



PES UNIVERSITY, BENGALURU

FINAL SEMESTER ASSESSMENT (FSA) – B.TECH. (CSE) – IV SEM

SESSION: JANUARY –MAY, 2019

UE17CS251 – DESIGN AND ANALYSIS OF ALGORITHMS

Project Report

on

“Spell checker using trie trees in C, with an auto-suggest feature”

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ABOUT

THIS PROJECT IS A SPELL CHECKER IMPLEMENTED IN C USING THE TRIE DATA STRUCTURE.

IT ALSO HAS AN ADDITIONAL AUTO SUGGEST FEATURE, WHOSE IMPLEMENTATION HAS BEEN EXPLAINED IN DETAIL IN THE UPCOMING SECTIONS.

THE TRIE DATA STRUCTURE

TRIE IS AN EFFICIENT INFORMATION RETRIEVAL DATA STRUCTURE. USING TRIE, SEARCH COMPLEXITIES CAN BE BROUGHT TO OPTIMAL LIMIT (KEY LENGTH). IF WE STORE KEYS IN BINARY SEARCH TREE, A WELL BALANCED BST WILL NEED TIME PROPORTIONAL TO $M * \log N$, WHERE M IS MAXIMUM STRING LENGTH AND N IS NUMBER OF KEYS IN TREE. USING TRIE, WE CAN SEARCH THE KEY IN $O(M)$ TIME. HOWEVER THE PENALTY IS ON TRIE STORAGE REQUIREMENTS.

EVERY NODE OF TRIE CONSISTS OF MULTIPLE BRANCHES. EACH BRANCH REPRESENTS A POSSIBLE CHARACTER OF KEYS. WE NEED TO MARK THE LAST NODE OF EVERY KEY AS END OF WORD NODE. A TRIE NODE FIELD *isEndOfWord* IS USED TO DISTINGUISH THE NODE AS END OF WORD NODE. THE DATA STRUCTURE USED IN THE PROGRAM IS:

```
#DEFINE ALPHABET_SIZE 26

//THE TRIE DATA STRUCTURE

STRUCT TRIENODE
{
    STRUCT TRIENODE *CHILDREN[ALPHABET_SIZE];
    INT isEndOfWord;
};
```



INPUT

THE PROGRAM TAKES IN TWO INPUT FILES, ONE IS THE DICTIONARY(DICT.TXT) USING WHICH IT CHECKS THE LEGALITY OF THE WORDS IN THE OTHER INPUT FILE (INPUT.TXT), THE LATER IS GIVEN BY THE USER.

OUTPUT

THE OUTPUT(OUTPUT.TXT) PRODUCED BY THE PROGRAM IS THE LINE-BY-LINE ERRORS IN THE INPUT FILE.

ALGORITHMS

//TO INSERT A WORD IN A TRIE TREE

//INPUT : A STRING KEY[0....N-1] AND THE ROOT OF THE TRIE TREE

//OUTPUT: THE TRIE WITH THE KEY INSERTED IN IT

INSERT_TRIE(KEY[0..N-1], ROOT):

 STRING_LENGTH <- STRLEN(KEY)

 TEMP_ROOT <- ROOT

 FOR I<-0 TO I<-(N-1):

 IF TEMP_ROOT->CHILDREN[CHAR_TO_INDEX(KEY[I])]==NULL:

 TEMP_ROOT->CHILDREN[CHAR_TO_INDEX(KEY[I])]= GET_NODE

 TEMP_ROOT <- TEMP_ROOT->CHILDREN[CHAR_TO_INDEX(KEY[I])]

 ELSE

 TEMP_ROOT <- TEMP_ROOT->CHILDREN[CHAR_TO_INDEX(KEY[I])]

 TEMP_ROOT-> IsEndOfWord -> TRUE

//TO SEARCH IN A TRIE TREE

//INPUT : A STRING KEY[0....N-1] AND THE ROOT OF THE TRIE TREE



//OUTPUT: 1 IF FOUND IN THE TRIE, 0 OTHERWISE

SEARCH_TRIE(String KEY[0...N-1], ROOT):

TEMP_ROOT <- ROOT

FOR(i<-0 TO LEN(KEY)-1):

IF(TEMP_ROOT->CHILDREN[CHAR_TO_INDEX(KEY[i])] = NULL)

RETURN 0;

ELSE

TEMP_ROOT <- TEMP_ROOT->CHILDREN[CHAR_TO_INDEX(KEY[i])]

RETURN (TEMP_ROOT!=NULL AND TEMP_ROOT->IsEndOfWord= TRUE)

//TO FIND THE PERMUTATION OF A WRONG WORD

//INPUT : A STRING KEY[0...N-1] AND THE ROOT OF THE TRIE TREE

//OUTPUT: THE PERMUTATION OF THE STRING THAT EXISTS IN THE TRIE, EMPTY STRING IF //THERE'S NO SUCH STRING

CHECK_PERMUTATIONS(String KEY[0...N-1], ROOT):

FOR(i<- 0 TO LEN(KEY)-1):

TEMP_KEY = KEY

SWAP TEMP_KEY[i] TO THE CHARACTERS ADJACENT TO IT.

CHECK IF THE RESULTANT TEMP_KEY IS IN TRIE USING SEARCH FUNCTION

IF THERE, RETURN THE TEMP_KEY AFTER SWAPPING

CONTINUE

RETURN ""

SNAPSHOTS OF INPUT AND OUTPUT FILE:



INPUT FILE (INPUT.TXT):

A screenshot of a Sublime Text editor window. The title bar reads "C:\cygwin64\home\Kark\DAI PROJECT\input.txt - Sublime Text (UNREGISTERED)". The menu bar includes File, Edit, Selection, Find, View, Goto, Tools, Project, Preferences, and Help. The tab bar shows several open files: server.c, output.txt, client.c, header.h, input.txt (which is the active file), and dict.txt. The editor area displays the following text:

```
1 Hey theer my name is siddartha!  
2 I am here to shwo yuo how the auto suggest feature works.  
3 Let's take common words that have an error of '2-bit permutations'  
4 thier thees
```

The status bar at the bottom indicates "Line 4, Column 12", "Tab Size: 4", and "Plain Text". The Windows taskbar is visible at the very bottom, showing the time as 8:49 AM on 5/18/2019.

OUTPUT FILE (OUTPUT.TXT)



```
C:\cygwin64\home\Kark\DAA PROJECT\output.txt - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
server.c x output.txt x client.c x header.h x input.txt x dict.txt x
1 ERRORS ON LINE 1 : theer(there) siddarth()
2 ERRORS ON LINE 2 : shwo(show) yuo(you)
3 ERRORS ON LINE 3 :
4 ERRORS ON LINE 4 : thier(their) thees(these)
5 |
```

GITHUB LINK

[HTTPS://GITHUB.COM/KARKI23/SpellChecker](https://github.com/KARKI23/SpellChecker)
