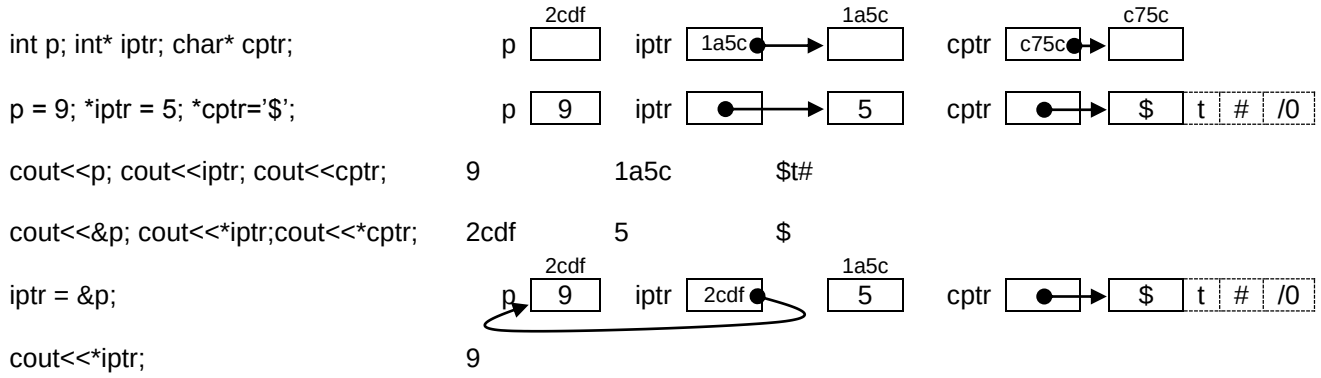
3. Linked List Data Structure

What is Pointer?

Pointer contains memory address of a particular type of data.
In C++, we use * to declare a pointer.



What is Structure (in C++)?

```
structemployee
{
Int empNo;
  float salary;
}emp;
```

emp: empNo, salary

```
emp.empNo=1005;
emp.salary=40000.00;
```

emp: empNo 1005, salary 40000.00

```
cout<<emp.salary+1000.00;        41000.00
```

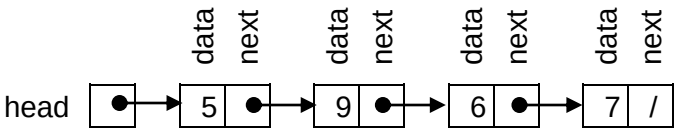
```
employee* eptr;
eptr = new employee;
eptr->empNo=1006;
eptr->salary=30000.00;
cout<<eptr->empNo;               1006
```

eptr → empNo 1006, salary 30000.00

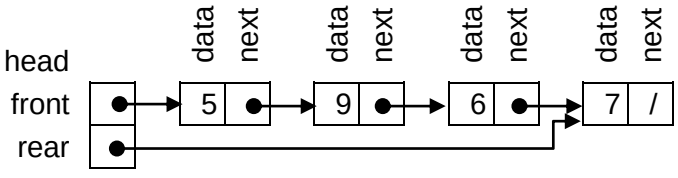
What is Linked List?

A linked list consists of nodes of data which are connected to other nodes. There are several types of linked lists.

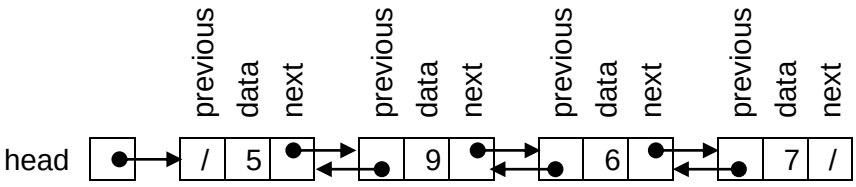
E.g1:



E.g2:



E.g3:

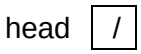


Common operations of Linked List are:

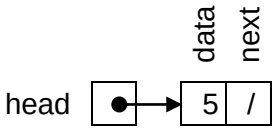
initializeList() - initializes the list as empty list.
insertFirstElt(int elt) - inserts a new element into an empty list.
insertAtFront(int elt) - inserts an element at the beginning of the list.
insertAtEnd(int elt) - inserts an element at the end of the list (appendElt or appendNode).
insertAfter(int oldElt, int newElt) - inserts an element after a specified element.
deleteElt(int elt) - deletes a specified element.
displayList() - displays all the elements in the list
isEmpty() - returns true if the list has no elements, false otherwise.
isFull() - returns false if the list is full, false otherwise.

Structural Diagramsof Linked List Operations:

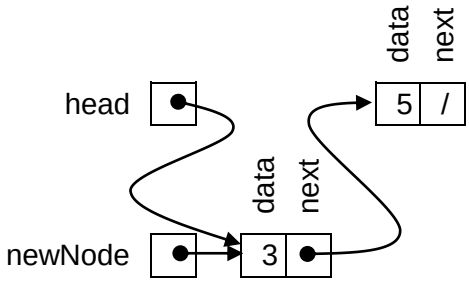
1. initializeList()



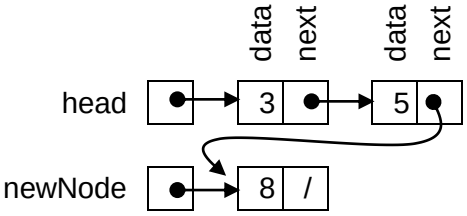
2. insertFirstElt(5)



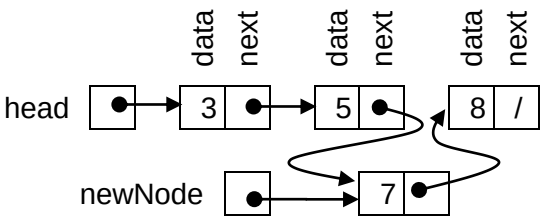
3.insertAtFront(3)



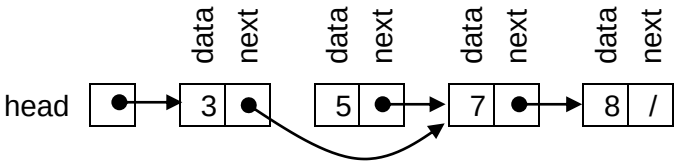
4. insertAtEnd(8)



5. insertAfter(5,7)

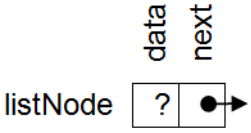


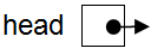
6. deleteElt(5):

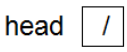


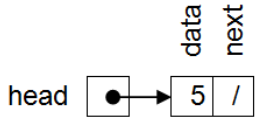
Implementation of Linked List Operations:

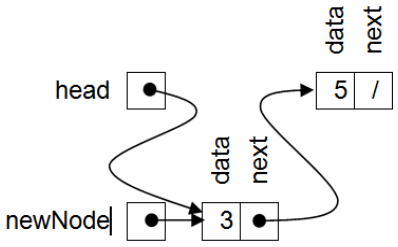
```
#include<iostream.h>
#include<conio.h>
class LinkedList
{
private:
        struct listNode
        {
                int data;
                listNode* next;
        };

        listNode* head;

public:
        LinkedList();
        void initializeList();
        void insertFirstElt(int elt);
        void insertAtFront(int elt);
        void insertAtEnd(int elt);
        void insertAfter(int oldElt, int newElt);
        void deleteElt(int elt);
        void displayList();
        int isEmpty();
        int isFull();
}

LinkedList::LinkedList()  //Constructor
{
        head=NULL;
}

void LinkedList::initializeList()
{
        head=NULL;
}

void LinkedList::insertFirstElt(int elt)
{
        head=new listNode;
        head->data=elt;
        head->next=NULL;
}

void LinkedList::insertAtFront(int elt)
{
        listNode *newNode;
        newNode=new listNode;
        newNode->data=elt;
```



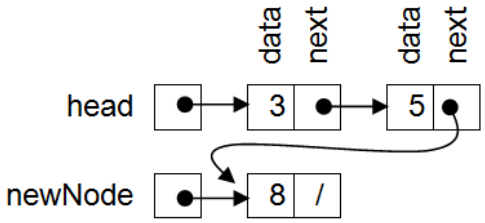




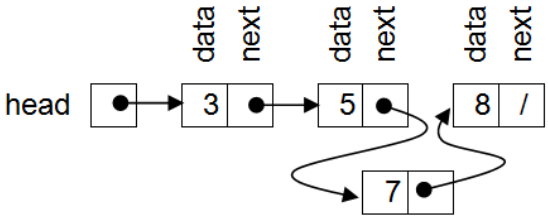


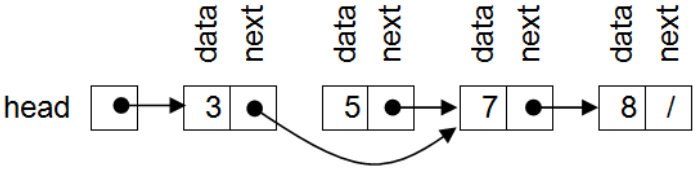


```
        newNode->next=head;
        head=newNode;
}

void LinkedList::insertAtEnd(int elt)
{
        listNode *newNode, *curNode;
        newNode=new listNode;
        newNode->data=elt;
        newNode->next=NULL;
        if (!head)
                head=newNode;
        else
        {
                curNode=head;
                while (curNode->next != NULL)
                        curNode = curNode->next;
                curNode->next = newNode;
        }
}
```

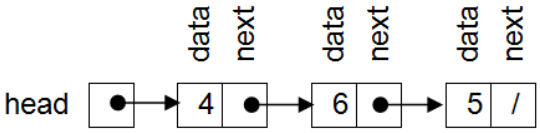



```
void LinkedList::insertAfter(int oldElt, int newElt)
{




}

void LinkedList::deleteElt(int elt)
{




}

void LinkedList::displayList()
{
        listNode* curNode;
        curNode=head;
        while (curNode)
        {
                cout<<curNode->data<<"  ";
                curNode=curNode->next;
        }
}

int LinkedList::isEmpty()
{
        if (head== NULL)
                return 1;
        else
                return 0;
}
```





```
int LinkedList::isFull()  //It always returns false.
{
        return 0;
}

void main()
{
        clrscr();
        LinkedList lst;
        lst.insertAtEnd(4);
        lst.insertAtEnd(6);
        lst.insertAtEnd(5);
        lst.displayList();
}
```



Advantages of Linked List:
Easy to insert and delete elements.
Unlike array, memory space is not wasted in linked list.

Disadvantages of Linked List:
Slow in searching.