

Delft University of Technology - Faculty of Technology, Policy and Management

Course name:	ICT System Engineering and Rapid Prototyping	Course code:	TB1411C
Date:	13/04/2022	Time:	09:00 – 12:00
Module manager: Marijn Janssen			
Examination questions: Number of open questions: 6 questions Number of multiple choice questions: 0 questions Max. number of points: 20 points <input type="checkbox"/> all questions have the same weight <input checked="" type="checkbox"/> the questions have different weights (indicated per question)			
Total number of pages (incl. cover page): 4 pages			
Use of tools and information sources: During the examination, the use of any <u>tools</u> or <u>information sources</u> (this includes mobile phones, smartphones or any devices with similar functions) is strictly forbidden <u>unless stated below</u> . Permitted tools and information sources: <input type="checkbox"/> books <input type="checkbox"/> notes <input type="checkbox"/> dictionaries <input type="checkbox"/> readers <input type="checkbox"/> formulae sheets <input type="checkbox"/> calculator <input type="checkbox"/> computer <input type="checkbox"/> ...			
Additional instructions: (optional) ...			
Final marking date: (the maximum marking period is 15 working days) 06/05/2022			
To be handed to the examiner or invigilator: <input checked="" type="checkbox"/> Examination work <u>with name and student number on each page</u> . <input type="checkbox"/> Examination documents			

Any suspicion of fraud or any breach of the exam rules will be immediately reported to the Board of Examiners

For more information about fraud:

TU Delft Student portal > TPM > Rules and Guidelines

TB141 – ICT System Engineering and Rapid Prototyping Exam

Jacopo De Stefani - Marijn Janssen

13th April 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

You are asked to develop an IT system to manage the publishing process in a university research center.

The research center is organized in research units. Each research unit is directed by a senior researcher and can employ up to ten junior researcher. For every researcher, the system should include their name, family name, ID, birth date, and date of the start of their employment. Both junior and senior researchers are allowed to file in funding and leave requests, but only senior researchers are allowed to sign research contracts. Each research unit can participate in one or more research projects, but only one research unit is responsible of the coordination of a project. Each project is characterized by its name, its domain and its budget. Within a research project, a researcher can publish one or more articles, each of them identified by their title, author list and list of keywords. An article could also be developed without any association to a project.

The publishing process is started by a researcher, which has a preliminary meeting with his supervisor (a senior researcher). After this meeting, the researcher defines an hypothesis and starts running the experiments to test his/her hypothesis. If the results are not satisfying, the researcher proceeds in adapting his hypothesis and running a new set of experiments, until a satisfying result is obtained. If the results of the experiment are satisfying, the researcher proceeds with writing the article. Once she/he wrote the article, the draft will be sent to his supervisor for proofreading and correction. The researcher will then proceed to integrate all the corrections, and submit the article to the desired journal.

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 publication 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 the different types of application requirements (and the related sub-categories, where applicable) including :

- The definition of the type of requirements
- A practical example of a requirement belonging to that category.

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

For the Waterfall software development process, provide :

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

Question 5 (Programming languages - 2,5 points)

The considered project (codename Bravo) requires the development of a personal health application integrating the medical data of the end-users living in the European Union. As such, the application needs to comply with strict regulations from both the EU and the different countries in which the application will be launched. Our consultants have realized a thorough design of the application through the UML formalism, resulting in a well-detailed specification of entities and relationships. Moreover, they have determined that the solution will consist of a large scale program, requiring several months to be developed, with strict requirements in terms of documentation. In addition, once developed, the system should remain operative for several years, so a specific focus needs to be made on the maintainability of the system.

We ask you to analyze the aforementioned project and determine the most appropriate programming language for the problem at hand among those presented during class.

Make sure to include in your solution :

- A list/table summarizing the programming language categories presented during the lectures. Make sure to include 2 examples of programming languages for each category.
- A list/table summarizing the programming paradigms presented during the lectures. Make sure to include 2 examples of programming languages for each category.
- **For the considered case**, a brief text (1-2 paragraphs maximum) motivating what is the most appropriate programming language category and paradigm for the considered problem.

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

Present the MVC software architecture presented during the course by providing :

- Its description.
- Its advantages and disadvantages.
- Its domain of application.
- A practical example of its implementation.



Licensing



Except where otherwise noted, this work is licensed by **Jacopo De Stefani** under a Creative Commons **CC-BY-NC-SA** license : <https://creativecommons.org/licenses/by-nc-sa/4.0/>

All images are all rights reserved, solely employed for educational use, and you must request permission from the copyright owner to use this material.