Assignment 2 — Report (Partner Algorithm)

Author: Myssyrgaliyev Mirzhan

Group:SE-2414

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# 1. Goal

The goal of this report is to analyze the performance of my partner's sorting algorithm by measuring key performance metrics: number of comparisons, swaps, and array accesses.

# 2. Algorithm Description

The analyzed algorithm is provided by my partner. It implements a sorting strategy that was instrumented to record performance metrics during execution. The metrics collected were: comparisons, swaps, and array accesses. These values allow empirical verification of the theoretical complexity of the algorithm.

# 3. Complexity Analysis

- Worst-case complexity: O(n log n) or O(n^2) depending on algorithm specifics.  
- Best-case complexity: close to O(n) if data is already sorted.  
- Space complexity: depends on algorithm (e.g., O(1) for in-place, O(n) for merges).

# 4. Results

The following table summarizes the results recorded during runs of the partner algorithm:

|  |  |  |  |
| --- | --- | --- | --- |
| Case | Comparisons | Swaps | Array accesses |
| Test 1 | 0 | 0 | 0 |
| Test 2 | 0 | 0 | 0 |
| Test 3 | 9 | 2 | 18 |
| Test 4 | 4 | 0 | 8 |
| Test 5 | 9 | 2 | 18 |
| Large Test | 659767409 | 90489 | 1319534818 |

# 5. Discussion

From the results we observe:  
- Some tests resulted in 0 comparisons and swaps, likely representing trivial or empty inputs.  
- Small arrays (Tests 3–5) produced a handful of comparisons and swaps, consistent with expected behavior.  
- The large test produced extremely high values: ~659 million comparisons, ~90k swaps, and ~1.3 billion array accesses. This demonstrates the algorithm's asymptotic complexity when handling large random or adversarial inputs.

# 6. Conclusion

The partner algorithm correctly executed and passed all tests. Performance metrics align with theoretical expectations: negligible cost on trivial inputs, moderate cost on small cases, and very high cost on large-scale inputs. These results highlight the importance of algorithmic complexity in practice.