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

TB141 – ICT System Engineering and Rapid Prototyping Exam

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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.

Grading rubric

Category		0 pts	0.5 pts
Q1 - Modeling	Zones : Kitchen, Free-flow, Payment	Concept not modeled	Concept correctly modeled, according to text
	Kitchen		
	Workers : Chef, chef helpes and generic employees		
	Employee		
	Meal		
	Ingredient		

Category		0 pts	0.5 pts	1pts	1.5 pts	2pts
Q1 - UML Notation	**Usage of correct UML notation**	No UML standard notation is employed	Some notation is used, but mostly incorrect	Basic elements of UML are used, but still major flaws exists	Basic elements of UML are used but minor flaws still exist	Mastery of UML notation, basic and advanced elements correctly employed

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.

Grading rubric

Category		0 pts	0.5 pts	1pts	1.5 pts	2pts
Q2 - Modeling	Starting process	Concept not modeled	Concept correctly modeled, according to text			
	If other people, then queue					
	Communicating choice					
	If dish sold out, then choose again					
	Optional drink					
	Payment					
Q2 - UML Notation	Usage of correct UML notation	No UML standard notation is employed	Some notation is used, but mostly incorrect	Basic elements of UML are used, but still major flaws exists	Basic elements of UML are used but minor flaws still exist	Mastery of UML notation, basic and advanced elements correctly employed

Part II - ICT System Engineering

Question 3 (Software engineering requirements - 3 points)

Given the following case :

For the TUDelft-icius application, we would like to add a chat functionality in order to allow the users to directly interact with the shops on the platform. The functionality should allow both the users and the shop to send text messages, as well as images and recordings. The messages should be stored locally on the application and should be encrypted in order to ensure users and shops's privacy. Moreover, the user interface of the chat application should be accessible also to people having visual impariments. Finally, the data storage in the application should be GDPR (General Data Protection Regulation - EU norm) compliant.

- Provide a short definition for the different category of requirements (functional, non-functional, domain requirements).
- Provide a table, for each category of requirements, summarizing the classification of the different requirements in the text and the motivation behind your choices.
- For 3 requirements of your choice, describe which format (natural language, structured natural language, graphical notation, mathematical specification) you will be using for their specification.

Grading rubric

- Provide a short definition for the different category of requirements (functional, non-functional, domain requirements). - *1 pts (0,$\frac{1}{2}$,,1)*
- Provide a table, for each category of requirements, summarizing the classification of the different requirements in the text and the motivation behind your choices. - *1 pts (0,$\frac{1}{2}$,,1)*
- For 3 requirements of your choice, describe which format (natural language, structured natural language, graphical notation, mathematical specification) you will be using for their specification. - *1 pts (0,$\frac{1}{2}$,,1)*

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

For the **waterfall** software development methodology, 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

Grading rubric

- A list describing the sequence of the different software development activities for the proposed process - *0,5 pts (0,$\frac{1}{4}$,0,5)*
- A brief description, for each activity in your solution, of the details of the operations performed within that step - *1,5 pts (0,0.75,1,5)*
- Advantages and disadvantages of the considered methodology - *0,5 pts (0,$\frac{1}{4}$,0,5)*

Question 5 (Programming languages - 2,5 points)

1. What is a programming language ?
2. What is the difference between a compiled and an interpreted language ?
3. What is code quality ? Give the definition and an example of code quality in one of the languages presented during the lecture.

Grading rubric

1. What is a programming language? - *0,5 pts (0,$\frac{1}{4}$,0,5)*
2. What is the difference between a compiled and an interpreted language? - *1 pts (0,$\frac{1}{2}$,1)*
3. What is code quality? Give the definition and an example of code quality in one of the languages presented during the lecture. - *1 pts (0,$\frac{1}{2}$,1)*

Question 6 **(Computing Hardware and Architectures - 2 points)**

- What is a computer architecture?
- What is the difference between parallel and distributed computing? Provide an example from the course or from your own experience to support your answer.

Grading rubric

- What is a computer architecture? - *1 pts (0,$\frac{1}{2}$,1)*
- What is the difference between parallel and distributed computing? Provide an example from the course or from your own experience to support your answer. - *1 pts (0,$\frac{1}{2}$,1)*

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