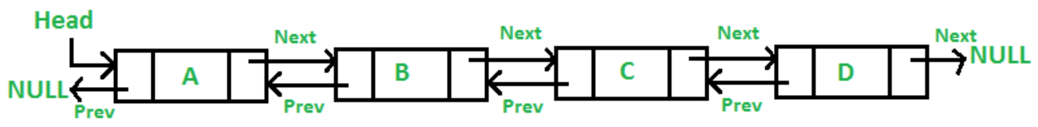
Doubly Linked List | Set 1 (Introduction and Insertion)

We strongly recommend to refer following post as a prerequisite of this post.

Linked List Introduction
Inserting a node in Singly Linked List

A **D**oubly **L**inked **L**ist (DLL) contains an extra pointer, typically called *previous pointer*, together with next pointer and data which are there in singly linked list.



Following is representation of a DLL node in C language.

C

```
/* Node of a doubly linked list */
struct Node {
    int data;
    struct Node* next; // Pointer to next node in DLL
    struct Node* prev; // Pointer to previous node in DLL
};
```

Java

```
// Class for Doubly Linked List
public class DLL {
    Node head; // head of list

    /* Doubly Linked list Node*/
    class Node {
        int data;
        Node prev;
        Node next;

        // Constructor to create a new node
        // next and prev is by default initialized as null
        Node(int d) { data = d; }
    }
}
```

Python3

```
# Node of a doubly linked list
class Node:
    def __init__(self, next=None, prev=None, data=None):
        self.next = next # reference to next node in DLL
        self.prev = prev # reference to previous node in DLL
        self.data = data
```

Following are advantages/disadvantages of doubly linked list over singly linked list.

Advantages over singly linked list

1) A DLL can be traversed in both forward and backward direction.

2) The delete operation in DLL is more efficient if pointer to the node to be deleted is given.

3) We can quickly insert a new node before a given node.

In singly linked list, to delete a node, pointer to the previous node is needed. To get this previous node, sometimes the list is traversed. In DLL, we can get the previous node using previous pointer.

Disadvantages over singly linked list

1) Every node of DLL Require extra space for an previous pointer. It is possible to implement DLL with single pointer though (See this and this).

2) All operations require an extra pointer previous to be maintained. For example, in insertion, we need to modify previous pointers together with next pointers. For example in following functions for insertions at different positions, we need 1 or 2 extra steps to set previous pointer.

Insertion

A node can be added in four ways

1) At the front of the DLL

2) After a given node.

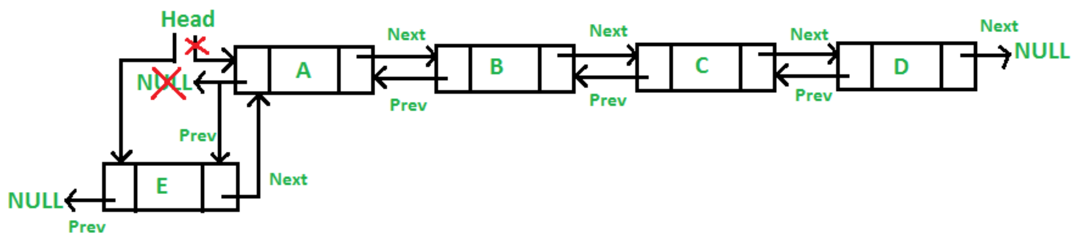
3) At the end of the DLL

4) Before a given node.

Recommended: Please solve it on "*PRACTICE*" first, before moving on to the solution.

1) Add a node at the front: (A 5 steps process)

The new node is always added before the head of the given Linked List. And newly added node becomes the new head of DLL. For example if the given Linked List is 10152025 and we add an item 5 at the front, then the Linked List becomes 510152025. Let us call the function that adds at the front of the list is push(). The push() must receive a pointer to the head pointer, because push must change the head pointer to point to the new node (See this)



Following are the 5 steps to add node at the front.

C

```
/* Given a reference (pointer to pointer) to the head of a list
   and an int, inserts a new node on the front of the list. */
void push(struct Node** head_ref, int new_data)
{
    /* 1. allocate node */
    struct Node* new_node = (struct Node*)malloc(sizeof(struct Node));

    /* 2. put in the data  */
    new_node->data = new_data;
    /* 3. Make next of new node as head and previous as NULL */
    new_node->next = (*head_ref);
    new_node->prev = NULL;

    /* 4. change prev of head node to new node */
    if ((*head_ref) != NULL)
        (*head_ref)->prev = new_node;

    /* 5. move the head to point to the new node */
    (*head_ref) = new_node;
}
```

Java

```
// Adding a node at the front of the list
public void push(int new_data)
{
    /* 1. allocate node
    * 2. put in the data */
    Node new_Node = new Node(new_data);

    /* 3. Make next of new node as head and previous as NULL */
    new_Node.next = head;
    new_Node.prev = null;

    /* 4. change prev of head node to new node */
    if (head != null)
        head.prev = new_Node;

    /* 5. move the head to point to the new node */
    head = new_Node;
}
```

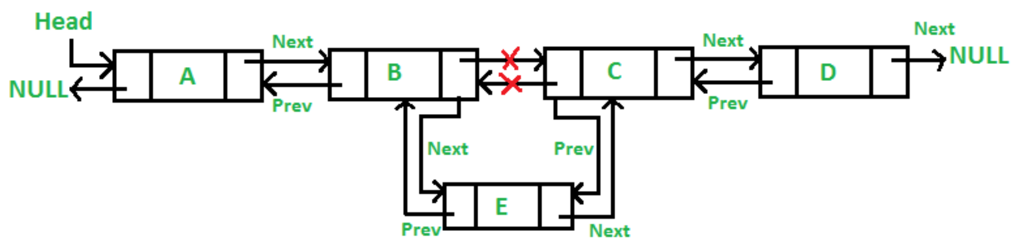
Python3

```
# Adding a node at the front of the list
def push(self, new_data):

    # 1 & 2: Allocate the Node & Put in the data
    new_node = Node(data = new_data)

    # 3. Make next of new node as head and previous as NULL
    new_node.next = self.head
    new_node.prev = None

    # 4. change prev of head node to new node
    if self.head is not None:
        self.head.prev = new_node

    # 5. move the head to point to the new node
    self.head = new_node

# This code is contributed by jatinreaper
```

Four steps of the above five steps are same as the 4 steps used for inserting at the front in singly linked list. The only extra step is to change previous of head.

2) Add a node after a given node.: (A 7 steps process)

We are given pointer to a node as prev_node, and the new node is inserted after the given node.



C

```c
/* Given a node as prev_node, insert a new node after the given node */
void insertAfter(struct Node* prev_node, int new_data)
{
    /*1. check if the given prev_node is NULL */
    if (prev_node == NULL) {
        printf("the given previous node cannot be NULL");
        return;
    }

    /* 2. allocate new node */
    struct Node* new_node = (struct Node*)malloc(sizeof(struct Node));

    /* 3. put in the data  */
    new_node->data = new_data;

    /* 4. Make next of new node as next of prev_node */
    new_node->next = prev_node->next;

    /* 5. Make the next of prev_node as new_node */
    prev_node->next = new_node;

    /* 6. Make prev_node as previous of new_node */
    new_node->prev = prev_node;

    /* 7. Change previous of new_node's next node */
    if (new_node->next != NULL)
        new_node->next->prev = new_node;
}
```

Java

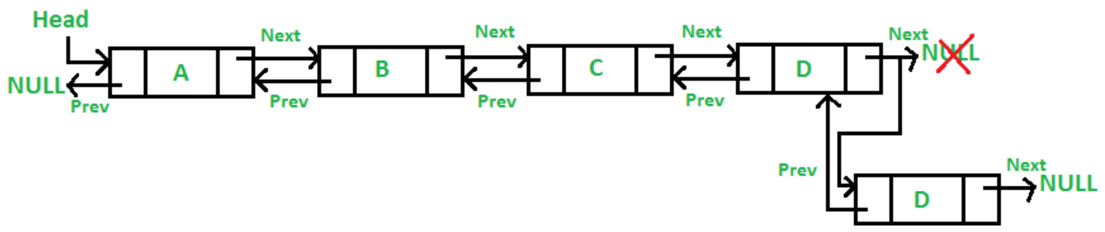
```java
/* Given a node as prev_node, insert a new node after the given node */
public void InsertAfter(Node prev_Node, int new_data)
{

    /*1. check if the given prev_node is NULL */
    if (prev_Node == null) {
        System.out.println("The given previous node cannot be NULL ");
        return;
    }

    /* 2. allocate node
    * 3. put in the data */
    Node new_node = new Node(new_data);

    /* 4. Make next of new node as next of prev_node */
    new_node.next = prev_Node.next;

    /* 5. Make the next of prev_node as new_node */
    prev_Node.next = new_node;

    /* 6. Make prev_node as previous of new_node */
    new_node.prev = prev_Node;

    /* 7. Change previous of new_node's next node */
    if (new_node.next != null)
        new_node.next.prev = new_node;
}
```

Python3

```
# Given a node as prev_node, insert
# a new node after the given node

def insertAfter(self, prev_node, new_data):

        # 1. check if the given prev_node is NULL
        if prev_node is None:
            print("This node doesn't exist in DLL")
            return

        #2. allocate node  & 3. put in the data
        new_node = Node(data = new_data)

        # 4. Make next of new node as next of prev_node
        new_node.next = prev_node.next

        # 5. Make the next of prev_node as new_node
        prev_node.next = new_node

        # 6. Make prev_node as previous of new_node
        new_node.prev = prev_node

        # 7. Change previous of new_node's next node */
        if new_node.next is not None:
            new_node.next.prev = new_node

#  This code is contributed by jatinreaper
```

Five of the above steps step process are same as the 5 steps used for inserting after a given node in singly linked list. The two extra steps are needed to change previous pointer of new node and previous pointer of new node's next node.

3) Add a node at the end: (7 steps process)
The new node is always added after the last node of the given Linked List. For example if the given DLL is 510152025 and we add an item 30 at the end, then the DLL becomes 51015202530.
Since a Linked List is typically represented by the head of it, we have to traverse the list till end and then change the next of last node to new node.



Following are the 7 steps to add node at the end.

C

```
/* Given a reference (pointer to pointer) to the head
   of a DLL and an int, appends a new node at the end  */
void append(struct Node** head_ref, int new_data)
{
    /* 1. allocate node */
    struct Node* new_node = (struct Node*)malloc(sizeof(struct Node));

    struct Node* last = *head_ref; /* used in step 5*/

    /* 2. put in the data  */
    new_node->data = new_data;

    /* 3. This new node is going to be the last node, so
          make next of it as NULL*/
    new_node->next = NULL;

    /* 4. If the Linked List is empty, then make the new
          node as head */
    if (*head_ref == NULL) {
        new_node->prev = NULL;
        *head_ref = new_node;
        return;
    }

    /* 5. Else traverse till the last node */
    while (last->next != NULL)
        last = last->next;

    /* 6. Change the next of last node */
    last->next = new_node;

    /* 7. Make last node as previous of new node */
    new_node->prev = last;

    return;
}
```

Java

```
// Add a node at the end of the list
void append(int new_data)
{
    /* 1. allocate node
     * 2. put in the data */
    Node new_node = new Node(new_data);

    Node last = head; /* used in step 5*/

    /* 3. This new node is going to be the last node, so
     * make next of it as NULL*/
    new_node.next = null;

    /* 4. If the Linked List is empty, then make the new
     * node as head */
    if (head == null) {
        new_node.prev = null;
        head = new_node;
        return;
    }

    /* 5. Else traverse till the last node */
    while (last.next != null)
        last = last.next;

    /* 6. Change the next of last node */
    last.next = new_node;

    /* 7. Make last node as previous of new node */
    new_node.prev = last;
}
```

Python3

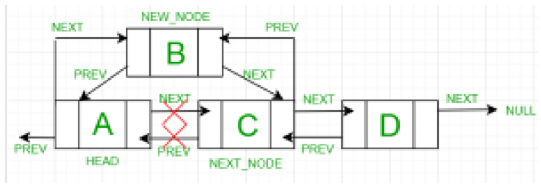
```
# Add a node at the end of the DLL
def append(self, new_data):

        # 1. allocate node 2. put in the data
        new_node = Node(data = new_data)
        last = self.head

        # 3. This new node is going to be the
        # last node, so make next of it as NULL
        new_node.next = None

        # 4. If the Linked List is empty, then
        #  make the new node as head
        if self.head is None:
            new_node.prev = None
            self.head = new_node
            return
        # 5. Else traverse till the last node
        while (last.next is not None):
            last = last.next

        # 6. Change the next of last node
        last.next = new_node
        # 7. Make last node as previous of new node */
        new_node.prev = last

#  This code is contributed by jatinreaper
```

Six of the above 7 steps are same as the 6 steps used for inserting after a given node in singly linked list. The one extra step is needed to change previous pointer of new node.

4) Add a node before a given node:

Steps
Let the pointer to this given node be next_node and the data of the new node to be added as new_data.

1. Check if the next_node is NULL or not. If it's NULL, return from the function because any new node can not be added before a NULL
2. Allocate memory for the new node, let it be called new_node
3. Set new_node->data = new_data
4. Set the previous pointer of this new_node as the previous node of the next_node, new_node->prev = next_node->prev
5. Set the previous pointer of the next_node as the new_node, next_node->prev = new_node
6. Set the next pointer of this new_node as the next_node, new_node->next = next_node;
7. If the previous node of the new_node is not NULL, then set the next pointer of this previous node as new_node, new_node->prev->next = new_node
8. Else, if the prev of new_node is NULL, it will be the new head node. So, make (*head_ref) = new_node.



Below is the implementaton of the above approach:

C++

```
// A complete working C program to demonstrate all
// insertion before a given node
#include <stdio.h>
#include <stdlib.h>

// A linked list node
struct Node {
    int data;
    struct Node* next;
    struct Node* prev;
};

/* Given a reference (pointer to pointer) to the head of a list
and an int, inserts a new node on the front of the list. */
void push(struct Node** head_ref, int new_data)
{
    struct Node* new_node = (struct Node*)malloc(sizeof(struct Node));

    new_node->data = new_data;

    new_node->next = (*head_ref);
    new_node->prev = NULL;

    if ((*head_ref) != NULL)
        (*head_ref)->prev = new_node;

    (*head_ref) = new_node;
}
```

```c
/* Given a node as next_node, insert a new node before the given node */
void insertBefore(struct Node** head_ref, struct Node* next_node, int new_data)
{
    /*1. check if the given next_node is NULL */
    if (next_node == NULL) {
        printf("the given next node cannot be NULL");
        return;
    }

    /* 2. allocate new node */
    struct Node* new_node = (struct Node*)malloc(sizeof(struct Node));

    /* 3. put in the data */
    new_node->data = new_data;

    /* 4. Make prev of new node as prev of next_node */
    new_node->prev = next_node->prev;

    /* 5. Make the prev of next_node as new_node */
    next_node->prev = new_node;

    /* 6. Make next_node as next of new_node */
    new_node->next = next_node;

    /* 7. Change next of new_node's previous node */
    if (new_node->prev != NULL)
        new_node->prev->next = new_node;
    /* 8. If the prev of new_node is NULL, it will be
       the new head node */
    else
        (*head_ref) = new_node;

}

// This function prints contents of linked list starting from the given node
void printList(struct Node* node)
{
    struct Node* last;
    printf("\nTraversal in forward direction \n");
    while (node != NULL) {
        printf(" %d ", node->data);
        last = node;
        node = node->next;
    }

    printf("\nTraversal in reverse direction \n");
    while (last != NULL) {
        printf(" %d ", last->data);
        last = last->prev;
    }
}

/* Driver program to test above functions*/
int main()
{
    /* Start with the empty list */
    struct Node* head = NULL;
    push(&head, 7);

    push(&head, 1);

    push(&head, 4);

    // Insert 8, before 1. So linked list becomes 4->8->1->7->NULL
    insertBefore(&head, head->next, 8);

    printf("Created DLL is: ");
    printList(head);

    getchar();
    return 0;
}
```

Output:

```
Created DLL is:
Traversal in forward direction
 4  8  1  7
Traversal in reverse direction
 7  1  8  4
```

A complete working program to test above functions.

Following is complete program to test above functions.

C++

```cpp
// A complete working C++ program to
// demonstrate all insertion methods
#include <bits/stdc++.h>
using namespace std;

// A linked list node
class Node
{
    public:
    int data;
    Node* next;
    Node* prev;
};

/* Given a reference (pointer to pointer) to the head of a list
and an int, inserts a new node on the front of the list. */
void push(Node** head_ref, int new_data)
{
    /* 1. allocate node */
    Node* new_node = new Node();

    /* 2. put in the data */
    new_node->data = new_data;

    /* 3. Make next of new node as head and previous as NULL */
    new_node->next = (*head_ref);
    new_node->prev = NULL;

    /* 4. change prev of head node to new node */
    if ((*head_ref) != NULL)
        (*head_ref)->prev = new_node;

    /* 5. move the head to point to the new node */
    (*head_ref) = new_node;
}

/* Given a node as prev_node, insert a new node after the given node */
void insertAfter(Node* prev_node, int new_data)
{
    /*1. check if the given prev_node is NULL */
    if (prev_node == NULL)
    {
        cout<<"the given previous node cannot be NULL";
        return;
    }

    /* 2. allocate new node */
    Node* new_node = new Node();

    /* 3. put in the data */
    new_node->data = new_data;

    /* 4. Make next of new node as next of prev_node */
    new_node->next = prev_node->next;

    /* 5. Make the next of prev_node as new_node */
    prev_node->next = new_node;

    /* 6. Make prev_node as previous of new_node */
    new_node->prev = prev_node;

    /* 7. Change previous of new_node's next node */
    if (new_node->next != NULL)
        new_node->next->prev = new_node;
}
```

```
/* Given a reference (pointer to pointer) to the head
of a DLL and an int, appends a new node at the end */
void append(Node** head_ref, int new_data)
{
    /* 1. allocate node */
    Node* new_node = new Node();

    Node* last = *head_ref; /* used in step 5*/

    /* 2. put in the data */
    new_node->data = new_data;

    /* 3. This new node is going to be the last node, so
        make next of it as NULL*/
    new_node->next = NULL;

    /* 4. If the Linked List is empty, then make the new
        node as head */
    if (*head_ref == NULL)
    {
        new_node->prev = NULL;
        *head_ref = new_node;
        return;
    }

    /* 5. Else traverse till the last node */
    while (last->next != NULL)
        last = last->next;

    /* 6. Change the next of last node */
    last->next = new_node;

    /* 7. Make last node as previous of new node */
    new_node->prev = last;

    return;
}

// This function prints contents of
// linked list starting from the given node
void printList(Node* node)
{
    Node* last;
    cout<<"\nTraversal in forward direction \n";
    while (node != NULL)
    {
        cout<<" "<<node->data<<" ";
        last = node;
        node = node->next;
    }

    cout<<"\nTraversal in reverse direction \n";
    while (last != NULL)
    {
        cout<<" "<<last->data<<" ";
        last = last->prev;
    }
}

/* Driver program to test above functions*/
int main()
{
    /* Start with the empty list */
    Node* head = NULL;

    // Insert 6. So linked list becomes 6->NULL
    append(&head, 6);

    // Insert 7 at the beginning. So
    // linked list becomes 7->6->NULL
    push(&head, 7);

    // Insert 1 at the beginning. So
    // linked list becomes 1->7->6->NULL
    push(&head, 1);

    // Insert 4 at the end. So linked
    // list becomes 1->7->6->4->NULL
    append(&head, 4);

    // Insert 8, after 7. So linked
    // list becomes 1->7->8->6->4->NULL
    insertAfter(head->next, 8);

    cout << "Created DLL is: ";
    printList(head);

    return 0;
}

// This is code is contributed by rathbhupendra
```

C

```
// A complete working C program to demonstrate all insertion methods
#include <stdio.h>
#include <stdlib.h>

// A linked list node
struct Node {
    int data;
    struct Node* next;
    struct Node* prev;
};

/* Given a reference (pointer to pointer) to the head of a list
   and an int, inserts a new node on the front of the list. */
void push(struct Node** head_ref, int new_data)
{
    /* 1. allocate node */
    struct Node* new_node = (struct Node*)malloc(sizeof(struct Node));

    /* 2. put in the data  */
    new_node->data = new_data;

    /* 3. Make next of new node as head and previous as NULL */
    new_node->next = (*head_ref);
    new_node->prev = NULL;

    /* 4. change prev of head node to new node */
    if ((*head_ref) != NULL)
        (*head_ref)->prev = new_node;

    /* 5. move the head to point to the new node */
    (*head_ref) = new_node;
}

/* Given a node as prev_node, insert a new node after the given node */
void insertAfter(struct Node* prev_node, int new_data)
{
    /*1. check if the given prev_node is NULL */
    if (prev_node == NULL) {
        printf("the given previous node cannot be NULL");
        return;
    }

    /* 2. allocate new node */
    struct Node* new_node = (struct Node*)malloc(sizeof(struct Node));

    /* 3. put in the data  */
    new_node->data = new_data;

    /* 4. Make next of new node as next of prev_node */
    new_node->next = prev_node->next;

    /* 5. Make the next of prev_node as new_node */
    prev_node->next = new_node;

    /* 6. Make prev_node as previous of new_node */
    new_node->prev = prev_node;

    /* 7. Change previous of new_node's next node */
    if (new_node->next != NULL)
        new_node->next->prev = new_node;
}

/* Given a reference (pointer to pointer) to the head
   of a DLL and an int, appends a new node at the end  */
void append(struct Node** head_ref, int new_data)
{
    /* 1. allocate node */
    struct Node* new_node = (struct Node*)malloc(sizeof(struct Node));

    struct Node* last = *head_ref; /* used in step 5*/

    /* 2. put in the data  */
    new_node->data = new_data;

    /* 3. This new node is going to be the last node, so
          make next of it as NULL*/
    new_node->next = NULL;

    /* 4. If the Linked List is empty, then make the new
          node as head */
    if (*head_ref == NULL) {
        new_node->prev = NULL;
        *head_ref = new_node;
        return;
    }

    /* 5. Else traverse till the last node */
    while (last->next != NULL)
        last = last->next;

    /* 6. Change the next of last node */
    last->next = new_node;

    /* 7. Make last node as previous of new node */
    new_node->prev = last;

    return;
}

// This function prints contents of linked list starting from the given node
void printList(struct Node* node)
{
    struct Node* last;
    printf("\nTraversal in forward direction \n");
    while (node != NULL) {
        printf(" %d ", node->data);
        last = node;
        node = node->next;
    }

    printf("\nTraversal in reverse direction \n");
    while (last != NULL) {
        printf(" %d ", last->data);
        last = last->prev;
    }
}

/* Drier program to test above functions*/
int main()
{
    /* Start with the empty list */
    struct Node* head = NULL;

    // Insert 6.  So linked list becomes 6->NULL
    append(&head, 6);

    // Insert 7 at the beginning. So linked list becomes 7->6->NULL
    push(&head, 7);

    // Insert 1 at the beginning. So linked list becomes 1->7->6->NULL
    push(&head, 1);

    // Insert 4 at the end. So linked list becomes 1->7->6->4->NULL
    append(&head, 4);

    // Insert 8, after 7. So linked list becomes 1->7->8->6->4->NULL
    insertAfter(head->next, 8);

    printf("Created DLL is: ");
    printList(head);

    getchar();
    return 0;
}
```

Java

```
// A complete working Java program to demonstrate all

// Class for Doubly Linked List
public class DLL {
    Node head; // head of list

    /* Doubly Linked list Node*/
    class Node {
        int data;
        Node prev;
        Node next;

        // Constructor to create a new node
        // next and prev is by default initialized as null
        Node(int d) { data = d; }
    }

    // Adding a node at the front of the list
    public void push(int new_data)
    {
        /* 1. allocate node
        * 2. put in the data */
        Node new_Node = new Node(new_data);

        /* 3. Make next of new node as head and previous as NULL */
        new_Node.next = head;
        new_Node.prev = null;

        /* 4. change prev of head node to new node */
        if (head != null)
            head.prev = new_Node;

        /* 5. move the head to point to the new node */
        head = new_Node;
    }

    /* Given a node as prev_node, insert a new node after the given node */
    public void InsertAfter(Node prev_Node, int new_data)
    {

        /*1. check if the given prev_node is NULL */
        if (prev_Node == null) {
            System.out.println("The given previous node cannot be NULL ");
            return;
        }

        /* 2. allocate node
        * 3. put in the data */
        Node new_node = new Node(new_data);

        /* 4. Make next of new node as next of prev_node */
        new_node.next = prev_Node.next;

        /* 5. Make the next of prev_node as new_node */
        prev_Node.next = new_node;

        /* 6. Make prev_node as previous of new_node */
        new_node.prev = prev_Node;

        /* 7. Change previous of new_node's next node */
        if (new_node.next != null)
            new_node.next.prev = new_node;
    }

    // Add a node at the end of the list
    void append(int new_data)
    {
        /* 1. allocate node
        * 2. put in the data */
        Node new_node = new Node(new_data);

        Node last = head; /* used in step 5*/

        /* 3. This new node is going to be the last node, so
        * make next of it as NULL*/
        new_node.next = null;

        /* 4. If the Linked List is empty, then make the new
```

```
         * node as head */
        if (head == null) {
            new_node.prev = null;
            head = new_node;
            return;
        }

        /* 5. Else traverse till the last node */
        while (last.next != null)
            last = last.next;

        /* 6. Change the next of last node */
        last.next = new_node;

        /* 7. Make last node as previous of new node */
        new_node.prev = last;
    }

    // This function prints contents of linked list starting from the given node
    public void printlist(Node node)
    {
        Node last = null;
        System.out.println("Traversal in forward Direction");
        while (node != null) {
            System.out.print(node.data + " ");
            last = node;
            node = node.next;
        }
        System.out.println();
        System.out.println("Traversal in reverse direction");
        while (last != null) {
            System.out.print(last.data + " ");
            last = last.prev;
        }
    }

    /* Drier program to test above functions*/
    public static void main(String[] args)
    {
        /* Start with the empty list */
        DLL dll = new DLL();

        // Insert 6. So linked list becomes 6->NULL
        dll.append(6);

        // Insert 7 at the beginning. So linked list becomes 7->6->NULL
        dll.push(7);

        // Insert 1 at the beginning. So linked list becomes 1->7->6->NULL
        dll.push(1);

        // Insert 4 at the end. So linked list becomes 1->7->6->4->NULL
        dll.append(4);

        // Insert 8, after 7. So linked list becomes 1->7->8->6->4->NULL
        dll.InsertAfter(dll.head.next, 8);

        System.out.println("Created DLL is: ");
        dll.printlist(dll.head);
    }
}

// This code is contributed by Sumit Ghosh
```

Python

```
# A complete working Python program to demonstrate all
# insertion methods

# A linked list node
class Node:

    # Constructor to create a new node
    def __init__(self, data):
        self.data = data
        self.next = None
        self.prev = None
```

```
# Class to create a Doubly Linked List
class DoublyLinkedList:

    # Constructor for empty Doubly Linked List
    def __init__(self):
        self.head = None

    # Given a reference to the head of a list and an
    # integer, inserts a new node on the front of list
    def push(self, new_data):

        # 1. Allocates node
        # 2. Put the data in it
        new_node = Node(new_data)

        # 3. Make next of new node as head and
        # previous as None (already None)
        new_node.next = self.head

        # 4. change prev of head node to new_node
        if self.head is not None:
            self.head.prev = new_node

        # 5. move the head to point to the new node
        self.head = new_node

    # Given a node as prev_node, insert a new node after
    # the given node
    def insertAfter(self, prev_node, new_data):

        # 1. Check if the given prev_node is None
        if prev_node is None:
            print "the given previous node cannot be NULL"
            return

        # 2. allocate new node
        # 3. put in the data
        new_node = Node(new_data)

        # 4. Make net of new node as next of prev node
        new_node.next = prev_node.next

        # 5. Make prev_node as previous of new_node
        prev_node.next = new_node

        # 6. Make prev_node ass previous of new_node
        new_node.prev = prev_node

        # 7. Change previous of new_nodes's next node
        if new_node.next is not None:
            new_node.next.prev = new_node

    # Given a reference to the head of DLL and integer,
    # appends a new node at the end
    def append(self, new_data):

        # 1. Allocates node
        # 2. Put in the data
        new_node = Node(new_data)

        # 3. This new node is going to be the last node,
        # so make next of it as None
        new_node.next = None

        # 4. If the Linked List is empty, then make the
        # new node as head
        if self.head is None:
            new_node.prev = None
            self.head = new_node
            return

        # 5. Else traverse till the last node
        last = self.head
        while(last.next is not None):
            last = last.next

        # 6. Change the next of last node
        last.next = new_node

        # 7. Make last node as previous of new node
        new_node.prev = last
        return

    # This function prints contents of linked list
    # starting from the given node
    def printList(self, node):

        print "\nTraversal in forward direction"
        while(node is not None):
            print " % d" %(node.data),
            last = node
            node = node.next

        print "\nTraversal in reverse direction"
        while(last is not None):
            print " % d" %(last.data),
            last = last.prev

# Driver program to test above functions

# Start with empty list
llist = DoublyLinkedList()

# Insert 6. So the list becomes 6->None
llist.append(6)

# Insert 7 at the beginning.
# So linked list becomes 7->6->None
llist.push(7)

# Insert 1 at the beginning.
# So linked list becomes 1->7->6->None
llist.push(1)

# Insert 4 at the end.
# So linked list becomes 1->7->6->4->None
llist.append(4)

# Insert 8, after 7.
# So linked list becomes 1->7->8->6->4->None
llist.insertAfter(llist.head.next, 8)

print "Created DLL is: ",
llist.printList(llist.head)

# This code is contributed by Nikhil Kumar Singh(nickzuck_007)
```

C#

```
// A complete working C# program to demonstrate all
using System;

// Class for Doubly Linked List
public class DLL
{
    Node head; // head of list

    /* Doubly Linked list Node*/
    public class Node
    {
        public int data;
        public Node prev;
        public Node next;

        // Constructor to create a new node
        // next and prev is by default initialized as null
        public Node(int d)
        {
            data = d;
        }
    }

    // Adding a node at the front of the list
    public void push(int new_data)
    {
        /* 1. allocate node
        * 2. put in the data */
        Node new_Node = new Node(new_data);
        /* 3. Make next of new node as
        head and previous as NULL */
        new_Node.next = head;
        new_Node.prev = null;

        /* 4. change prev of head node to new node */
        if (head != null)
            head.prev = new_Node;

        /* 5. move the head to point to the new node */
        head = new_Node;
    }

    /* Given a node as prev_node, insert
    a new node after the given node */
    public void InsertAfter(Node prev_Node, int new_data)
    {

        /*1. check if the given prev_node is NULL */
        if (prev_Node == null)
        {
            Console.WriteLine("The given previous node cannot be NULL ");
            return;
        }

        /* 2. allocate node
        * 3. put in the data */
        Node new_node = new Node(new_data);

        /* 4. Make next of new node as next of prev_node */
        new_node.next = prev_Node.next;

        /* 5. Make the next of prev_node as new_node */
        prev_Node.next = new_node;

        /* 6. Make prev_node as previous of new_node */
        new_node.prev = prev_Node;

        /* 7. Change previous of new_node's next node */
        if (new_node.next != null)
            new_node.next.prev = new_node;
    }

    // Add a node at the end of the list
    void append(int new_data)
    {
        /* 1. allocate node
        * 2. put in the data */
        Node new_node = new Node(new_data);

        Node last = head; /* used in step 5*/

        /* 3. This new node is going
            to be the last node, so
        * make next of it as NULL*/
        new_node.next = null;

        /* 4. If the Linked List is empty,
        then make the new * node as head */
        if (head == null)
        {
            new_node.prev = null;
            head = new_node;
            return;
        }

        /* 5. Else traverse till the last node */
        while (last.next != null)
            last = last.next;

        /* 6. Change the next of last node */
        last.next = new_node;

        /* 7. Make last node as previous of new node */
        new_node.prev = last;
    }

    // This function prints contents of
    // linked list starting from the given node
    public void printlist(Node node)
    {
        Node last = null;
        Console.WriteLine("Traversal in forward Direction");
        while (node != null) {
            Console.Write(node.data + " ");
            last = node;
            node = node.next;
        }
        Console.WriteLine();
        Console.WriteLine("Traversal in reverse direction");
        while (last != null) {
            Console.Write(last.data + " ");
            last = last.prev;
        }
    }

    /* Driver code*/
    public static void Main(String[] args)
    {
        /* Start with the empty list */
        DLL dll = new DLL();

        // Insert 6. So linked list becomes 6->NULL
        dll.append(6);

        // Insert 7 at the beginning.
        // So linked list becomes 7->6->NULL
        dll.push(7);

        // Insert 1 at the beginning.
        // So linked list becomes 1->7->6->NULL
        dll.push(1);

        // Insert 4 at the end. So linked list
        // becomes 1->7->6->4->NULL
        dll.append(4);

        // Insert 8, after 7. So linked list
        // becomes 1->7->8->6->4->NULL
        dll.InsertAfter(dll.head.next, 8);

        Console.WriteLine("Created DLL is: ");
        dll.printlist(dll.head);
    }
}

// This code is contributed by 29AjayKumar
```

Output:

```
 Created DLL is:
Traversal in forward direction
 1  7  8  6  4
Traversal in reverse direction
 4  6  8  7  1
```

Also see – Delete a node in double Link List

Please write comments if you find anything incorrect, or you want to share more information about the topic discussed above.

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Sethu • 2 months ago
There could be a better implementation of the insertAfter() function.
In the driver code, the user is giving "head->next" in this function call [insertAfter(head->next, 8);]

However, the code should be written in a manner that the user can insert a node anywhere.
The user should be asked for a position.

Given the position, we should traverse the list till the previous node and insert the new node after it.
• Reply • Share ›

Venkatesh Chowdary Alaparthi • 5 months ago

```
public void insertBeforeaGivenNode(Node next_node,int new_data)
{
Node new_node= new Node(new_data);

if(next_node==null)
{
System.out.print("Next node should not be null");

}

new_node.prev=next_node.prev;
new_node.next=next_node;
```

next_node.prev=new_node;

if(new_node.prev!=null)
{
new_node.prev.next=new_node;
}
else
{
head=new_node;
}

}

Reply • Share ›

nihar • 8 months ago

In the insertAfter() code in python....the prev of the Prev.next node should directly be passed on in the new_node.prev rather than doing
new_node=prev
if new_node.next is not None:
new_node.next.prev = new_node
because I guess here the prev.next.prev needs to be empties before directly assigning it new_node...
so this could be done by:
new_node.prev=prev.next.prev
new_node.next.prev=new_node
----
and for ease first change the prev.next node's value and then the prev node's value:
----
step 4-7 of def **insertAfter**()
#first assign the new_node its new_node.prev and new_node.next values

new_node.prev=prev.next.prev
new_node.next=prev.next

#assign the new_node as permanently the prev.next node and
#as of now prev.next has now become the new_node.next so now assign new_node.prev as new_node

prev.next=new_node
new_node.next.prev=new_node

Reply • Share ›

nihar nihar • 8 months ago

some edits are there....
prev.next>>> prev_node.next

Reply • Share ›

Piyush Singh • 8 months ago

Hi.. The Python implementation of push method is wrong because Node object doesn't have a head attribute as defined in initializer.

Reply • Share ›

Harshit Gupta • 9 months ago

I tried implementing the insert and search functions with a lot of comments for better understanding.
Have a look here: https://ide.geeksforgeeks.o...

Thanks!

Reply • Share ›

Youssef El-Shabasy • 10 months ago

Java
public void printList(){
DLL current = head;
System.out.print("Traversal in forward direction : ");
while(current.next != null){
System.out.print(current.data+"\t");
current = current.next;
}
System.out.println(current.data);
System.out.print("--------------------------------\nTraversal in reverse direction : ");
while(current.prev != null){
System.out.print(current.data+"\t");
current = current.prev;
}
System.out.println(current.data);

}

^ | ⌄ • Reply • Share ›

Sourav Saikia • 10 months ago

The JAVA code for adding a node before a given nextNode
https://ide.geeksforgeeks.o...

^ | ⌄ • Reply • Share ›

Satyaki Basu • a year ago

There is some doubt at insertAfter part. The prev of the node pointed by prev_node.next should also point to newNode after insertion, but this is not done here.

37 ^ | ⌄ • Reply • Share ›

Archito Goswami • a year ago

easy python3 implementation of insertion and traversals in doubly linked list :
https://marryingpython.blog...

^ | ⌄ • Reply • Share ›

aditya • a year ago

Easy to understand append operation :

```
void append(int new_data){
Node prev_node = head;
if(prev_node == null){
head = new Node(new_data);
return;
}
Node new_node = new Node(new_data);
while(prev_node.next != null){
prev_node = prev_node.next;
}
new_node.next = prev_node.next;
prev_node.next = new_node;
new_node.prev = prev_node;
}
```

^ | ⌄ • Reply • Share ›

Ankit Anudeep • a year ago • edited

Doubly Linked List Insertion - Made easy (C++)
https://pastebin.com/dPvnzTqd

^ | ⌄ • Reply • Share ›

Amar Soni • a year ago

Double Linked List Insertion Program in Python:
https://pastebin.com/ufdpPE3r

^ | ⌄ • Reply • Share ›

Haomin Shi • a year ago

is this one really correct? Im under the impression that a double linked list, has "head" and "tail" thus i can start from both ends, the append and prepend is both at constant time cost. But its not the case in this example.

^ | ⌄ • Reply • Share ›

Ahmed Sadman • 2 years ago

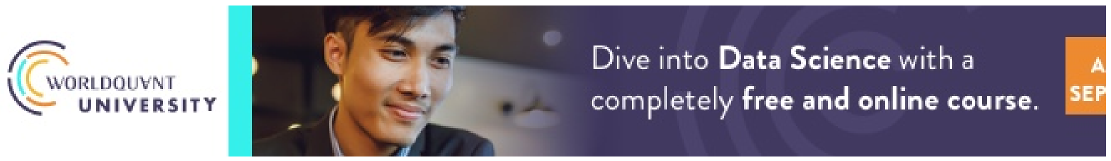
For those who can't figure out how to implement the insertBefore function, here it is: https://pastebin.com/m1j8XqhE

^ | ⌄ • Reply • Share ›

Vivek sharma • 2 years ago

Mentioned link for deleting a node is not working. Update it.

1 ^ | ⌄ • Reply • Share ›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