BAHRIA UNIVERSITY

Islamabad Campus

Department of Computer Science

Parallel and Distributed Computing — BSCS-7A, Spring 2024

Assignment # 1 — Due on: 28th Feb, 2024

Serial vs. Multithreaded Applications

Solving a System of Linear Equations

Linear systems are the basis and a fundamental part of linear algebra, a subject used in most modern mathematics. Computational algorithms for finding the solutions are an important part of numerical linear algebra, and play a prominent role in engineering, physics, chemistry, computer science, and economics.
A general system of *m* linear equations with *n* unknowns and coefficients can be written as:

$$\begin{cases} a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n = b_1 \\ a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n = b_2 \\ \vdots \\ a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n = b_m, \end{cases}$$

where $x_1, x_2, \ldots, x_n$ are the unknowns, $a_{11}, a_{12}, \ldots, a_{mn}$ are the coefficients of the system, and $b_1, b_2, \ldots, b_m$ are the constant terms.

There are several algorithms for solving a system of linear equations, for more information please see the following article: https://www.baeldung.com/cs/solving-system-linear-equations

- Select an **efficient** algorithm to solve a system of linear equations with n unknowns which can be **parallelized** (i.e. can be decomposed into independent parts).

- Implement the selected algorithm as a C# application using following three program design techniques:

  a) **Serial (single threaded) application**
  b) **Multithreaded application (using Thread objects)**
  c) **Multithreaded application (using a ThreadPool)**

- Compute the **execution time** of these three applications using a *data file containing at least 10 linear systems of different sizes*.
  (Hint: Stopwatch class can be used to log execution time).

- Prepare a **comparison table** to compare the performance of these three techniques.

- **Conclude** your findings by ranking these three techniques in terms of their efficiency.

Submission:

Please submit a report containing Problem Statement, Objective, Source Code, Data File, Sample Program Outputs and Conclusion.

Please Note:

- Program should be **well designed** 😊
- This is a **group** assignment, only **two** members per group allowed 😊 😊
- **Zero tolerance for Source code plagiarism/generation from ANY source** 😡
- The report should be submitted via BU LMS individually by both the members.