

# COSC 3P93

## Project – Step 1

**Due date:** September 19<sup>th</sup>, 2025 at 23:59 (11:59pm)

**Delivery method:** the student must deliver the assignment only through BrightSpace.

**Delivery contents:** document with answers and codes if applicable (see [Submission instructions](#)).

**Attention:** check the [Late Assignment Policy](#).

### Project Overview

This project is intended for students to apply design patterns, as well as strategies, for parallel systems in a sequential solution. The patterns and strategies applied in the project for the design and implementation are the ones covered in classes and course reading materials. The final output of the project is a performance comparison between a sequential program and its respective parallel design. For both programs, students will have to write the codes themselves, as well as define performance analysis parameters and metrics for the comparative analysis. It is strongly recommended that the implementation language in this project be either C or C++. Mostly likely, students will need to familiarize with Linux/Unix systems, as well as bash command line, to compile, debug, and run their code. For each of the project steps, the students are expected to employ the concepts learned in class properly and report them in the document submitted together with their code.

### Step 1 - Description

The first step of the project is basically setting up groups and topics of the project.

### Step 1 - Specifics

The student will have to pair up with another student and explicitly list the two members of the group in the submission document of this step. Both students, members of the group, need to submit this step 1 document. There are no mark penalties for late assignment delivery, but students are strongly encouraged to submit their step 1 before the deadline. Together with the group members, the students must explicitly write the topic of their project. Each topic contains sub-topics; students may be able to indicate a sub-topic together with their topic. Sub-topics not necessarily need to be selected at this *Step 1*, but they students may mention them to indicate their preference for the future work to be done in *Step 2*. Please note that indicating a sub-topic does not guarantee that the group will work on it in case there are too many groups mentioning the same sub-topic. The topic must be chosen from the list below:

- **Machine learning / AI**
  - Genetic Algorithms
  - Artificial Neural Networks (Supervised learning)
  - k-nearest Neighbours Algorithm (Supervised learning)
  - DBScan - classification (Supervised learning)
  - Deep Convolutional Neural Networks (Deep learning)
  - Deep Recurrent Neural Networks (Deep learning)
  - Random Forests / Decision Trees
  - Gradient Descent optimization for large datasets
  - Transformer-based models (simplified version, e.g., attention mechanism parallelization)
- **Optimization**
  - Monte Carlo Method
  - Simulated Annealing

- Combinatorial Optimization
- Linear Programming
- Genetic Programming for optimization
- Parallel Branch-and-Bound
- **Graphics / Visualization**
  - Rendering of Multiple Depth Images
  - Rendering of triangle meshes
  - Ray Tracing (basic parallel implementation)
  - Image Convolution and Filtering
  - Fractal Generation (e.g., Mandelbrot set)
- **Coding / Cryptography**
  - Linear Network coding
  - AES encryption algorithm
  - RSA or ECC cryptography
  - Parallel Hashing (SHA variants, MD5)
  - Reed-Solomon or LDPC coding
- **Scientific Computing / Data Processing**
  - Matrix Multiplication and Linear Algebra kernels (BLAS-like)
  - Fast Fourier Transform (FFT)
  - Sorting Algorithms (Parallel Merge Sort, QuickSort)
  - Graph Processing (PageRank, BFS/DFS on large graphs)
  - Parallel File Compression/Decompression

## Submission

The submission for this assignment will consist of two parts:

(A) An **Project group+topic document (PDF) - a must**. A document that just lists the name of the students that compose the group and the topic that the group chooses for its project. Keep the information listed in it clear and succinct, such as the following:

- Group members: Student A (StudentID A), Student B (StudentID B)
- Topic: selected topic
- Sub-topic: preference of sub-topic

The document must follow the provided Latex template:

- **Latex template - a must for writing your description document**. Use the Latex template enclosed in this assignment (update it accordingly!). Students do not need to install Latex software on their computers. Students can write it through Overleaf on their browser (it is a free tool). Just upload the latex template to an Overleaf project; it should compile/render the tex file gracefully.

\* **Do not forget to include the names and student IDs of group members.**

\*\* **Only one student needs to submit the assignment on behalf of a group.**

## Marking Scheme

Marks will be awarded for guaranteeing that this step is complete. Also, failing to arrange groups before the “extended” (final) deadline will indicate that the student has chosen to conduct the project alone. Groups cannot be made nor changed after the extended deadline unless there is a convincing reason for the delay.

**Submission**

The submission is expected to contain only a word processed document. The document must be in PDF format and must follow the layout of the attached Latex template.

The document should be submitted through BrightSpace.

**Late Assignment Policy**

There is no late submission policy. No late submission are allowed.

**Plagiarism**

Students are expected respect academic integrity and deliver evaluation materials that are only produced by themselves. Any copy of content, text or code, from other students, books, web, or any other source is not tolerated. Similarity checking tools (Turnitin) will be used on submitted materials. If there is any indication that an activity contains any part copied from any source, a case will be open and brought to a plagiarism committee's attention. In case plagiarism is determined, the activity will be cancelled, and the author(s) will be subject to the university regulations.

For further information on this sensitive subject, please refer to the document below:

<https://brocku.ca/academic-integrity/>