CSC 413/513 Course Programming Project

Inversion Count by Divide-and-Conquer

Inversion Count for an array indicates – how far (or close) the array is from being sorted. If array is already sorted then inversion count is 0. If array is sorted in reverse order, then inversion count is the maximum. Formally speaking, two elements $a[i]$ and $a[j]$ form an inversion if $a[i] > a[j]$ and $i < j$. **Example:** The sequence 2, 4, 1, 3, 5 has three inversions (2, 1), (4, 1), (4, 3).

Project Description: the file "IntegerArray.txt" included in this project folder contains all the 100,000 integers between 1 and 100,000 (inclusive) in some order, with no integer repeated. Your task is to compute the number of inversions in the file given, where the *i-th* row of the file indicates the *i-th* entry of an array. Because of the large size of this array, you should implement a **divide-and-conquer** algorithm.

Grade: 100 marks in total, while it accounts for **25%** of the final grade.

Due time: March 29, 2023, 11:59 PM

Type: Independent work

Programming language: C/C++, Java, Python, or any other advanced programming languages

Submission:

1. **Venue: Canvas**.
2. **Contents:**
   (1) **Code**. Please add necessary comments to the code to help me understand and grade your program.
   (2) **Running instruction and results**. Please provide a Readme.txt file to list the steps to compile and run your program, including the software environment. It is also REQUIRED to provide your running time and running result (a sorted array saved in a file) by including the relevant **screenshots/files** in a **"Result"** folder.
   (3) **Project report**. Each student is required to submit a project report including at least the following items: **abstract**, **problem description**, **algorithm (pseudocode)**, **implementation details**, **running results and analysis**, **conclusions on what you have learned in the project**, and **references** (if applicable, also explicitly cite them in your project report).

Please **zip** all the above documents into one package and name it as "**Your_Last_Name_ Your_First_Name.zip**". The upload page will be closed after the due date, so please upload your assignment before the deadline. You may submit your assignments several times before the deadline. No email submission is accepted.

(Possible) Project Presentation: According to the Canvas grading outcome, some students will be notified for a presentation (5~15 minutes including Q&A according to need) during our

Zoom-based office hours to further clarify project details. Selected students will be notified at least one week prior to his/her presentation. Then, your presentation outcome will be used as a ratio (range: 0.0~1.0) to multiply the score you have obtained purely obtained based on your Canvas submission to generate your final course project score. That is,

Final Course Project Score = **Presentation quality ratio** * **Canvas submission grading score**.