

MTAT.03.083 – Systems Modelling

Homework 2 (HW2) - Interaction Modelling, Application Modelling, and Coding (20 points)

Due on 19.11.2018 at 23:59

complete the homework in groups of 2 students.

SUBMISSIONS:

One of the members of the group has to login and submit the assignment using the link “submit” on the course webpage. Please specify in a comment the members of the group.

You have to submit a single .zip file containing:

- A pdf with the documentation of your application that includes:
 1. domain model
 2. use cases (diagram and descriptions)
 3. sequence diagrams
 4. application model
- A folder with the source code of your application where a main class plays the role of Boundary class (similarly to what you have seen during the practice session: an example is available at <https://courses.cs.ut.ee/2018/SM/fall/uploads/Main/ExampleCode.zip>). The database behind the application has to be implemented using HSQLdb (see the tutorial available at <https://www.tutorialspoint.com/hsqldb/index.htm> and use a database called hospitaldb by specifying it into a server.properties file like the one available at <https://courses.cs.ut.ee/2018/SM/fall/uploads/Main/serverProperties.zip>). As shown in the example, the Boundary class should provide the possibility of resetting and initializing the database. This functionality has to be implemented in a DatabaseManager class: an example is available at <https://courses.cs.ut.ee/2018/SM/fall/uploads/Main/ExampleCode.zip>).

Grading criteria:

- Correct definition of use cases and sequence diagrams (in terms of correct use of the different elements and in terms of compatibility with the interfaces of the classes in the application: the role of each method defined in the interfaces of the classes should be clear from the use cases and sequence diagrams) (7 points)
- Use of the design patterns. ECB and DAO patterns must be used plus at least 1 of the patterns you saw during the lecture on Design Patterns (2 points)
- Correct definition of the application model and correct use of the methodology that from the domain model allows you to obtain the application model through interaction modeling (1 point)
- Code consistent with the documentation (6 points)
- The application passes a small test (4 points)

Hospital Information System

A hospital plans to develop an Information System to manage its oncological patients. This system will keep track of all the visits, therapies and surgeries of each oncological patient. All users should be able to register into the system by specifying username, password and role, and login with the registered username and password (stored in the database at registration time). The system should maintain the

personal data of the patients (name, surname, ID-code, date of birth) and the insurance code for all the patients who are registered at the national medical insurance, or a private insurance code for all the patients who are not covered by the national medical insurance. In the latter case, the name of the insurance company should also be specified. Each patient is univocally identified by her ID-code. The insurance code for patients who are registered at the national medical insurance is obtained as the concatenation of surname and ID-code. The hospital system maintains a list of oncologists characterized by name, surname, professional-ID, type of oncologist (Medical oncologist, Radiation oncologist, Surgical oncologist, Gynecologic oncologist, Pediatric oncologist, Hematologist-oncologist) and level of career (Medical Student, Physician Assistant, Fellow, Specialist). An administrative officer should be able to add a new oncologist and see the list of all the oncologists with their personal data.

A person who wants to become a patient of the hospital has to book a so called first visit that may be prescribed and booked only by an oncologist of the hospital. A visit can be prescribed by specialists and fellows only. The same doctor will book the first visit through the system.

During the check-in for the first visit, a new patient folder is opened by a receptionist, and the personal data of the patient are specified in the folder (name, surname, ID-code, date of birth) and the insurance code for all the patients who are registered at the national medical insurance (automatically generated), or the private insurance code and agency if the patient is not covered by the national medical insurance (inserted manually). The receptionist should be able to see the list of all the patients with their personal data. At the same time, but after the opening of the patient folder, the receptionist assigns a specialist oncologist to the patient (given by the head physician of the department and added to the patient folder), who will follow her case. The receptionist also specifies the date of the first visit in the patient folder. The first visit is always assigned to the reference specialist of the patient.

During the first visit, the doctor has to copy and add to the patient folder all the tests the patient did outside the hospital and that she brought with her at the visit (this is done by entering a catalogue code that will be used in the future to access all the documents of the patient). Secondly, the doctor has to write the patient anamnesis, which will be added to the catalogue (the upload of documents into the catalogue is under the responsibility of a separate system). Finally, after the evaluation of all the info collected during the first visit the doctor has to take a decision: (i) she asks for more clinical tests and/or (ii) she chooses a therapeutic treatment and/or (iii) she books a surgery.

- (i) The doctor has to book imaging and/or blood tests. The system should keep a calendar for the availability of imaging tests at the hospital (X-Ray, PET, TC, MRI). The doctor can specify a day and check the availability of spots for that day, and can book a free spot (for each booked spot the ID-code of the patient who booked it should be specified). Also, once the results of the imaging tests are ready, they are uploaded into the patient folder and the doctors can view and print both the written report of the tests and the images. Doctors can also book blood tests for their patients. Similarly to the imaging tests, the system should keep another calendar for the availability of blood tests at the hospital laboratory. The doctor can specify a day and check the availability of spots for that day, and can book a free spot (for each booked spot the ID-code of the patient who booked it should be specified). Also, once the results of the blood tests are ready, they are uploaded into the patient folder and the doctors can view and print the reports. For each type of imaging tests there are 20 time slots available per day. A test has a duration of 30 minutes and the tests are scheduled at the hour or 30 minutes past the hour between 9:00 and 19:00. Blood collections require 10 minutes and can be done between 9:00 and 11:00 every day (with time slots at 9:00, 9:10, 9:20 etc.).
- (ii) The doctor has to decide the therapeutic treatment (a.k.a. a therapy) to prescribe according to the patient's condition. A doctor can add a therapy for a patient into the

patient folder. A therapy specifies the medicine or the medicines that should be taken in a period of time. A medicine is characterized by a name, a pharmaceutical company, and it is univocally identified by a code. The system keeps a catalogue of all the medicines used in the hospital. A doctor can add a new medicine and see the list of all the medicines. Each medicine in a therapy should be taken following a specific posology (for simplicity here the posology is a number indicating the medicine units to be taken per day). The posology for taking a certain medicine is different for different therapies and the same medicine cannot be taken in the same therapy with different posologies. Different therapies for the same patient cannot overlap. The therapy can be taken at home or in the hospital (e.g., chemotherapy infusions). The hospital offers two types of hospital therapies: day hospital therapy and therapy with overnight hospitalization. The former is for therapies which last for one day, the latter is for therapies which last for more than one day and therefore the patient needs to stay at the hospital at least for one night. Each therapy (at home or in the hospital) should keep track of the day or the days when the patient is taking a certain medicine. In addition, the hospital has, for each day of the therapy calendar, a limited number of free places for both types of hospital therapies. In particular, in one day, the hospital can host twenty patients in total, but at most ten patients for therapy with overnight hospitalization. During the visit, the doctor has to book the schedule for a day hospital therapy, or for an overnight hospitalization. Booking the schedule means booking all the dates in which the patient will have to undertake the therapy from the first therapy-session to the last. The doctor can specify a day and check the availability of spots for that day (for each day, the doctor can retrieve the number of spots available for day hospital therapies and therapies with overnight hospitalization), and can book a free spot.

- (iii) It is possible that the patient needs a surgery. In this case, the doctor books a surgery by specifying a date and an available surgeon suitable for the surgery needed by the patient. The doctor can specify a day and a surgeon type and get the surgeons of that type available in that day. The hospital system contains a list of surgeons characterized by name, surname, professional-ID, type of surgeon (General, Pediatric, Cardiothoracic, Neurosurgery, Oral and Maxillofacial, Urology). An administrative officer should be able to add a new surgeon and see the list of all the surgeons with their personal data. From one week to five days before the surgery, the surgeon defines the team that carries out the operation (Medical Students, Physician Assistants, Fellows, or Specialists). A doctor can participate only in one operation per day and cannot do visits in that day.

Lastly, the doctor writes a report about the first visit and she books the follow-up visit (with an available oncologist). The doctor can specify a day and get the availability of oncologists for that day, and can book a free oncologist. During the follow-up visit, the doctor evaluates the conditions of the patient and the info collected in the patient folder and after the evaluation follows the same procedure as in the first visit: (i) she asks for more clinical tests and/or (ii) she chooses a therapeutic treatment and/or (iii) she books a surgery. Lastly, the doctor writes a report about the follow-up visit and she books the next follow-up visit.

A doctor can do ten visits per day. A visit has a duration of 30 minutes and the visits are scheduled at the hour or 30 minutes past the hour between 9:00 and 14:00. Each visit (first visit and follow-ups) should specify the visit date, the specialist who is following the patient, the doctor who did the visit (which must be necessarily a specialist or a fellow), possible clinical tests prescribed, possible therapies and/or surgery prescribed. A doctor should be able to retrieve all the information available in the patient folder. An administrative officer can delete a patient folder. When a patient folder is deleted the clinical tests, surgeries and therapies are also deleted.