Word Chain iOS application

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Code Details

Program : Word Chain application
Language : Objective-C
Platform : Apple iPhone

Runtime Complexity

My application uses a methodology that spawns all possible mutations of a word by looping over each character index of the word.From here, the code deletes, inserts or swaps the character in the word. This is cross-checked against the dictionary to make a set of possible words that are mutations of the original. If the original number of characters in the string is n, then the time complexity is:

The deletion operations are of $O(n)$,
The algorithm can be further optimized from its current state. Currently there are 26 swaps (26 alphabets) over each of the indices of the word which creates a complexity of $O(26 \times n)$.
Appending a character to the string can be made over the n indices as well as the $(n+1)^{th}$ index. This works out to $O(26 \times (n+1))$.
The deletion operations take $O(n)$.
The lookup of words in the word list is of $O(1)$ since my code uses the `NSSet` type to store them.

Accumulating these calculations, we arrive at a complexity of $O(n(26+26+1)+26) = O(53 \times n + 26)$. After accounting for comparisons (The code also compare the generated words to the word list), we will get $\approx 2 \times (53 \times n + 26)$ which gives us $O((106 \times n) + 52)$. So the overall complexity comes to $\underline{O(n)}$.

Optimization Suggestions

The word list could be made into an `NSDictionary` object which would take the words as keys. The values of the keys would store an `NSSet` which would contain all possible mutations that can be spawned from that entry in the word list. This would give us $O(1)$ access instead of iteratively looping through each word. Though this was not really necessary for my sample dictionary (and I am making this suggestion in hindsight), it could save when dealing with word lists of the order of a million words. The number of words in the English Language currently stands at 1,013,913 ! (http://www.languagemonitor.com/new-words/number-of-words-in-the-english-language-1008879/)

Acknowledgements

English Word List courtesy the English Open Word List (http://dreamsteep.com/projects/the-english-open-word-list.html)
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