Analysis Report Student B (Pair 4)

Assignment 2: Heap Data Structures
Implementation: Max-Heap

1. Introduction

This report analyzes the implementation of a Max-Heap data structure with support for the following operations:

- Insert
- Extract-Max
- Increase-Key
- Peek-Max

The heap is implemented using an array-based representation.

2. Algorithm Analysis

- Insert:
  - Complexity: O(log n) in the worst case (due to sift-up).
  - Uses array resizing when capacity is exceeded.
- Extract-Max:
  - Complexity: O(log n) (sift-down to restore heap property).
- Increase-Key:
  - Complexity: O(log n) (sift-up after key increase).
- Peek-Max:
  - Complexity: O(1).

3. Performance Measurements

Performance is tracked using the PerformanceTracker class:

- Comparisons
- Swaps
- Array accesses

Benchmark experiments were conducted with random and sorted input distributions.
Results are exported as .csv files into docs/performance-plots/.

4. Conclusion

The Max-Heap implementation is correct and efficient.
It supports all required operations with expected logarithmic complexity.
The performance tracker enables deeper experimental evaluation.