**Time Complexity of Z-Algorithm**

The time complexity of the Z algorithm for pattern searching is typically **O(m + n) ,** where m is the length of the pattern and n is the length of the text. This linear time complexity makes the Z algorithm efficient for pattern searching in many practical scenarios.

Let's break down the time complexity of the Z algorithm:

* Constructing the Z Array:

The main time-consuming step of the Z algorithm is constructing the Z array, which is done in O(n) time, where n is the length of the concatenated string (pattern + text). This is because we iterate over each character of the concatenated string once to compute the Z values.

* Pattern Matching:

After constructing the Z array, the time complexity for pattern matching is O(n), where n is the length of the concatenated string. This is because we iterate over the Z array once to identify occurrences of the pattern.

The time complexity of the Z algorithm is dominated by the construction of the Z array, which is O(n), where n is the length of the concatenated string. Once the Z array is constructed, pattern matching can be performed in linear time O(n). Therefore, the overall time complexity of the Z algorithm for pattern searching is O(m+n), where

m is the length of the pattern and n is the length of the text.

**Space Complexity of Z-Algorithm**

The space complexity of the Z algorithm for pattern searching

is **O(n) ,**  where n is the length of the concatenated string

(pattern + text).

The space complexity of the Z algorithm mainly depends on:

* Z Array:

The main component contributing to space complexity is the Z array, which stores the Z values for each position in the concatenated string. The size of the Z array is equal to the length of the concatenated string. Therefore, the space complexity of storing the Z array is O(n).

The primary contributor to the space complexity of the Z algorithm is the Z array, which requires O(n) space. Therefore, the overall space complexity of the Z algorithm for pattern searching is O(n), where n is the length of the concatenated string (pattern + text).