# **Optimization in High-Performance Computing**

## **Overview:**

This assignment is divided into two parts and focuses on data structure optimization in the context of high-performance computing (HPC). You will first conduct an examination of the study to assess the optimization techniques used in HPC. Following this, you will implement a small project demonstrating one of the optimization techniques discussed in the study. Additionally, you will prepare a PowerPoint presentation summarizing your findings.

## **Part 1: Optimization Technique and Implementation Project Report**

### **Objective:**

Assess the optimization techniques and implement a small-scale project demonstrating one of the optimization techniques discussed in the empirical research study.

### **Instructions:**

For this assignment, use the empirical research study presented in the instructions to discuss the impact of optimization techniques for data structures in HPC.

Select one of the optimization techniques discussed in the empirical research that you find particularly interesting or impactful. Justify your choice based on its relevance and potential for improving data structure performance in HPC. You will discuss the strengths and weaknesses of the optimization technique of your choice, especially in data structure optimization, and how it can be used in Python (or another suitable programming language) to write performance-efficient code.

As part of your selection, you will implement a small prototype in Python (or another suitable programming language) that demonstrates the chosen optimization technique. The implementation should be simple yet effective in showcasing the benefits of the optimization. You will discuss the problems you encountered, how the technique was applied, and the observed performance improvements. In your lessons learned, show the difference between the problem's optimization version and the empirical study's theoretical expectations.

**Use information found at** [An Empirical Study of High Performance Computing (HPC) Performance Bugs](https://foyzulhassan.github.io/files/MSR23_HPC.pdf)

Prepare a report to address all assignment aspects with supporting diagrams and illustrations.  This report should contain no less than 6 pages of content, including an implementation analysis. You need to include outside sources and properly cite and reference your sources.  You must have at least 6 references, 3 of which must be scholarly peer-reviewed articles.  In addition to the six (6) pages of content, you will want a title page and a reference sheet.  This report needs to be in proper APA 7 edition format.

Finally, in addition to the Project Report submission, you will include a well-documented source code for the implementation with screenshots in an MS Word document to be uploaded to Blackboard with your source code link from your GitHub repository.

### **Part 2:**

Perform a 10-minute PowerPoint presentation of Part 2. This presentation must include a minimum of 5 slides in addition to the title slide and the reference slide. Audio/video narration of each slide is required