

# Assignment 1: Analyzing sorting algorithms in real-world scenarios

CSE 373: Design and Analysis of Algorithms

Spring 2023

Section: 1, 2

Deadline: 17 May 2024

Total Marks: 50

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**Mark Distribution:** You will be marked on three categories:

- Implementation – 20 marks
- Experimental analysis – 20 marks
- Discussion – 10 marks

**Objective:** To analyze, implement, and compare the efficiency of various sorting algorithms in real-world scenarios.

**Introduction:** Sorting is a fundamental operation in computer science, with numerous applications in various domains. In this assignment, you will explore the performance of different sorting algorithms: Insertion Sort, Merge Sort, Heapsort, and Quicksort. You will analyze their time complexity, space complexity, and suitability for different scenarios.

**Scenario:** You are hired as a software engineer at a logistics company that needs to optimize its package sorting system. The company receives thousands of packages daily, each with different weights, sizes, and delivery destinations. Your task is to design and implement an efficient sorting algorithm to streamline the package sorting process.

## Assignment Tasks:

### 1. Implementation:

- Implement Insertion Sort, Merge Sort, Heapsort, and Quicksort in your preferred programming language.
- Ensure that your implementations correctly sort a randomly generated array of integers.

### 2. Experimental Analysis:

- Generate random datasets representing packages with varying sizes (e.g., weights or volumes).
- Sort each dataset using all four algorithms.
- Measure and record the execution time of each algorithm for different dataset sizes.

- Plot graphs illustrating the relationship between dataset size and execution time for each algorithm.

### 3. Discussion:

- Analyze the experimental results and compare the performance of the sorting algorithms.
- Discuss which algorithm(s) would be most suitable for sorting packages in the logistics company's scenario.
- Justify your choice(s) based on the analysis of time complexity, space complexity, and experimental results.

**Deliverables:** You should upload the assignment (pdf file) via canvas. Your code should be well documented and should be in the pdf file.