

# ETERNITY

## 1. INTRODUCTION

Instead of learning big methodologies [...] focus on practices. [...] You can become an expert in a practice without being an expert in a complete methodology.

— Ivar Jacobson

This is a medium-sized **scientific software engineering project** with the following characteristics: it is to be pursued from **first principles**; it includes certain elements of **agile methodologies and DevOps**; it consists of a number of **activities** resulting in a number of **artifacts**; it treats **styling, versioning, hosting, testing, documenting, and communicating** as **primary concerns**, while **technologies and tools** as **secondary concerns**; and it involves **individual work** only.

It is common for **software for scientific computing** to carry out **numerical or symbolic calculations**. For example, a sophisticated, state-of-the-art, **scientific calculator** is such software. Furthermore, it is conceivable for a scientific calculator to have support for a number of things, including certain transcendental functions.

A **transcendental function** is a function that does not satisfy any single-variable polynomial equation whose coefficients are themselves roots of polynomials. For example,  $\sin(x)$  is a transcendental function, but  $\sqrt{x}$  is not.

You will be assigned a transcendental function pseudo-randomly at an appropriate time. This transcendental function will be from the following list:

- F1:  $\arccos(x)$
- F2:  $\tan(x)$
- F3:  $\sinh(x)$
- F4:  $\Gamma(x)$
- F5:  $ab^x$
- F6:  $B(x, y)$
- F7:  $x^y$
- F8:  $\sigma$

(F1 – F8 are identifiers for the sake of reference.) In the foregoing,  $x$  and  $y$  are real variables, and  $a$  and  $b$  are real constants, unless otherwise stated.

The project has three interrelated deliverables, namely D1, D2, and D3, each which is divided into a number of problems.

The project progresses **nonlinearly (specifically, iteratively and incrementally)**. In particular, the problems in later deliverables depend on the problems in earlier deliverables.

In the rest of the document, “must” means mandatory and “encouraged” means optional.

D1, D2, and D3 must use the **Microsoft PowerPoint template** provided.

All non-original work (that is, any work external to the work by you) in D1, D2, and D3 must be **cited and referenced appropriately**. This includes the use of any **generative artificial intelligence (GAI)** tools. A comprehensive collection of resources on citing and referencing is available<sup>1</sup>.

It is important that all expression in any form be **evidence-based**, and **not to make claims that cannot be substantiated**. Furthermore, it is important **not to copy others’ work verbatim** regardless of whether it is cited. A copy could be **syntactic or semantic**. A copied work does not receive any credit, as the credit goes to the original, not to its copy.

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<sup>1</sup> URL: <http://library.concordia.ca/help/howto/citations.html> .

## 2. DELIVERABLE 1 (D1)

This involves preparing slides to be presented and demonstration to be given on Zoom.

The students are expected to have their audio and video on during their session.

### PROBLEM 1. [30 MARKS]

**Express requirements** of your function based on one of the **styles** and **guidelines** given in the **ISO/IEC/IEEE 29148** Standard. Associate **each** requirement with a unique **identifier**. Make any assumptions **explicit**.

You are **encouraged** to use a tool for managing requirements, such as **Atlassian Jira**.

### PROBLEM 2. [50 MARKS]

**Implement your function** in Java. Your implementation **must** have a **textual user interface** for input and output.

Problem 2 must be informed by Problem 1.