Programming Project Report: Autocorrect

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Overview of Approach

For our project, we used the LCS pseudocode from class in order to compare the word we input to a correctly spelled word on our word list. The words on the word list represent correctly spelled words that we would autocorrect our input word to if the input word was spelled wrong. For our word list, we used the Excel sheet, allWords.xlsx, and copied all the words from it into our own .txt file. This made it easier to search for the words that were correctly spelled versions of our misspelled words because they were all in alphabetical order. In order to decrease runtime, we used the hashmap data structure along with other algorithms that will be described in our "Algorithms" section. When we ran our code, we found that it autocorrected the words properly but we still play on adding extra features such as a GUI later on.

Algorithms

For the createDict function what we had done was read each line of the txt file containing all the words and then one by one adding each word to its respective key (big O should be O(n) since we go through the whole word list).

The longestCommonSub function creates a matrix (we shall call it the c matrix) that will be the size of the len(word1) x len(word2). We first loop through the indices of the first word and compare it to all the indices of the second word. If they match we add a point to the respective area in the matrix. If it does not we adjust our location marker in the c matrix and continue. To get the best score we would need to return c[m][n] (m = len(word1) and n = len(word2) so c[m][n] is the top right corner of our matrix).

The searchDict function takes in the user input word and then compares it to every word in its respective key value (the first letter of the user input word) using the longestCommonSub function. It will save the best score returned by the LCS function and its corresponding word. The runtime for the searchDict function should be O(nm). This is because searching through a hashmap should be O(1) and so the largest contributor to this function's run time would be the LCS function making it O(nm).

Data Structures

For our dictionary, we used a hashmap. Hashmaps map keys to their value pairs. The keys are the letters of the alphabet and the value pairs are the words we are inputting. This allows for an efficient lookup of the correctly spelled words given what words we input; by using this hashmap, it decreases the runtime drastically.

Other Choices

We plan to talk about extra features as we add them.

Asymptotic Runtimes

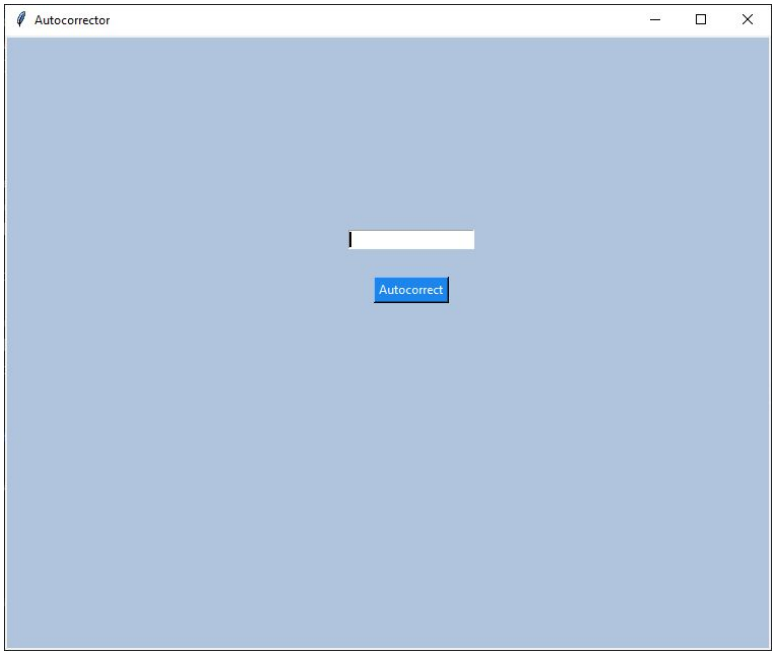
The complexity of our program is largely dominated by the LongestCommonSubsequence algorithm that we implemented. The runtime of this algorithm depends on the words that are passed into it, as the words will be compared letter by letter in order to obtain a similarity score. This of course is not the only function in our program, yet the runtimes of the others are relatively less significant by comparison.

The initializer function is straightforward and has a runtime of O(1).
The createDictionary function runs through the entire text file, sectioning off the dictionary by first letter. There are 26 entries in the dictionary based on the 26 letters in the alphabet that could be the first letter of a given word. The runtime ends up being O(n) where n is the number of words in the text file, as each word must be appended to the dictionary one by one.
The longestCommonSubsequence function, as mentioned earlier, provides the bulk of the runtime complexity of our program. The algorithm compares our two inputs letter by letter, which creates a runtime of O(m*n) where m and n are the lengths of the two words that were passed into the function.
The searchDict function runs based on the hashmap that we implemented as our dictionary. Based on the input word, this function finds the corresponding key in the dictionary (the first letter of the word) and cycles through each value, running the LCS function on the original word and each word in the key's values. Since searching in a hashmap has complexity O(1), the resulting complexity is the same as LCS itself, O(m*n). More specifically, we can give an upper bound of (input word length) * (length of longest dictionary word * number of words in key) where they key is the section of the dictionary containing words starting with the first letter of the input word. Since words will be compared letter by letter, the worst case runtime would include the length of the longest word in that key multiplied by the amount of words in the key, then multiplied by the input word length as there will be letter by letter comparisons. However, we can provide a more realistic bound where we take the average word length of words in the given key as opposed to the longest word in the worst case scenario. We then have a runtime bound of (input word length) * (average word length * number of words in key) for the SearchDict function.

Extra Credit- GUI

In our program, we decided to add a GUI where a window would appear and the user could enter the words they want into a nice looking window in order to autocorrect them. Our window gave the user a text box for them to type their word, then when they hit "autocorrect" the new word we have autocorrected their word to will appear. Every time after the autocorrected word is displayed, we have an empty string display over the word so that if the user enters another word, the autocorrected words will not overlap on one another. We also changed the colors of our

window in order to make it look nice and more user friendly. Here is an example of what the window looks like:



Extra Credit- Dealing with Ties

Ties happen when there are multiple words in the dictionary with the same score that could potentially be the autocorrected version of the word that was typed in. In order to deal with ties, we added an extra if statement where we check the length of the word that was entered compared to the words from the dictionary with the same score. The word that was closest in length to the word that was entered would then be the “autocorrected word” that is displayed to the user.