterous!” I exclaimed, and then suddenly realizing how he had echoed the inmost thought of my soul, I sat up in my chair and stared at him in blank amazement.

“What is this, Holmes?” I cried. “This is beyond anything which I could have imagined.”

He laughed heartily at my perplexity.

“You remember,” he said, “that some little time ago when I read you the passage in one of Poe’s sketches in which a close reasoner follows the unspoken thoughts of his companion, you were

inclined to treat the matter as a mere tour-de-force of the author. On my remarking that I was constantly in the habit of doing the same thing you expressed incredulity."

"Oh, no!"

"Perhaps not with your tongue, my dear Watson, but certainly with your eyebrows. So when I saw you throw down your paper and enter upon a train of thought, I was very happy to have the opportunity of reading it off, and eventually of breaking into it, as a proof that I had been in rapport with you."

But I was still far from satisfied. "In the example which you read to me," said I, "the reasoner drew his conclusions from the actions of the man whom he observed. If I remember right, he stumbled over a heap of stones, looked up at the stars, and so on. But I have been seated quietly in my chair, and what clues can I have given you?"

"You do yourself an injustice. The features are given to man as the means by which he shall express his emotions, and yours are faithful servants."

"Do you mean to say that you read my train of thoughts from my features?"

"Your features and especially your eyes. Perhaps you cannot yourself recall how your reverie commenced?"

"No, I cannot."

"Then I will tell you. After throwing down your paper, which was the action which drew my attention to you, you sat for half a minute with a vacant expression. Then your eyes fixed themselves upon your newly framed picture of General Gordon, and I saw by the alteration in your face that a train of thought had been started. But it did not lead very far. Your eyes flashed across to the unframed portrait of Henry Ward Beecher which stands upon the top of your books. Then you glanced up at the wall, and of course your meaning was obvious. You were thinking that if the portrait were framed it would just cover that bare space and correspond with Gordon's picture over there."

"You have followed me wonderfully!" I exclaimed.

"So far I could hardly have gone astray. But now your thoughts went back to Beecher, and you looked hard across as if you were studying the character in his features. Then your eyes ceased to pucker, but you continued to look across, and your face was thoughtful. You were recalling the incidents of Beecher's career. I was well aware that you could not do this without thinking of the mission which he undertook on behalf of the North at the time of the Civil War, for I remember your expressing your passionate indignation at the way in which he was received by the more turbulent of our people. You felt so strongly about it that I knew you could not think of Beecher without thinking of that also. When a moment later I saw your eyes wander away from the picture, I suspected that your mind had now turned to the Civil War, and when I observed that your lips set, your eyes sparkled, and your hands clenched I was positive that you were indeed thinking of the gallantry which was shown by both sides in that desperate struggle. But then, again, your face grew sadder; you shook your head. You were dwelling upon the sadness and horror and useless waste of life. Your hand stole towards your own old wound and a smile quivered on your lips, which showed me that the ridiculous side of this method of settling international questions had forced itself upon your mind. At this point I agreed with you that it was preposterous and was glad to find that all my deductions had been correct."

"Absolutely!" said I. "And now that you have explained it, I confess that I am as amazed as before."

We cannot hope to mirror the abilities of the famous detective, but it is nevertheless possible to make some deductions. For example, most of us can deduce with some certainty whether a person we are observing is surprised, angry, depressed, etc. Assume that we have developed such a service with the help of deep learning and that we are now supposed to test it out in different kinds of situations. We will in the following focus on the use of this service to assist therapists in couples' therapy. We consider the case where we have a one video recorder, a therapist, a couple, and the service. The service performs emotion analysis on recorded video segments. The therapist has a controller that may steer the video recorder. During the conversation the therapist make short recordings that are inputted to the service to get a second opinion about what the individual partners (of the couple) really think. The partners are both sitting in front of the therapist. The controller directs the video recorder to switch its focus between partners during the session, controlled by the therapist.

Task I

Make a class-diagram describing the relevant concepts. The class-diagram should at least represent the following concepts: service, video recorder, therapist, partner-a, partner-b, controller (used amongst others to steer the recorder from one partner to the other). The class-diagram should contain the generalization relation and illustrate correct use of both composition and aggregation. All associations should be decorated with multiplicities.

Task II

Make one main sequence diagram describing a therapy session. There should at least be lifelines for therapist, service, controller, video recorder, partner-a and partner-b. The sequence diagram should illustrate correct use of at least referencing (the referenced sequence diagrams should also be specified in full), loop, lifeline creation and termination, and opt. The sequence diagram should also describe some negative behaviour. The sequence diagram should provide a basic representation of the interactions between the involved actors during a therapy session. Please avoid excessive complexity. The sequence diagram being made in this task will be used further in the next task.

Describe the first ten events of at least one positive trace represented by your sequence diagram.

Task III

Make a communicating state-machine that correctly reflects all the traces specified by the sequence diagram for the **controller lifeline**.

Make a communicating state-machine that correctly reflects all the traces specified by the sequence diagrams for the **therapist lifeline**.

The two state-machines must allow any positive trace allowed by the respective lifelines in the sequence diagrams but may have additional traces.

Remember that the machines should **communicate the messages specified** by the sequence diagrams. **Hence, for a lifeline, an input signal (output signal) in a state machine should be the reception (sending) of a message in the sequence diagram.**