Birla Institute of Technology & Science, Pilani

Work-Integrated Learning Programmes Division
MTech in Data Science & Engineering
S2_2022-2023, DSECLZG519- Data Structures & Algorithms Design
Assignment 1 – PS03 - Text Editor

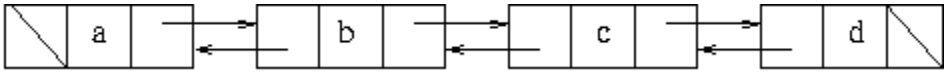
Group Number: 03

(Group ID: DSAD_Group 03)

Data Structure Model:

We needed to create a Text Editor, which supports insertion anywhere, along with deletion anywhere and it also allows the movement among the list freely. To make this happen we needed a data structure and algorithm and we have chosen Doubly Linked List which can insert anywhere at cursor point, delete anywhere at cursor point, also we can move around using the next and previous pointers.

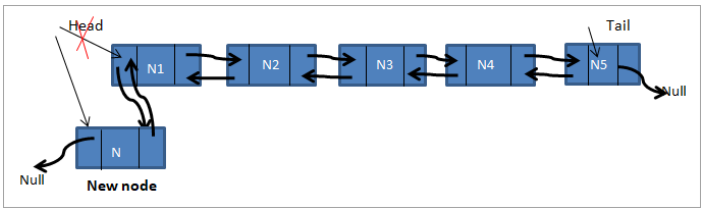
Doubly linked list is a list structure in which each cell in the list has a pointer to the cell before it and also a pointer to the cell behind it



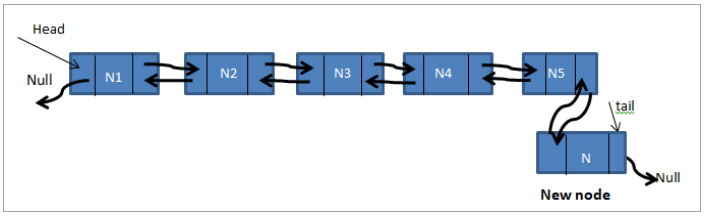
Commands:

AddText: The char will be added/inserted following the insertion point and this point will become the new insertion point.

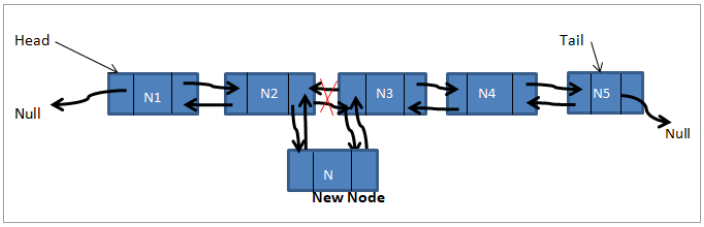
Insert a node at the front



Insert node at the end



Insert node before/after given node



DeleteText: This will delete the element from the current cursor point and deletion point becomes the current point of the list.

MoveRight: This will move the pointer to the Rightward/forward direction of the list.

MoveLeft: This will move the pointer to the Leftward/backward direction of the list.

PrintText: This will print whatever text is available in the list.

Operations:

Together with these four functionalities, the algorithm checks for the empty list, so that if the list is empty move operations and deletion will not be performed.

Here we are using the Strip() method in Python which removes or truncates the given characters from the beginning and the end of the original string which make the command format to work easily. Using this method, we can give the instruction as a single command.

Entire code is written in python language which can accept commands from file named inputPS03 and output is written to file named outputPS03. We are using file handling techniques Using this method, we can give the instruction as a single command.

Algorithms

Add Algorithm used:

1.Start

2.Create a new node with 3 variables: 1.Prev 2.Data 3.Next

3.Store the new data in the data variable

4. If the list is empty, make a new node as head

5. Otherwise, link the address of the existing first node to the next variable of the new node, and assign null to the prev variable.

6. Point the head to the new node

7.end

Deletion Algorithm

1.Start

2.Check the status of the double linked list

3. If the list is empty, deletion is not possible

4.If the list is not empty then run a loop for the number of deletions and save the next of the current cursor.

4.1 Move the cursor to the left.

5. Connect the current node to the saved variable in Step 4.

6.End

Implementation:

We need to implement a normal doubly linked list of characters with

AddText:
<command><space><string><newline>
DeleteText
<command><space><no_of_backspace_strokes><newline>
MoveLeft / MoveRight
<command><space><no_of_arraw_key_strokes><newline>
PrintText
<command><newline>

Time complexity /Run Time Analysis for doubly Linked List

Operation	Time complexity(worst case)	Time Complexity (average Case)
Insert at beginning or End or at Cursor	0(1)	0(1)
Delete at beginning or end or at Cursor	0(1)	0(1)
search	0(n)	0(n)
Access	0(n)	0(n)

O(k) for Insert Text where K length of text to be inserted.

O(m) for Delete Text ,move Left, move Right where m is number provided as argument.

O(n) for Print Text where n is total letters in editor.

O(1) for Space complexity as no additional space needed.

Let us discuss some of the advantages and disadvantages of doubly linked list

Advantages:

- The doubly linked list can be traversed in forward as well as backward directions
- Delete operation in a doubly-linked list is more efficient when a specific node is given.This hits the performance.

Disadvantages:

- As the doubly linked list contains one more extra pointer, the memory space taken up by the doubly linked list is larger when compared to the singly linked list.
- Since two pointers are present i.e. previous and next, all the operations performed on the doubly linked list have to take care of these pointers and maintain them thereby resulting in a management overhead.

Alternate way of modeling /Cost Implementation.

An alternate way of modeling can be achieved by **Singly linked list** but in this Move Left and Delete operation comes with management and computation overhead.

In Doubly linked list the run time complexity of delete and Move Left operation is O(m) where m is the number of arguments where most of the times (m<<n) [n is the length of linked list.]

But in alternate way(singly linked list) the run time complexity is increased to O(n) as we can only reach to any node that is left of current cursor by only starting from the head.