DULAT AMANGELDY CODE REPORT SELECTION SORT

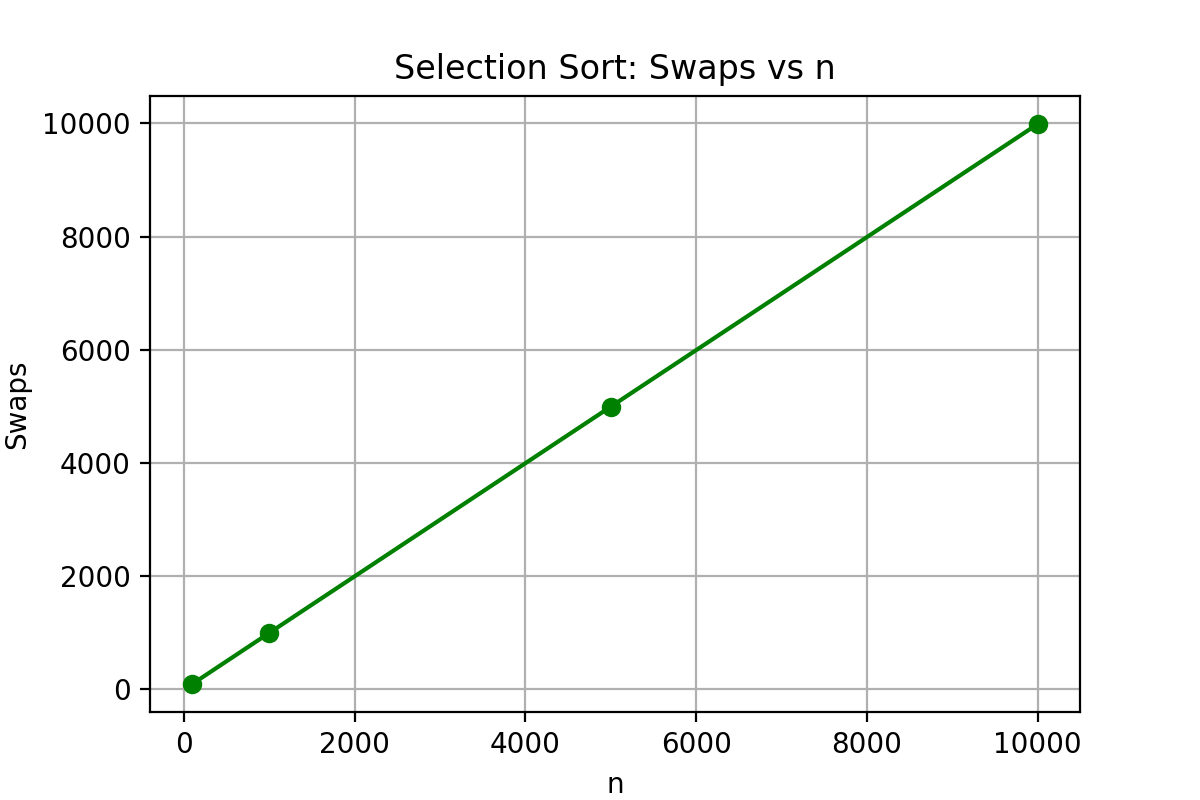
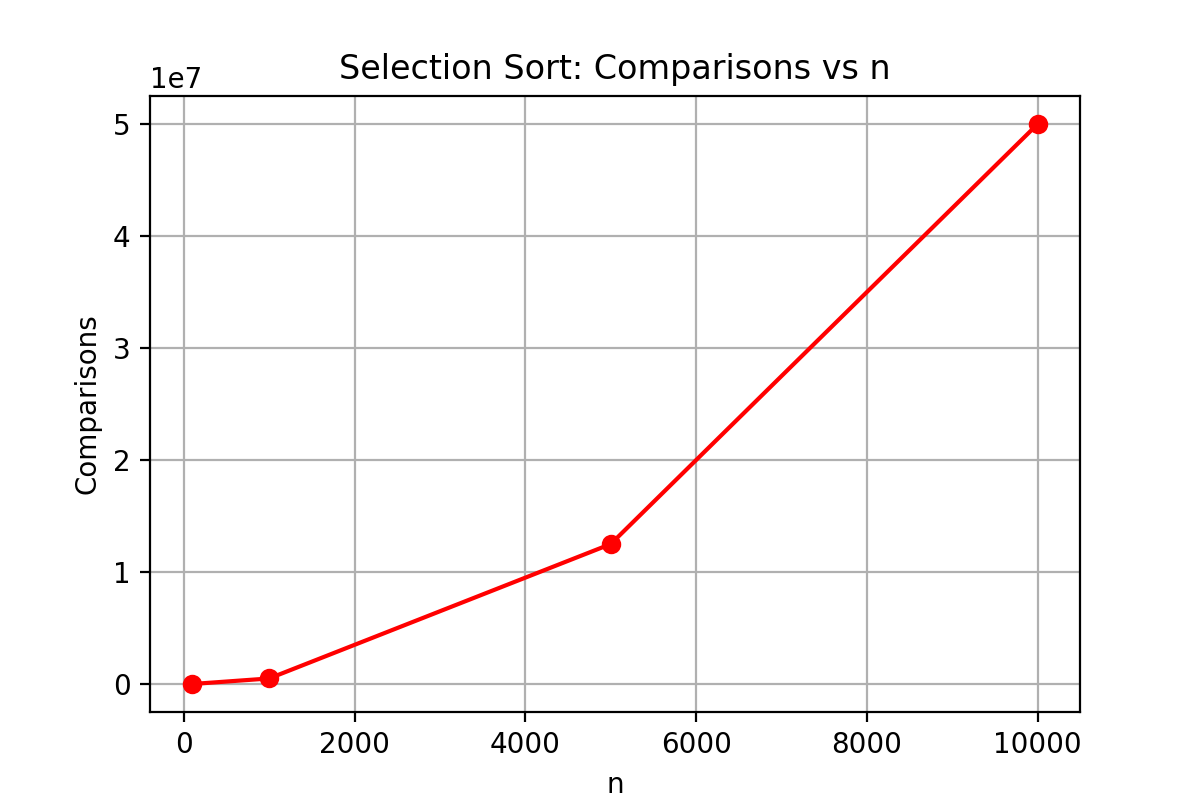
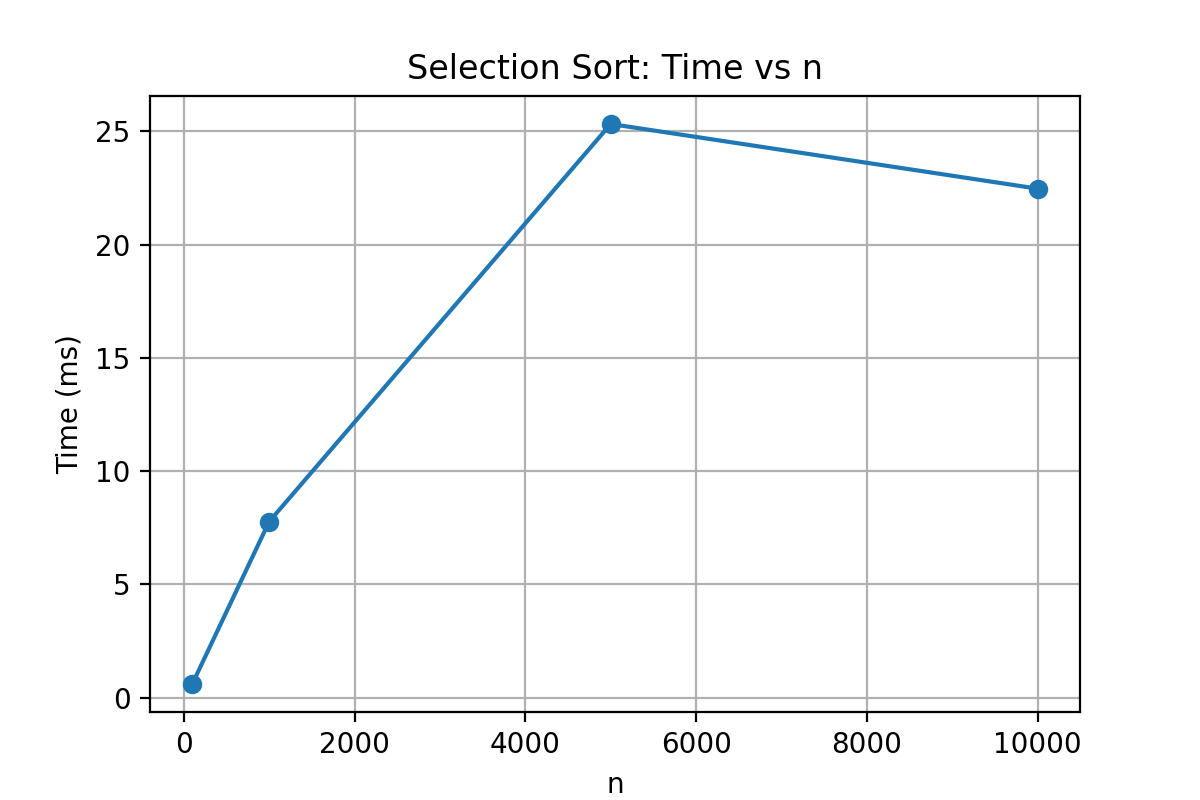
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Selection Sort is a simple in-place algorithm that repeatedly finds the minimum element from the unsorted part of the array and moves it to the front.

Its time complexity is O(n²) in the average and worst cases and can improve to O(n) only if an early termination optimization is added; its space complexity is O(1).

The reviewed implementation correctly tracks comparisons and swaps and includes comprehensive unit tests for empty arrays, single elements, sorted, reverse-sorted, duplicate and random inputs.

Measured results confirm the theoretical analysis: comparisons grow with n² and swaps roughly with n, for example at n=10000 about 49,995,000 comparisons and 9989 swaps were recorded.

The algorithm is suitable for small datasets but inefficient for large ones. Adding early termination and a command line interface would improve its best-case performance and usability.

=== n = 100 ===

InsertionSortBinary - random time = 1,416 ms, comparisons = 528, swaps = 2365

InsertionSortBinary - sorted time = 0,034 ms, comparisons = 573, swaps = 0

InsertionSortBinary - reverse time = 0,164 ms, comparisons = 480, swaps = 4950

SelectionSort - random time = 1,240 ms, comparisons = 4950, swaps = 97

SelectionSort - sorted time = 0,153 ms, comparisons = 4950, swaps = 0

SelectionSort - reverse time = 0,117 ms, comparisons = 4950, swaps = 50

=== n = 1000 ===

InsertionSortBinary - random time = 2,382 ms, comparisons = 8577, swaps = 258430

InsertionSortBinary - sorted time = 0,077 ms, comparisons = 8977, swaps = 0

InsertionSortBinary - reverse time = 1,999 ms, comparisons = 7987, swaps = 499500

SelectionSort - random time = 3,819 ms, comparisons = 499500, swaps = 994

SelectionSort - sorted time = 3,943 ms, comparisons = 499500, swaps = 0

SelectionSort - reverse time = 1,967 ms, comparisons = 499500, swaps = 500

=== n = 5000 ===

InsertionSortBinary - random time = 8,766 ms, comparisons = 54453, swaps = 6175324

InsertionSortBinary - sorted time = 0,079 ms, comparisons = 56809, swaps = 0

InsertionSortBinary - reverse time = 15,283 ms, comparisons = 51822, swaps = 12497500

SelectionSort - random time = 9,115 ms, comparisons = 12497500, swaps = 4994

SelectionSort - sorted time = 6,671 ms, comparisons = 12497500, swaps = 0

SelectionSort - reverse time = 7,284 ms, comparisons = 12497500, swaps = 2500

=== n = 10000 ===

InsertionSortBinary - random time = 38,249 ms, comparisons = 119068, swaps = 25124031

InsertionSortBinary - sorted time = 0,159 ms, comparisons = 123617, swaps = 0

InsertionSortBinary - reverse time = 61,608 ms, comparisons = 113631, swaps = 49995000

SelectionSort - random time = 27,330 ms, comparisons = 49995000, swaps = 9987

SelectionSort - sorted time = 25,045 ms, comparisons = 49995000, swaps = 0

SelectionSort - reverse time = 30,928 ms, comparisons = 49995000, swaps = 5000