FACULTY OF TECHNOLOGY, POLICY AND MANAGEMENT
ENGINEERING SYSTEM AND SERVICES SECTION
ICT TRACK

TB141 – ICT System Engineering and Rapid Prototyping Exam

Jacopo De Stefani - Marijn Janssen

18^{th} May 2022

Instructions

General remarks

- The exam lasts three hours and it is a closed book, computer exam in two parts :
  - **First part - UML Modeling**
    - **Points :** 10 pts
    - **Weight on the final grade :** 30%
  - **Second part - ICT System Engineering**
    - **Points :** 10 pts
    - **Weight on the final grade :** 40%
- The remaining 30% of final grade of the course is based on the (previously developed) summative assignment.
- Make sure to write your name, family name, student ID and faculty on **each** sheet you are going to hand in.

Disclaimer

All characters and other entities appearing in this work are fictitious. Any resemblance to real persons or other real-life entities is purely coincidental.

Part I - UML Modeling

Given your excellent performances in modeling the TUDelftToGo application, TUDelft would like to employ your expertise in modeling and designing the IT system related to a university canteen.

The considered canteen is composed of three zones : the kitchen, the service/free-flow area and the payment area.

The canteen employs different categories of workers : chefs, chef helpers and generic employees. Each employee works in exactly one zone and only the chefs and chef helpers can work in the kitchen area. Moreover, each kitchen is managed by at most one chef and can employ a maximum three chef helpers. Each employee (including chefs and helpers) is characterized by its name, family name, gender, birth date, id number and employment duration.

The kitchen is responsible for the preparation of the meals, which are then transferred in the service/free-flow area. Several types of meals are offered : vegetarian meal, vegan meal, fish-based meal and meal of the day. Each meal is characterized by a list of ingredients as well as their price. Each ingredient is characterized by the name, its preparation (cooked, fried or boiled) along with its quantities of carbohydrates, fats and proteins. Finally, the checkout area is responsible for the payment of the meals.

The process of purchasing a meal can be summarized as follows : The client starts the process by reaching the service area. If other people are already present, he/she joins the end of the queue and patiently waits for his/her turn. Once his/her turn has arrived, he/she communicates his/her choice to the employee responsible of the service. It might happen that the chosen dish has already been sold out. In this case, the client will be required to choose another dish. Optionally, the client can also decide to buy a drink or a dessert. In this case, he/she will ask the employee for the desired drink/dessert. The process is concluded by the payment of the meal by the client. The employee will then ask the client his campus card, in order to apply a status-based discount to the final amount.

We ask you to model the aforementioned ICT system using the UML modeling language. For each of the following questions, provide :

- The required UML diagram
- A brief text motivating the modeling choices you made and the additional modeling hypotheses you might have made.

Make sure to employ the appropriate notation for the requested diagram.

Question 1 (UML Class Diagram - 5 points)

Represent the entities that the application described in the previous text needs to manipulate using a `UML Class Diagram`. Make sure to include all the relevant attributes and methods in the appropriate parts of the diagram.

Question 2 (UML Sequence Diagram - 5 points)

Represent the meal payment process, including regular/exceptional flows, described in the previous text using a `UML Sequence Diagram`. Make sure to use the appropriate notation to distinguish between synchronous, asynchronous and response messages.

Part II - ICT System Engineering

Question 3 (Software engineering requirements - 2,5 points)

Present **user** and **system** requirements by providing :

- Their definition
- A practical example of a requirement belonging to that category.
- For each category, mention at least two different stakeholders that have an interest in it

Question 4 (Software development methodology - 2,5 points)

For a software development methodology **enabling re-use**, provide :

- A list describing the sequence of the different software development activities for the proposed process
- A brief description, for each activity in your solution, of the details of the operations performed within that step
- Advantages and disadvantages of the considered methodology

Question 5 (Programming languages - 2,5 points)

Discuss the difference between compiled and interpreted languages by answering to the following questions :

1. What is a programming language ?
2. How does an interpreter process code ?
3. How does a compiler process code ?
4. What are advantages and disadvantages of the two approaches ?

Question 6 (Computing Hardware and Architectures - 2,5 points)

Present the **Von-Neumann** hardware architecture introduced in the course by providing :

- Its description and its components.
- For each hardware component, a practical example (drawn from the course or your own experience)

Licensing