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**Rangkuman Algoritma dan Struktur Data**

**Chapter 5 – Optimizing Code with and Without Big O**

Selection Sort, an alternative to Bubble Sort, is a sorting algorithm with a time complexity of O(N^2). It iterates through an array, identifying the smallest value in each pass and swapping it with the element in the current position, gradually sorting the entire array through repeated iterations until completion. While more efficient than Bubble Sort in some scenarios, Selection Sort still exhibits a quadratic time complexity. Selection Sort, with its two main steps of comparisons and swaps, is more efficient than Bubble Sort. In a specific example with an array of five elements, Selection Sort required a total of 10 comparisons and a maximum of four swaps, demonstrating its comparative efficiency. The general formula for the number of comparisons in Selection Sort is (N - 1) + (N - 2) + (N - 3) ... + 1 for N elements, whereas swaps are limited to a maximum of one per passthrough. A side-by-side comparison with Bubble Sort shows that Selection Sort typically involves about half the number of steps, making it twice as fast in terms of performance. Despite appearing to be twice as fast in practical scenarios, Selection Sort and Bubble Sort are described in Big O Notation with the same time complexity, O(N^2), because Big O ignores constants. This mathematical principle means that regular numbers or coefficients, such as the factor of 1/2 in the case of Selection Sort's step count, are not considered in Big O analysis, simplifying the notation but potentially overlooking performance nuances between algorithms. Despite this limitation, the rule holds practical significance, guiding the choice of algorithms based on their general efficiency rather than constant factors. While Big O Notation may not distinguish between algorithms with the same time complexity, it plays a crucial role in classifying the long-term growth rates of algorithms. Despite O(N^2) encompassing both Bubble Sort and Selection Sort, the notation is valuable in understanding that, for a certain amount of data, O(N) will consistently be faster than O(N^2). However, when two algorithms fall under the same Big O classification, additional analysis is necessary to discern their actual speeds, as observed in the case of Bubble Sort and Selection Sort.