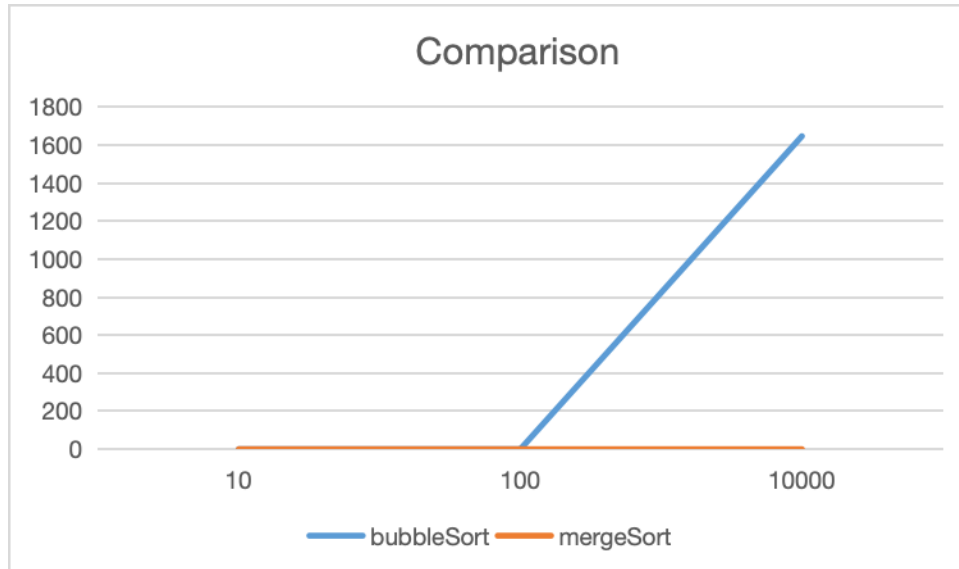


# BubbleSort and MergeSort

## Complexity Reflection



A comparison of BubbleSort and MergeSort reveals significant differences in their efficiency and scalability. As illustrated in the graph, BubbleSort's execution times grow dramatically as input size increases. While it starts near zero milliseconds for sort10 and remains low for sort100, its runtime surges exponentially to approximately 1600 milliseconds at sort10000. This sharp rise aligns with BubbleSort's  $O(n^2)$  time complexity, where the number of operations increases quadratically with the input size.

By contrast, MergeSort maintains stable performance across all tested input sizes. The execution times remain nearly constant, reflecting its  $O(n \log n)$  complexity and efficient divide-and-conquer approach. These experimental results validate MergeSort's theoretical advantage, especially for large datasets. Although both algorithms perform acceptably on small inputs, the performance gap widens significantly as input sizes grow, making MergeSort the clearly better choice for handling substantial amounts of data.