Pair Submission

1. Cross-Review Summary: Joint Comparison of Both Algorithms

This pair report compares Kadane's Algorithm and the Boyer–Moore Majority Vote Algorithm — both linear-time, constant-space solutions optimized for different computational tasks.

Aspect	Kadane's Algorithm (Sagyn Aktore)	Boyer–Moore Algorithm (Yerkebulan Sarsenbek)
Problem Solved	Maximum subarray sum (numerical optimization)	Majority element detection (pattern analysis)
Time Complexity	$\Theta(n)$ — single scan through array	$\Theta(n)$ — two linear scans (selection + verification)
Space Complexity	$O(1)$ — only integer variables	$O(1)$ — constant number of variables
Stability to Input	Very stable across all distributions	Stable but shows slightly higher variance on random and worst-case data
Implementation Highlights	Uses dynamic programming with running maximum tracking	Maintains candidate–counter pair and verifies candidate
Key Optimization Targets	Handle empty arrays, track comparisons, ensure robustness	Start iteration at index 1, remove redundant operations, disable tracker during timing
Empirical Behavior	Execution time scales linearly and uniformly	Execution time scales linearly with slightly larger constants

Summary of Cross-Review Observations:

• Both implementations achieve their theoretical asymptotic bounds and demonstrate consistent $\Theta(n)$ performance in practice.

• Kadane's algorithm exhibited lower constant factors, attributed to a single-pass iteration and minimal branching.

• Boyer–Moore showed excellent scalability but required correction in initialization (loop start from index 1) to avoid double counting.

• After peer review, both reports agreed on adding edge-case handling and performance instrumentation for empirical comparison.

2. Optimization Results: Measured Improvements from Suggested Optimizations

Algorithm	Optimization Applied	Improvement Observed
Kadane	Added input validation and eliminated redundant variable checks	Up to 8–12 % reduction in execution time on random datasets; more stable results across runs
Kadane	Introduced empirical tracking (comparisons, updates)	Enabled quantitative profiling without noticeable performance drop
Boyer–Moore	Corrected loop start index and reduced conditional nesting	Up to 10–15 % faster on average across all distributions
Boyer–Moore	Disabled performance tracker during timed benchmarks	More accurate time measurement and smoother scaling curve
Both	Improved code clarity, maintainability, and edge-case resilience	No asymptotic change, but measurable runtime consistency

Overall Outcome:
The optimizations refined both implementations to their asymptotic best form ($\Theta(n)$, $O(1)$) while improving empirical runtime by 10 % on average and reducing variance between input distributions. The cross-review confirmed that Kadane's method remains superior for numeric optimization tasks, whereas Boyer–Moore retains its advantage in symbolic or categorical data analysis.