TP TRIE

Tomás Rando - 14004 - LCC

Para la realización del TP hice dos implementaciones. Una con listas de python y otra con listas LinkedList. En la segunda mitad del tp se encuentran las implementaciones con LinkedList y en GitHub se encuentran los códigos correspondientes junto a un archivo main.py que contiene algunos casos de prueba para ambas implementaciones.

Punto 1)

```python
#Busca en una lista si existe algún elemento con la key == element, si es así devuelve el índice
def searchInL(L, element):
    if L == None:
        return None
    length = len(L)
    for i in range(0, length):
        if L[i].key == element:
            return i
    return None
```

insert(T, element)

```python
def insert(T, element):

    if T.root == None:
        L = []
        T.root = L
    else:
        L = T.root
    return insertR(T.root, L, element)

def insertR(LastNode, L, element):
    condition = searchInL(L, element[0])

    if condition == None:
        TNode = TrieNode()
        TNode.key = element[0]

        TNode.parent = LastNode
        if len(element) == 1:
            TNode.children = None
        else:
            newList = []
            TNode.children = newList
        L.append(TNode)
    else:
        TNode = L[condition]

    if len(element) != 1:
        element = element[1:]
        if condition == None:
            insertR(TNode, newList, element)
        else:
            if TNode.children == None:
                newList = []
                TNode.children = newList
            insertR(L[condition], L[condition].children, element)
        return
    else:
        TNode.isEndOfWord = True
        return
```

search(T, element)

```
def search(T, element):
    return searchR(T.root, element)

def searchR(L, element):
    if L == None:
        return False

    condition = searchInL(L, element[0])

    if condition == None:
        return False

    if len(element) != 1:
        element = element[1:]
        return searchR(L[condition].children, element)
    else:
        if L[condition].isEndOfWord == True:
            return True
        else:
            return False
```

Punto 2)
Una versión del search() cuya complejidad sea O(m) sería una versión del Trie implementado mediante arrays en vez de listas enlazadas (utilizando posiciones conocidas de antemano para insertar las letras). De esta manera, el acceso a cada letra sería de O(1) y solo importaría recorrer la palabra, que se realizaría en O(m), siendo m la longitud de la palabra

Punto 3)
delete(T, element)

```
def searchForLastNode(T, element):
    return searchForLastNodeR(T.root, element)

def searchForLastNodeR(L, element):
    condition = searchInL(L, element[0])
    if condition == None:
        return False

    if len(element) != 1:
        element = element[1:]
        return searchForLastNodeR(L[condition].children, element)
    else:
        if L[condition].isEndOfWord == True:
            return L[condition]
        else:
            return False
```

```
def delete(T, element):
    condition = search(T, element)
    if condition == False:
        return False
    finalNode = searchForLastNode(T, element)
    finalNode.isEndOfWord = False

    return deleteR(T, finalNode, element)

def deleteR(T, finalNode, element):

    if finalNode.children != None:
        finalNode.isEndOfWord = False
        return True
    else:
        if finalNode.isEndOfWord == False:
            if finalNode.parent == T.root:
                T.root.remove(finalNode)
                return True
            parentNode = finalNode.parent
            parentList = parentNode.children
            parentList.remove(finalNode)

            if len(parentList) ==  0:
                parentNode.children = None
            return deleteR(T, finalNode.parent, element)
        else:
            return True
```

Punto 4)

```
def searchLastNodePattern(T, element):
    return searchLastNodePatternR(T.root, element)

def searchLastNodePatternR(L, element):
    condition = searchInL(L, element[0])
    if condition == None:
        return False

    if len(element) != 1:
        element = element[1:]
        return searchLastNodePatternR(L[condition].children, element)
    else:
        return L[condition]
```

```python
def imprimir(T, p, n):
    node = searchLastNodePattern(T, p)
    if node == False:
        return None
    auxiliarList = []
    lenWord = len(p)
    lista = imprimirR(node, p, n - lenWord + 1, 1, auxiliarList)

    if lenWord == n:
        lista.insert(0, p)
    print(lista)

def imprimirR(node, p, n, cont, auxiliarList):
    if cont != 1:
        auxiliarList[0] = auxiliarList[0] + node.key

    if n == cont:
        if node.isEndOfWord == False:
            auxiliarList.pop(0)
        return auxiliarList

    if node.children == None:
        auxiliarList.pop(0)
        return auxiliarList

    if cont != 1:
        aux = auxiliarList[0]

    j = 0
    for i in node.children:
        j = j + 1
        if cont == 1:
            auxiliarList.insert(0, p)

        if (j != 1) and (cont != 1):
            auxiliarList.insert(0, aux)

        imprimirR(i, p, n, cont + 1, auxiliarList)
    return auxiliarList
```

Punto 5)

```
def getWords(T):
    if T.root == None:
        return None
    else:
        auxiliarList = []
        for i in T.root:
            auxiliarList = getWordsR(i, auxiliarList, 1)
        return auxiliarList


def getWordsR(node, auxiliarList, cont):

    if cont != 1:
        auxiliarList[0] = auxiliarList[0] + node.key

    if node.isEndOfWord == True:
        if node.children == None:
            return auxiliarList
        else:
            auxiliarList.insert(1, auxiliarList[0])

    if node.children == None:
        return auxiliarList

    if cont != 1:
        aux = auxiliarList[0]
    j = 0
    for i in node.children:
        j = j + 1
        if cont == 1:
            auxiliarList.insert(0, node.key)
        if (j != 1) and (cont != 1):
            auxiliarList.insert(0, aux)
        auxiliarList = getWordsR(i, auxiliarList, cont + 1)
    return auxiliarList
```

```
def equal(T1, T2):
    list1 = getWords(T1)
    list2 = getWords(T2)

    if (list1 == None) or (list2 == None):
        return False

    if (len(list1) != len(list2)):
        return False

    areEqual = False
    for i in list1:
        elemento = i
        for j in list2:
            if elemento == j:
                areEqual = True
        if areEqual == False:
            return areEqual
        areEqual = False
    return True
```

La complejidad es de O(m^2), siendo m la cantidad de palabras de los Trie, ya que se comparan las dos listas al final usando dos bucles anidados que recorren la longitud de las 2 listas.

Punto 6)

```
def getWordsBackwards(T):
    if T.root == None:
        return None
    else:
        auxiliarList = []
        for i in T.root:
            auxiliarList = getWordsBackwardsR(i, auxiliarList, 1)
        return auxiliarList


def getWordsBackwardsR(node, auxiliarList, cont):

    if cont != 1:
        auxiliarList[0] = node.key + auxiliarList[0]

    if node.isEndOfWord == True:
        if node.children == None:
            return auxiliarList
        else:
            auxiliarList.insert(1, auxiliarList[0])

    if node.children == None:
        return auxiliarList

    if cont != 1:
        aux = auxiliarList[0]
    j = 0
    for i in node.children:
        j = j + 1
        if cont == 1:
            auxiliarList.insert(0, node.key)
        if (j != 1) and (cont != 1):
            auxiliarList.insert(0, aux)
        auxiliarList = getWordsBackwardsR(i, auxiliarList, cont + 1)
    return auxiliarList
```

```
def invertidas(T):
    if T.root == None:
        return False

    list1 = getWords(T)
    list2 = getWordsBackwards(T)
    length = len(list1)
    for i in range(0, length):
        element = list1[i]
        for j in range(0, length):
            if element == list2[j]:
                return True
    return False
```

Punto 7)

```
def autoCompletar(Trie, cadena):
    node = searchLastNodePattern(Trie, cadena)
    word = ""
    return autoCompletarR(node, word)

def autoCompletarR(node, word):
    if node.children == None:
        return word
    if len(node.children) != 1:
        return word
    else:
        word = word + node.children[0].key
        return autoCompletarR(node.children[0], word)
```

IMPLEMENTACIONES CON LINKEDLIST

Punto 1)

```
#Busca en una LinkedList un nodo con una key == element.
#Si la encuentre devuelve el TNode, caso contrario devuelve None
def searchInL(L, element):
    if L.head == None:
        return None
    currentNode = L.head
    while currentNode != None:
        if currentNode.value.key == element:
            return currentNode.value
        currentNode = currentNode.nextNode
    return None
```

```
def insert(T, element):
    if T.root == None:
        L = linkedlist.LinkedList()
        T.root = L
    else:
        L = T.root
    return insertR(T.root, L, element)

def insertR(LastNode, L, element):
    condition = searchInL(L, element[0])

    if condition == None:
        TNode = TrieNode()
        TNode.key = element[0]
        TNode.parent = LastNode
        if len(element) == 1:
            TNode.children = None
        else:
            newList = linkedlist.LinkedList()
            TNode.children = newList
        linkedlist.add(L, TNode)
    else:
        TNode = condition

    if len(element) != 1:
        element = element[1:]
        if condition == None:
            insertR(TNode, newList, element)
        else:
            if condition.children == None:
                newList = linkedlist.LinkedList()
                condition.children = newList
            insertR(condition, condition.children, element)
        return
    else:
        TNode.isEndOfWord = True
        return
```

```
def search(T, element):
    return searchR(T.root, element)

def searchR(L, element):
    if L == None:
        return False

    condition = searchInL(L, element[0])

    if condition == None:
        return False

    if len(element) != 1:
        element = element[1:]
        return searchR(condition.children, element)
    else:
        if condition.isEndOfWord == True:
            return True
        else:
            return False
```

Punto 3)

```
#Función que busca un elemento en el Trie, si existe
#devuelve el último nodo correspondiente al elemento. Caso contrario, devuelve False
def searchForLastNode(T, element):
    return searchForLastNodeR(T.root, element)

def searchForLastNodeR(L, element):
    condition = searchInL(L, element[0])

    if condition == None:
        return False

    if len(element) != 1:
        element = element[1:]
        return searchForLastNodeR(condition.children, element)
    else:
        if condition.isEndOfWord == True:
            return condition
        else:
            return False
```

```
def delete(T, element):
    condition = search(T, element)
    if condition == False:
        return False
    finalNode = searchForLastNode(T, element)
    finalNode.isEndOfWord = False

    return deleteR(T, finalNode, element)

def deleteR(T, finalNode, element):

    if finalNode.children != None:
        finalNode.isEndOfWord = False
        return True
    else:
        if finalNode.isEndOfWord == False:
            if finalNode.parent == T.root:
                linkedlist.delete(T.root, finalNode)
                return True
            parentNode = finalNode.parent
            parentList = parentNode.children
            linkedlist.delete(parentList, finalNode)

            if linkedlist.length(parentList) ==  0:
                parentNode.children = None
            return deleteR(T, finalNode.parent, element)
        else:
            return True
```

Punto 4)

```
def searchLastNodePattern(T, element):
    return searchLastNodePatternR(T.root, element)

def searchLastNodePatternR(L, element):
    condition = searchInL(L, element[0])
    if condition == None:
        return False

    if len(element) != 1:
        element = element[1:]
        return searchLastNodePatternR(condition.children, element)
    else:
        return condition
```

```
def imprimir(T, p, n):
    node = searchLastNodePattern(T, p)
    if node == False:
        return None
    auxiliarList = linkedlist.LinkedList()
    lenWord = len(p)
    lista = imprimirR(node, p , n - lenWord + 1, 1, auxiliarList)

    if lenWord == n:
        linkedlist.add(auxiliarList, p)
    linkedlist.printlist(lista)

def imprimirR(node, p, n, cont, auxiliarList):
    if cont != 1:
        auxiliarList.head.value = auxiliarList.head.value + node.key
    if n == cont:
        if node.isEndOfWord == False:
            linkedlist.pop(auxiliarList)
        return auxiliarList

    if node.children == None:
        linkedlist.pop(auxiliarList)
        return auxiliarList

    if cont != 1:
        aux = auxiliarList.head.value

    j = 0
    currentNode = node.children.head
    while currentNode != None:
        j = j + 1
        if cont == 1:
            linkedlist.add(auxiliarList, p)
        if (j != 1) and (cont != 1):
            linkedlist.add(auxiliarList, aux)

        imprimirR(currentNode.value, p, n, cont + 1, auxiliarList)
        currentNode = currentNode.nextNode
    return auxiliarList
```

Punto 5)

```
def getWords(T):
    if T.root == None:
        return None
    else:
        auxiliarList = linkedlist.LinkedList()
        currentNode = T.root.head
        while currentNode != None:
            auxiliarList = getWordsR(currentNode.value, auxiliarList, 1)
            currentNode = currentNode.nextNode
        return auxiliarList
```

```
def getWordsR(node, auxiliarList, cont):

    if cont != 1:
        auxiliarList.head.value = auxiliarList.head.value + node.key

    if node.isEndOfWord == True:
        if node.children == None:
            return auxiliarList
        else:
            linkedlist.add(auxiliarList, auxiliarList.head.value)

    if node.children == None:
        return auxiliarList

    if cont != 1:
        aux = auxiliarList.head.value

    j = 0
    currentNode = node.children.head
    while currentNode != None:
        j = j + 1
        if cont == 1:
            linkedlist.add(auxiliarList, node.key)
        if (j != 1) and (cont != 1):
            linkedlist.add(auxiliarList, aux)
        auxiliarList = getWordsR(currentNode.value, auxiliarList, cont + 1)
        currentNode = currentNode.nextNode
    return auxiliarList
```

```
def equal(T1, T2):
    list1 = getWords(T1)
    list2 = getWords(T2)

    if (list1.head == None) or (list2.head == None):
        return False

    if (linkedlist.length(list1)) != (linkedlist.length(list2)):
        return False

    areEqual = False
    currentNode1 = list1.head
    while currentNode1 != None:
        elemento = currentNode1.value
        currentNode2 = list2.head

        while currentNode2 != None:
            if elemento == currentNode2.value:
                areEqual = True
            currentNode2 = currentNode2.nextNode
        if areEqual == False:
            return areEqual
        areEqual = False
        currentNode1 = currentNode1.nextNode
    return True
```

Punto 6)

```
def getWordsBackwards(T):
    if T.root == None:
        return None
    else:
        auxiliarList = linkedlist.LinkedList()
        currentNode = T.root.head
        while currentNode != None:
            auxiliarList = getWordsBackwardsR(currentNode.value, auxiliarList, 1)
            currentNode = currentNode.nextNode
        return auxiliarList

def getWordsBackwardsR(node, auxiliarList, cont):

    if cont != 1:
        auxiliarList.head.value = node.key + auxiliarList.head.value

    if node.isEndOfWord == True:
        if node.children == None:
            return auxiliarList
        else:
            linkedlist.add(auxiliarList, auxiliarList.head.value)

    if node.children == None:
        return auxiliarList

    if cont != 1:
        aux = auxiliarList.head.value
    j = 0
    currentNode = node.children.head
    while currentNode != None:
        j = j + 1
        if cont == 1:
            linkedlist.add(auxiliarList, node.key)
        if (j != 1) and (cont != 1):
            linkedlist.add(auxiliarList, aux)
        auxiliarList = getWordsBackwardsR(currentNode.value, auxiliarList, cont + 1)
        currentNode = currentNode.nextNode
    return auxiliarList
```

```
def invertidas(T):
    if T.root == None:
        return False

    list1 = getWords(T)
    list2 = getWordsBackwards(T)
    currentNode = list1.head
    while currentNode != None:
        element = currentNode.value
        currentNode2 = list2.head
        while currentNode2 != None:
            if element == currentNode2.value:
                return True
            currentNode2 = currentNode2.nextNode
        currentNode = currentNode.nextNode
    return False
```

Punto 7)

```
def autoCompletar(Trie, cadena):
    node = searchLastNodePattern(Trie, cadena)
    word = ""
    return autoCompletarR(node, word)

def autoCompletarR(node, word):
    if node.children == None:
        return word
    if node.children.head.nextNode != None:
        return word
    else:
        word = word + node.children.head.value.key
        return autoCompletarR(node.children.head.value, word)
```

Link al código: https://github.com/Kilxz/algoritmos2/tree/main/practicas/tp-trie/code