FIT3155 Assignment 1
Q1 Comments
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Z-Algorithm Implementation

Gusfield's Z algorithm is implemented according to the approach described in the lectures with all 3 cases. The algorithm depends on a compare function which checks if two values are the same and can terminate early if elements differ, thus eliminating needless inefficiency.

Time Complexity of Z algorithm: O(n) where n is the size of the input string.

Space complexity of Z algorithm: O(n) where n is the size of the input string.

Q1 Implementation

Assumptions: Only lowercase letters of the alphabet are inputted into the algorithm.

This solution utilised the Z algorithm to find all exact matches and matches with one transposition. At a high level, the solution took the approach to concatenate the pattern and text separated by a $. By running the algorithm normally on this we get all z-values of the text in relation to the pattern. Any z-values which are of length m (size of the pattern) are exact matches.

To find one transposed matches we first reverse the pattern and the text and run the z-algorithm on the new concatenated string. This creates an array of z-suffixes which we can use in conjunction with normal z-values. A property of the one transposed matches is that their length is m-2. As a result, using both the z-values and z-suffixes we can find indexes of the text where there could be a single transposition as the combined length of the suffix and prefix is m-2. Finally, we just need to check whether the 2 transposed letters correspond to the two letters in the pattern and from there we can conclude whether it is indeed a once transposed match of the pattern in the text.

Time Complexity of Solution: O(m + n) where m is the size of the pattern and is n the size of the text. I run 2 z-algorithms which are (m + n) and reverse both strings and concatenate which is m + n.

Space Complexity of Solution: O(m + n) where m is the size of the pattern and is n the size of the text. Space used involves 2 arrays of size (m + n) from 2 runs of the z algorithm.