CONCORDIA UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING

SOEN 6481: SOFTWARE SYSTEMS REQUIREMENTS SPECIFICATION: SECTION CC
SUMMER 2019

PROJECT DESCRIPTION

1. INTRODUCTION

Let there be a **calculator** that computes the value of certain established **irrational numbers**. The purpose of the project is to carry out a number of **activities**, resulting in a set of **interrelated artifacts for the problem domain** of such a calculator. In the rest of the document, **`ETERNITY: NUMBERS`** stands for the name of both the project and the product, unless otherwise stated.

The work on **`ETERNITY: NUMBERS`** has been organized into a number of constraints that you need to observe during the project, and problems for which you need to provide solutions. In some cases, a problem has a note associated with it, which is meant to serve as a guide for scoping, understanding, and/or solving the problem. For the students to be able to track their progress there are **Progress (Visibility) Markers**. For the sake of identification, any communal work involving one or more members of your team has been highlighted by an underline.

This document is **subject to change** at any time. You are expected to adapt to the changes.

3. GENERAL

You are **encouraged** to use **collaboration patterns** in your interaction with the members of your team.

There will be a need for **proper technical writing** in several places throughout the duration of the project. Your writing must comply with an **authoritative source** on technical writing. It is important not to make claims that cannot be substantiated. Creativity is as important as correctness. (You can expect spelling errors, grammatical errors, lack of clarity, over-writing, colloquial writing, unconvincing arguments, poor organization, and poor formatting to be critical factors in marking.)

For any non-original work, your artifacts should have **citations (and corresponding references)** in a 'standard' format at appropriate places. It is important not to copy others' work verbatim (100% identical) or almost verbatim (90% identical) regardless of whether it is cited. (A work on the solution to any problem that is copied to any extent from anywhere is considered equivalent to a non-submission for that problem.)

CONSTRAINT 1. [0 MARKS]

Each of your artifacts must be placed in a **distributed version control system**. You are **encouraged** to use **Git** and its services, such as **GitHub** or **GitLab**, for hosting and issue tracking. For regularity, at least one of your artifacts should evolve non-trivially, as necessary, **at least once** a weekday (Monday to Friday).

Your artifacts should be **accessible** and their **state** should be **visible** at **all** times to the instructor and to the teaching assistants. You should submit the address of your workspace to all relevant parties **by set date** and include the address in your documentation. (A non-submission of your address by given deadline, or a non-visibility of your address for a notable period of time, will lead to an assignment of –10 marks.)

Progress (Visibility) Marker: July 05, 2019. An account on a DVCS has been set.

CONSTRAINT 2. [0 MARKS]

Your documentation must be typeset in LATEX report style. Your presentation must be typeset in LATEX beamer style (or powerdot style). Any mathematical expressions must be typeset in LATEX, and not included as images. Submit both `*.tex` and `*.pdf` of your documentation and your presentation. (A non-submission by given deadline, or a submission that either does not process, or a submission of documentation not in LATEX, or not in the LATEX report style, will lead to an assignment of –10 marks.)

Progress (Visibility) Marker: July 12, 2019. LATEX necessary for the project has been learned.

4. SPECIFIC

An **irrational number** is a real number that is not a rational number, that is, it is not possible to express an irrational number as a quotient of two integers.

You will be assigned an irrational number pseudo-randomly at an appropriate time. This number will be **unique across your team** and will be from the following list:

- N1: Champernowne Constant (C_{10})
- N2: Euler's Constant (e)
- N3: Gaussian Integral ($\sqrt{\pi}$)
- N4: Gelfond's Constant (e^{π})
- N5: Golden Ratio (φ)
- N6: Liouville Constant (c)
- N7: Natural Logarithm of 2 ($\ln_e(2)$)
- N8: Pi (π)
- N9: Silver Ratio (δ_S)
- N10: Universal Parabolic Constant (P_2)

(N1 – N10 are identifiers for the sake of reference.)

PROBLEM 1. [20 MARKS]

Give a brief description, not exceeding one page, of your number, including the characteristics that make it unique. To ensure that you have attained sufficient background, Test 1 will have a problem related to your number. (A non-submission by given deadline will lead to an assignment of –20 marks for this problem to you.)

Progress (Visibility) Marker: July 05, 2019. The number has been researched, read about, and understood.

PROBLEM 2. [20 MARKS]

Find a suitable interviewee. Rationalize briefly the choice of your interviewee. Prepare interview questions together and conduct an interview of a potential user of **ETERNITY: NUMBERS**. You could focus specifically on the possible uses of your number, by itself or as a result of carrying out certain mathematical operations on the number. Submit your interview questions, responses to the interview questions, and your analysis of the interview.

Collaborate with your team members to ensure that your interviewee is unique across the team. (A non-submission by given deadline will lead to an assignment of –20 marks for this problem to you. An identical interviewee will lead to an assignment of –20 marks for this problem to you.)

Progress (Visibility) Marker: July 12, 2019. The interview has been carried out.

PROBLEM 3. [20 MARKS]

Collaboratively brainstorm and mind map with your team members to decide a persona template. The persona template must be identical across the team. Create a persona based on your analysis of the interview. (A non-submission by given deadline will lead to an assignment of –20 marks for this problem to you. A non-identical persona template will lead to a deduction of 10 marks for this problem for you and for other members of your team.)

Progress (Visibility) Marker: July 19, 2019. Persona template has been agreed upon and persona has been described.

PROBLEM 4. [40 MARKS]

Elicit, decide, and describe each relevant concept for your **ETERNITY: NUMBERS**. Elicit, decide, and describe each relevant relationship between the concepts **ETERNITY: NUMBERS**. Using UML, construct a problem domain model for your **ETERNITY: NUMBERS**. (A non-submission by given deadline will lead to an assignment of –40 marks for this problem to you.)

NOTE

The concerns outside the scope of the **ETERNITY: NUMBERS** should be, if necessary, included as an abstraction and their details should be ignored subsequently.

Progress (Visibility) Marker: July 19, 2019. The problem domain model has been constructed.

PROBLEM 5. [50 MARKS]

Elicit, decide, and describe each use case of the **ETERNITY: NUMBERS**. Using UML, construct **two different views** of a use case model. You could focus specifically on the possible uses of your number, by itself or as a result of carrying out certain mathematical operations on the number. Furthermore, using UML, express the **normal scenario** of each use case in **ETERNITY: NUMBERS**. (A non-submission by given deadline will lead to an assignment of –50 marks for this problem to you.)

NOTE

The behavioral concerns internal to the **ETERNITY: NUMBERS** should be ignored.

Progress (Visibility) Marker: July 19, 2019. The use case model has been constructed.

PROBLEM 6. [60 MARKS]

For your persona, elicit, decide, and create a set of user stories for your **ETERNITY: NUMBERS**. The constraints can be either local (that is, on a single user story) or global (that is, on multiple user stories).

The constraints must, as appropriate, highlight for your **ETERNITY: NUMBERS**-related product quality concerns. For example, such constraints could be **maintainability-specific and/or usability-specific**.

Each user story must be associated with a **priority**, **estimate (in story points)**, as well as with one or more **acceptance tests**. Each user story must be **identifiable, atomic, consistent (with respect to other user stories), implementable, validatable, and verifiable**. Each user story must also aim to **minimize the potential for ambiguity and indeterminacy**. (A non-submission by given deadline will lead to an assignment of –60 marks for this problem to you.)

Progress (Visibility) Marker: July 26, 2019. The user stories are created.

PROBLEM 7. [10 MARKS]

Create a **backward traceability matrix** for your **`ETERNITY: NUMBERS`**. This traceability matrix must have at least two columns, one for each user story, and the other for one or more sources from which the user story was elicited.

For a given user story, a 'source' could be another user story, one of the other artifacts of **`ETERNITY: NUMBERS`**, a person, or some literature, preferably reachable via the Internet. (A non-submission by given deadline will lead to an assignment of –10 marks for this problem to you.)

Progress (Visibility) Marker: July 26, 2019. The user stories are traced.

PROBLEM 8. [50 MARKS]

Implement the user stories assigned to you from **scratch** in Java. The user stories assigned to you will be a **subset** of the user stories submitted by you. The term "scratch" means that, apart from the numbers related to input, output, and arithmetic, your implementation is **prohibited** from using any built-in numbers provided by Java.

Submit your source code (`*.java` files), data files, if any, and the executable (`*.jar`). (A non-submission by given deadline, or a submission that either does not compile or does not execute, will lead to an assignment of –50 marks for this problem to you.)

Progress (Visibility) Marker: August 02, 2019. The user stories are implemented.

PROBLEM 9. [30 MARKS]

Give a presentation of your **retrospective**. Present any critical decisions made during the project, and explain briefly why those decisions were critical. Present any lessons learnt by doing the project, especially those from reviewing and testing by your team member. Your ability to provide convincing answers to questions will be a critical factor in marking. (A non-attendance will lead to an assignment of –30 marks for this problem to you.)