Bahçeşehir Cyprus University
Faculty of Architecture and Engineering
Computer Engineering Department

CMP6001 – Advanced Algorithm Design Techniques
Project - 1

Date: 07.10.2023

Report Submission Due: 16.12.2024 at 09:00
Presentation Date: 16.12.2024 at 17:00

Submission: Upload your Assignment as a Report to OIS (http://ois.baucyprus.edu.tr).

- This project is about time complexity analysis of sorting algorithms. Therefore, this project aims to implement sorting algorithms to measure their time complexity using empirical analysis. Each sorting algorithm's time complexity is defined using asymptotic notations. So, after implementing the experimental setup and measuring the time complexity of each algorithm empirically, it is beneficial to compare the findings with the theoretical complexity in order to analyse their complexity and determine the efficient algorithm.

- This study aims to enable students to apply their knowledge of analysis of algorithms to measure the time complexity of sorting algorithms using empirical analysis. Implementing several sorting algorithms will help students understand the strengths and weaknesses of different algorithms from the analysis and design of algorithms perspective. Additionally, they will know algorithm types and their suitability for various problem domains; by understanding this, students can choose the correct algorithm types and design efficient solutions for sorting problems. Also, comparing empirical findings with mathematical analysis will enable students to investigate complexity problems from two different approaches, and while understanding their advantages and disadvantages, they will see how these support each other. Finally, using scientific writing to present the study's findings will contribute to students writing and communication skills.

- This term project requires a short communication format to report your findings. The paper should comprise a maximum of 4 single-column pages with a font size of 10 points. The paper outline is given below.

- Experimental Setup:

Implement the Selection Sort, Bubble Sort, Insertion Sort, MergeSort, and QuickSort algorithms using any programming language you prefer, and then compare their time efficiencies using an empirical analysis approach for an array with N positive integer values between 1 and 1000. For the size of the array N, define 10^2, 10^3, and 10^4 to investigate the order of growth for each algorithm. Please note that arrays must be populated randomly with the values in the mentioned range.

- Paper Outline:
  - Title
  - Abstract (200 – 250 words)
  - Introduction
  - Materials and Methods
    - Sorting Algorithms
    - Experimental Setup
  - Results and Discussion
    - Empirical Analysis Results
    - Discussion of findings using Mathematical Analysis
  - Conclusion

Please note that *any sort of cheating and/or plagiarism, reports written by generative AI, and duplicated/copied reports/codes/results will be punished by failure from the course. In addition, the project due date is **strict**. Late submissions will not be accepted.*

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