AoL Data Structure

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```c
#include<stdio.h> //Included for standard input and output library

#include<stdlib.h> //Included for standard library including memory allocation

#include<string.h> //Included for string manipulation library


typedef struct trienode
{
    //To find the node for that particular char and will return NULL if there's no
    child for that character (128 is ASCII)
    struct trienode *child[128];
    //End of the word (if the node don't have a word, then return 0. if the node
    have a word, then return 1)
    int terminal;
    //For a new slang word description
    char desc[1000];
};


//Declare root as an empty root
struct trienode *root = NULL;
```

```c
//Function to create node
trienode *createNode(){
    //Allocate memory for a trienode and puts the memory's address in the pointer
    variable newNode
    trienode *newNode = (trienode*)malloc(sizeof(trienode));


    //Initialize that the child of new node is NULL (there is no child nodes)
    for(int i = 0; i < 128; i++){
        newNode->child[i] = NULL;
    }


    //Initialize end of the word is 0 (the node is not end of the word)
    newNode->terminal = 0;
```

```
    //Copy an empty string to the description in new node

    strcpy(newNode->desc, "");


    return newNode;

}
```

The '**createNode()**' function is a function to create a new node. It allocates memory for a trienode using the '**malloc()**' function and assigns the memory's address in the pointer variable '**newNode**'. Then, the function initialize the child of new node is **NULL** by iterating over an array, indicating that there's no child nodes. It initializes terminal of new node into 0 too, indicating the node is not the end of the word. Furthermore, the function copies an empty string to the description in new node using '**strcpy()**' function. Last, it returns '**newNode**'.

```
//Funtion to insert word to trienode

void insertWord(trienode **root, char word[], char desc[]){

    //If root is NULL then add the new character in the node

    if(*root == NULL) *root = createNode();


    //Create a temporary pointer and initialize with address of the root to
traverse the trie while inserting the word

    trienode *temp = *root;

    //Calculate the length of the word that we want to insert

    int len = strlen(word);


    //The loop check if there's a character in the child nodes

    for(int i = 0; i < len; i++){

        //If the child is NULL

        if(temp->child[word[i]] == NULL){

            //Create a new node

            temp->child[word[i]] = createNode();

        }

        //Move temp to the child node corresponding to the current character

        temp = temp->child[word[i]];

    }


    //Copy the description of the word into the description of the last node

    strcpy(temp->desc, desc);
```

```
    //If there's end of the word, then we update the word

    if(temp->terminal){

        printf("Successfully updated a slang word\n");

        printf("Press enter to continue...\n");

    }

    //If there's no end of the word (there's no child), then we release a new word

    else {

        printf("Successfully released new slang word\n");

        printf("Press enter to continue...\n");

    }


    //Mark that there's already end of the word by setting the terminal into 1

    temp->terminal = 1;

}
```

The **'insertWord()'** function is a function to insert word into a trie, ensuring proper traversal and node creation while maintaining accurate terminal markers. First, it check if the root node is **NULL**, indicating an empty trie. If the trie is empty, then the it will call the **'createNode()'** function to create a new node. Then, the function create a **'temp'** pointer and initialize with address of the root to traverse the trie while inserting the word. The function will check if there's a character in the child nodes use looping. If the child is **NULL**, then it creates a new node. If the child is **not NULL**, then the function will move temp to the child node corresponding to the current character. After traversing to the end of the word, the function copies the description of the word into the description of the last node. It also checks if the last node already marts the end of a word, If so, the function will print message that it successfully updated. Otherwise, the function will print message that it successfully released a word. At the end, it marks the terminal into 1.

```
//Function for menu 1

void menu1(){

    //Declare input word and description word as character

    char word_input[1000], desc_input[1000];

    //Declare count number as integer

    int countNum;


    //Validate the word must be more than one characters and contains no space

    do

    {
```

```c
        printf("Input a new slang word [Must be more than 1 characters and contains
no space]: ");

        scanf("%[^\n]s", word_input); getchar();

    } while (strlen(word_input) <= 1 || strchr(word_input, ' ') != NULL);


    //Validate the description of the word must be more than two words
    do
    {
        printf("Input a new slang word description [Must be more than 2 words]: ");
        scanf("%[^\n]", desc_input); getchar();


        //Initialize count number is 0
        countNum = 0;


        //Iterate each character of the string and count the number of spaces in it
        for(int i = 0; i < strlen(desc_input); i++){
            if(desc_input[i] == ' '){
                countNum++;
            }
        }
        countNum++;
    } while (countNum < 2);
    //Call function insertWord to add word and description to the trienode (each
character of the word will be the child nodes)
    insertWord(&root, word_input, desc_input);

}
```

The **'menu1()'** function is a function that provides an interactive for users to input new slang words and their descriptions, ensuring the validity of the input data. First, the function ask user to input the word and validate that the word must be more than one characters and contains no space, the function use **'do-while'** function to validate it. Then, the function will ask user again to input the description and validate that the word must be more than two words, it use **'do-while'** function too by iterate each character of the string and count the number of spaces in it. Lastly, this function call the **'insertWord()'** function to add word and description to the trie.

```c
//Function to search a word in the trienode
int searchWord(trienode **root, char key[], char desc[]){
    //Create a current node and initialize with address of the root
```

```
    trienode *currNode = *root;

    //Calculate the length of the key that we want to search

    int len = strlen(key);


    //Check if the word that we want to search is in the trienode or not by
iterates over each character of the word

    for(int i = 0; i < len; i++){

        //If the word is not present in trienode, return 0

        if(currNode->child[key[i]] == NULL){

            return 0;

        }

        //Move current node to the child node corresponding to the current
character

        currNode = currNode->child[key[i]];

    }

    //If the word is present in trienode, copy the description in the current node
into the description

    strcpy(desc, currNode->desc);

    //Return value of the terminal (If 1, then the word is present. If 0, then the
word isn't present)

    return currNode->terminal;

}
```

The **'searchWord()'** function is use to searching a given word in a trie and retrieving its associated description, if it exists. This function will check if the word to be searched is in the trienode or not by use looping. If so, the function will copy the description in the current node into the description and return the terminal. Otherwise, the function will return 0.

```
//Function for menu 2

void menu2(){

    //Declare key and description as character

    char key[1000];

    char description[1000];

    //Declare result as integer

    int result;


    //Validate the word must be more than one characters and contains no space

    do
```

```
    {

        printf("Input a slang word to be searched [Must be more than 1 characters
and contains no space]: ");

        scanf("%s", key); getchar();

    } while (strlen(key) <= 1 || strchr(key, ' ') != NULL);


    //Call seacrhWord function and store it in the result variable

    result = searchWord(&root, key, description);


    //If result is 0, it means that the word is not present

    if(result == 0){

        printf("There is no word \"%s\" in the dictionary.\n", key);

        printf("Press enter to continue...\n");

    }else{

        //If result is not 0, it means that the word is present and print the word with
the description

        printf("Slang word : %s\n", key);

        printf("Description: %s\n", description);

    }

}
```

The **'menu2()'** function is a function that provides an interactive for users to input word to be searched and give an output either there's word that we want to search or not. First, the function will ask user to input a word to be searched and validate it with **'do-while'** function. After that, it calls the **'searchWord()'** function and store it in the result variable. If there's word to be searched, the function will print the word and description. Otherwise, it'll print message that there's no word searched for.

```
//Function to search prefix word in the trienode

int searchPrefix(trienode **root, char prefix[]){

    //Create a current node and initialize with address of the root

    trienode *currNode = *root;

    //Calculate the length of the prefix word that we want to search

    int len = strlen(prefix);


    //Check if the prefix word that we want to search is in the trienode or not by
iterates over each character of the word

    for(int i = 0; i < len; i++){
```

```
        //If the prefix word is not present in trienode, return 0

        if(currNode->child[prefix[i]] == NULL){

            return 0;

        }

        //Move current node to the child node corresponding to the current
character

        currNode = currNode->child[prefix[i]];

    }

    //Return 1 if the prefix word is present in trienode

    return 1;

}
```

The **'searchPrefix()'** function is use to searching a prefix word in a trie. This function will check if the prefix word is in the trienode or not by use looping. The function will move the current node to the child node corresponding to the current character in that looping. If there's prefix word in the trie, the function will return 1. Otherwise, the function will return 0.

```
//Function to print all of the word in the trienode by lexicographically

void printAll(trienode *root, char word[], int len, int *count){

    //Declare new word as character with size length of the word + 2

    //Len + 2 will give enough space to accommodate the characters of the word plus
an extra character and NULL terminator

    char newWord[len + 2];

    //Copy each character of word to the new word

    memcpy(newWord, word, len);

    //Set the character at index len + 1 of new word to NULL terminator, indicating
the end of the string

    newWord[len + 1] = '\0';

    //Create a temporary pointer and initialize with root

    trienode *temp =  root;

    //If the root is NULL, returns immediately (there are no words to print)

    if(root == NULL) return;


    //Iterates each character of the word and updating temp to child node
corresponding to each character

    for(int i = 0; i < strlen(word); i++){

        temp = temp->child[word[i]];

    }
```

```
    //If terminal (end of the word) of the temp is not 0, print the word

    if(temp->terminal){

        printf("%d. %s\n", (*count), word);

        (*count)++;

    }


    //Check if child node is not NULL, update new word with current character and
    recursively call printAll function

    for(int i = 0; i < 128; i++){

        if(temp->child[i] != NULL){

            newWord[len] = i;

            printAll(root, newWord, len + 1, count);

        }

    }

}
```

The **'printAll()'** function is a function to print all of the words that present in trie by lexicographically. This function will check if the root is **NULL**, indicating an empty trie. If so, it will return immediately. Otherwise, the function will check if there's end of the word in that trie or not by use looping. If there's end of the word, the function will print the word. After that, if child nodes is not **NULL**, then update new word with current character and recursively call **'printAll()'** function.

```
//Function for menu 3

void menu3(){

    //Declare prefix and temp as character

    char prefix[1000];

    char temp[1000];

    //Declare result and count as integer

    int result;

    //Count start with 1

    int count = 1;


    //Ask a user to input the prefix to be searched

    printf("Input a prefix to be searched: ");

    scanf("%s", prefix); getchar();
```

```
    //Calculate the length of the prefix word

    int len = strlen(prefix);

    //Call searchPrefix function and store it in the result variable

    result = searchPrefix(&root, prefix);

    //Check if there's prefix word or not and print the word if the word is present
in the trienode

    if(result){

        printf("Words starts with \"%s\":\n", prefix);

        printAll(root, prefix, len, &count);

    }else{

        printf("There is no prefix \"%s\" in the dictionary\n", prefix);

    }

    printf("Press enter to continue...\n");

}
```

The **'menu3()'** function is a function that provides an interactive for users to input a prefix word to be searched. Then, it will call the **'searchPrefix()'** function and store it in the variable. After that, the function will check if there's prefix word or not in the trie. If so, it'll print all of the word that starts with that prefix word. Otherwise, the function will print message that there's no prefix word searched for.

```
//Function for menu 4

void menu4(){

    //Declare word as character

    char word[1000] = "";

    //Declare count as integer and start with 1

    int count = 1;

    //Check is there's word in the trienode or not and print all of the words if
there's word in trienode

    if(root == NULL){

        printf("There is no slang word yet in the dictionary.\n");

    }else{

        printf("List of all slang words in the dictionary:\n");

        printAll(root, word, strlen(word), &count);

    }

    printf("Press enter to continue...\n"); }
```

The **'menu4()'** function is a function to display all the words that user input to the trie. The function will check if there's word in the trie. If so, it'll print all of the words by lexicographically. Otherwise, the function will print message that there's no word in the trie.

```c
void displayAll(){

    printf("\t\t\tBoogle\n");

    printf("==========================================================\n");

    printf("Menu:\n");

    printf("1. Release a new slang word\n");

    printf("2. Search a slang word\n");

    printf("3. View all slang words starting with a certain prefix word\n");

    printf("4. View all slang words\n");

    printf("5. Exit\n");

    printf("Choice: ");

}
```

The **'displayAll()'** function is a function that display all of the menu in Boogle.

```c
int main(){

    //Declare root as an empty root

    trienode *root = NULL;

    //Declare choice as integer

    int choice;


    //The menu is displayed repeatedly as long as user's choice is not 5 (If user's choice is 5, it'll end of the program)

    do

    {

        //User should input choice between 1 until 5 or the menu will display the menu and ask user to input the choice again

        do

        {

            //Ask user to input the choice

            displayAll();

            scanf("%d", &choice); getchar();


            //Execute the corresponding menu function based on the user's choice

            switch (choice)
```

```c
            {
            case 1:
                //Called the function for menu 1 if user's choice is 1
                menu1();
                break;
            case 2:
                //Called the function for menu 2 if user's choice is 2
                menu2();
                break;
            case 3:
                //Called the function for menu 3 if user's choice is 3
                menu3();
                break;
            case 4:
                //Called the function for menu 4 if user's choice is 4
                menu4();
                break;
            case 5:
                //Print the farewell message if user's choice is 5
                printf("Thank you... Have a nice day :)\n");
                break;
            }
        } while (choice < 1 && choice > 5);
    } while (choice != 5);


    return 0;
}
```

Custom Case

```
                    Boogle
=========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: live
Input a new slang word description [Must be more than 2 words]: experience something in real t
ime
Successfully released new slang word
Press enter to continue...
                    Boogle
=========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: lush
Input a new slang word description [Must be more than 2 words]: luxurious or high quality
Successfully released new slang word
Press enter to continue...
                    Boogle
=========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: lame
Input a new slang word description [Must be more than 2 words]: boring or uninteresting
Successfully released new slang word
Press enter to continue...
```

```
                    Boogle
=========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: lit
Input a new slang word description [Must be more than 2 words]: amazing or cool
Successfully released new slang word
Press enter to continue...
                    Boogle
=========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: lizard
Input a new slang word description [Must be more than 2 words]: person who is socially awkward

Successfully released new slang word
Press enter to continue...
```

```
                        Boogle
===========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: bagel
Input a new slang word description [Must be more than 2 words]: a person who is boring
Successfully released new slang word
Press enter to continue...
                        Boogle
===========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: bank
Input a new slang word description [Must be more than 2 words]: to be successfull
Successfully released new slang word
Press enter to continue...
                        Boogle
===========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: bat
Input a new slang word description [Must be more than 2 words]: to leave quickly
Successfully released new slang word
Press enter to continue...
```

```
                        Boogle
===========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: basic
Input a new slang word description [Must be more than 2 words]: unoriginal or predictable
Successfully released new slang word
Press enter to continue...
```

```
                    Boogle
==========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: yeet
Input a new slang word description [Must be more than 2 words]: to throw with force
Successfully released new slang word
Press enter to continue...
                    Boogle
==========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: yearn
Input a new slang word description [Must be more than 2 words]: to have a strong desire
Successfully released new slang word
Press enter to continue...
                    Boogle
==========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: yikes
Input a new slang word description [Must be more than 2 words]: expression of surprise
Successfully released new slang word
Press enter to continue...
```

```
                    Boogle
==========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: yard
Input a new slang word description [Must be more than 2 words]: home or residence
Successfully released new slang word
Press enter to continue...
                    Boogle
==========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: yang
Input a new slang word description [Must be more than 2 words]: opposite of yin
Successfully released new slang word
Press enter to continue...
                    Boogle
==========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 1
Input a new slang word [Must be more than 1 characters and contains no space]: bae
Input a new slang word description [Must be more than 2 words]: term of endearment for a signi
ficant other
Successfully released new slang word
Press enter to continue...
```

```
                          Boogle
=========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 2
Input a slang word to be searched [Must be more than 1 characters and contains no space]: bat
Slang word : bat
Description: to leave quickly
                          Boogle
=========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 2
Input a slang word to be searched [Must be more than 1 characters and contains no space]: yang
Slang word : yang
Description: opposite of yin
                          Boogle
=========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 2
Input a slang word to be searched [Must be more than 1 characters and contains no space]: live
Slang word : live
Description: experience something in real time
```

```
                          Boogle
=========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 2
Input a slang word to be searched [Must be more than 1 characters and contains no space]: lizard
Slang word : lizard
Description: person who is socially awkward
                          Boogle
=========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 2
Input a slang word to be searched [Must be more than 1 characters and contains no space]: yeet
Slang word : yeet
Description: to throw with force
```

```
                        Boogle
========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 3
Input a prefix to be searched: ba
Words starts with "ba":
1. bae
2. bagel
3. bank
4. basic
5. bat
Press enter to continue...
```

```
                        Boogle
========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 4
List of all slang words in the dictionary:
1. bae
2. bagel
3. bank
4. basic
5. bat
6. lame
7. lit
8. live
9. lizard
10. lush
11. yang
12. yard
13. yearn
14. yeet
15. yikes
Press enter to continue...
                        Boogle
========================================================
Menu:
1. Release a new slang word
2. Search a slang word
3. View all slang words starting with a certain prefix word
4. View all slang words
5. Exit
Choice: 5
Thank you... Have a nice day :)
PS D:\Documents\DATA SCIENCE\SEMESTER 2\DATA STRUCTURES>
```