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## **Linked List (C++)**

1. Create a Singly Linked List in C++ and perform the following operations.

- Insert elements in the beginning
- Insert elements at the end.
- Insert elements in between
- Insert elements after an element (using value).
- Insert elements after an element (using index).

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```
1 #include <iostream>
2 using namespace std;
3
4 struct Node
5 {
6     int data;
7     Node *next;
8
9
10    Node(int val)
11    {
12        data=val;
13        next = NULL;
14    }
15 };
16
17
18 void linkedlist(Node** head)
19 {
20     int N, value;
21     cin>>N;
22
23     Node *current = NULL;
24     int i=0;
25
26     Node *dummynode = new Node(-1000);
27     *head=dummynode;
28
29
30     while(i!=N)
31     {   cin>>value;
32         current = new Node(value);
33         dummynode->next = current;
34         dummynode= dummynode->next;
35         i++;
36     }
37     *head = (*head)->next;
38 }
39
40
41 void printlinkedlist(Node* head)
42 {
43     //head = head->next;
44     cout<<endl;
45     while(head!=NULL)
46     {
47         cout<<head->data<<" \t";
48         head=head->next;
49     }
50
51 }
```



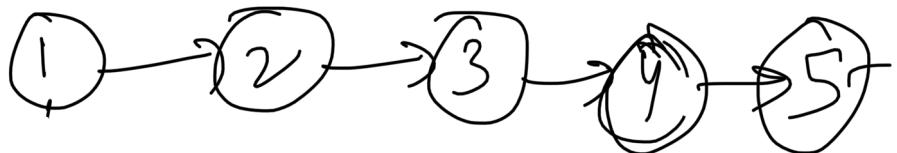
```
1 void insertatbeg(Node** head, int newval)
2 {
3     Node* newnode = new Node(newval);
4     newnode->next= *head;
5     *head= newnode;
6 }
7
8 void insertatend(Node** head, int newval)
9 {
10    Node* temp = *head;
11    Node* newnode = new Node(newval);
12    if(temp==NULL)
13    { *head = newnode;
14        return;
15    }
16    while(temp->next!=NULL)
17    {
18        temp=temp->next;
19    }
20
21    temp->next=newnode;
22    newnode->next = NULL;
23
24 }
25
26 void insertinbetween(Node* head, Node* n1, Node* n2, int newval)
27 {
28     Node* temp = head;
29     while(temp!=n1)
30     {
31         temp = temp->next;
32     }
33     Node* between = new Node(newval);
34     between->next = n2;
35     (n1)->next= between;
36 }
37
38
39 void insertafteranelement(Node* head, int after, int value)
40 {   Node* temp = head;
41
42     while(temp!=NULL && temp->next!=NULL && temp->data!=after)
43     {
44         temp=temp->next;
45     }
46
47 if((temp==NULL) || (temp->data!=after))
48 {
49     return;
50 }
51 else
52 {   Node* newnode = new Node(value);
53     newnode->next= temp->next;
54     temp->next = newnode;
55 }
56 }
```



```
1 void insertafteranelementwithindex(Node* prevnode, int val)
2 {
3     if(prevnode==NULL)
4         return ;
5
6     Node* newnode = new Node(val);
7     newnode->next = prevnode->next;
8     prevnode->next = newnode;
9 }
10
11 int main()
12 {
13 Node *head = NULL;
14 linkedlist(&head);
15 cout<<" Created linked list ";
16 printlinkedlist(head);
17
18 insertatbeg(&head,1000);
19 cout<<endl<<"insert at beginning";
20 printlinkedlist(head);
21 insertatbeg(&head,5000);
22 cout<<endl<<"insert at beginning";
23 printlinkedlist(head);
24
25 cout<<endl<<" Insert element at the Ending ";
26 insertatend(&head,50);
27 printlinkedlist(head);
28 cout<<endl<<" Insert element at the Ending ";
29 insertatend(&head,10);
30 printlinkedlist(head);
31 insertafteranelementwithindex(head, 200);
32 cout<<endl<<" Insert element after index head ";
33 printlinkedlist(head);
34
35 insertatbeg(&head,600);
36 cout<<endl<<"insert at beginning";
37 printlinkedlist(head);
38
39 Node *n1 = head->next;
40 Node *n2 = head->next->next;
41 insertinbetween(head,n1, n2, 25);
42 cout<<endl<<"insert bewtween two pointers";
43 printlinkedlist(head);
44
45 insertafteranelement(head,3,700);
46 cout<<endl<<"insert after an element";
47 printlinkedlist(head);
48
49 }
50
```

2. Create a Singly Linked List in C++ and perform the following operations.

- Delete elements from the beginning
- Delete elements from the end.
- Delete elements at position.



KAPIL YADAV



```
1 #include <iostream>
2 using namespace std;
3
4 struct Node
5 {
6     int data;
7     Node *next;
8
9
10    Node(int val)
11    {
12        data=val;
13        next = NULL;
14    }
15 };
16
17
18 void linkedlist(Node** head)
19 {
20     int N, value;
21     cin>>N;
22
23     Node *current = NULL;
24     int i=0;
25
26     Node *dummynode = new Node(-1000);
27     *head=dummynode;
28
29
30     while(i!=N)
31     {   cin>>value;
32         current = new Node(value);
33         dummynode->next = current;
34         dummynode= dummynode->next;
35         i++;
36     }
37     *head = (*head)->next;
38 }
39
40
41 void printlinkedlist(Node* head)
42 {
43     //head = head->next;
44     cout<<endl;
45     while(head!=NULL)
46     {
47         cout<<head->data<<" \t";
48         head=head->next;
49     }
50
51 }
```

```
1 void deletefrombeginning(Node** head)
2 {
3     if(*head!=NULL)
4     {
5         Node* dummysnode = new Node(-500);
6         dummysnode->next=*head;
7
8         Node* temp = dummysnode->next;
9
10        dummysnode->next = temp->next;
11        delete temp;
12        *head = dummysnode->next;
13    }
14
15 }
16
17 void deletefromend(Node** head)
18 {
19     if(*head!=NULL) // or we can use if(head==NULL) return;
20     { Node* dummysnode = new Node(-500);
21         dummysnode->next=*head;
22
23         Node* prev = dummysnode;
24         Node* current = *head;
25
26         while(current->next!= NULL)
27         {
28             prev= current;
29             current=current->next;
30         }
31         delete current;
32         prev->next= NULL;
33         *head= dummysnode->next;
34     }
35 }
36
37
38 void deleteatposition(Node** head, int position)
39 {
40     if(*head==NULL || position<0)
41         return;
42     Node* dummysnode = new Node(-500);
43     dummysnode->next=*head;
44
45     Node* temp =*head;
46
47     int count = 0;
48     Node* prev =dummysnode;
49     while(count<position && temp->next!=NULL)
50     {
51         count++;
52         prev=temp;
53         temp=temp->next;
54     }
55
56     if(count<position)
57         return;
58
59     prev->next = temp->next;
60     delete temp;
61     *head=dummysnode->next;
62 }
```

```
1 int main()
2 {
3
4     Node *head = NULL;
5     linkedlist(&head);
6     cout<<" Created linked list ";
7     printlinkedlist(head);
8
9     deleteatposition(&head,2523563);
10    cout<<endl<<" Delete from a particular position in the linked list ";
11    printlinkedlist(head);
12
13
14    deletefrombeginning(&head);
15    cout<<endl<<" Delete from beginning in the linked list ";
16    printlinkedlist(head);
17
18
19    deletefromend(&head);
20    cout<<endl<<" Delete from end in the linked list ";
21    printlinkedlist(head);
22
23    deletefromend(&head);
24    cout<<endl<<" Delete from end in the linked list ";
25    printlinkedlist(head);
26
27
28
29    deletefromend(&head);
30    cout<<endl<<" Delete from end in the linked list ";
31    printlinkedlist(head);
32    deletefromend(&head);
33    cout<<endl<<" Delete from end in the linked list ";
34    printlinkedlist(head);
35    deletefromend(&head);
36    cout<<endl<<" Delete from end in the linked list ";
37    printlinkedlist(head);
38
39 }
40
```

## Leetcode Problems:

### 206. Reverse Linked List :

#### 1. Iterative approach :



```
1 /**
2  * Definition for singly-linked list.
3  * struct ListNode {
4  *     int val;
5  *     ListNode *next;
6  *     ListNode() : val(0), next(nullptr) {}
7  *     ListNode(int x) : val(x), next(nullptr) {}
8  *     ListNode(int x, ListNode *next) : val(x), next(next) {}
9  * };
10 */
11 class Solution {
12 public:
13     ListNode* reverseList(ListNode* head) {
14         ListNode* prev=NULL;
15         ListNode* current = head;
16         ListNode* Temp= NULL;
17
18         while(current!=NULL)
19         {
20             Temp= current->next;
21             current->next= prev;
22             prev= current;
23             current=Temp;
24         }
25         return prev;
26     }
27 };
28
29 //TC = O(N)
30 //SC = O(1)
```

## 2. Recursive Approach:

```
1 /**
2  * Definition for singly-linked list.
3  * struct ListNode {
4  *     int val;
5  *     ListNode *next;
6  *     ListNode() : val(0), next(nullptr) {}
7  *     ListNode(int x) : val(x), next(nullptr) {}
8  *     ListNode(int x, ListNode *next) : val(x), next(next) {}
9  * };
10 */
11 class Solution {
12 public:
13     ListNode* reverseList(ListNode* head) {
14         if(head==nullptr) return nullptr;
15         if(head->next ==nullptr) return head;
16         ListNode* curr=head;
17         ListNode* temp=reverseList(head->next);
18         curr->next->next=curr;
19         curr->next=nullptr;
20         return temp;
21     }
22
23 };
24
25 /*Recursive approach
26     TC = O(N)
27     SC = O(1)
28 */
```

## 876. Middle of the Linked List :

### 1. Using Two traversals :

```
● ● ●  
1 class Solution {  
2 public:  
3     ListNode* middleNode(ListNode* head) {  
4         ListNode* current =head;  
5         int length = 0;  
6  
7         while(current!=NULL)  
8         {  
9             length+=1;  
10            current=current->next;  
11        }  
12  
13        int mid= length/2+1;  
14        for(int i=1;i<mid;i++)  
15        {  
16            head=head->next;  
17        }  
18        return head;  
19  
20    }  
21 };
```

### 2. Using two pointers approach :

```
● ● ●  
1 class Solution {  
2 public:  
3     ListNode* middleNode(ListNode* head) {  
4         ListNode* fast =head;  
5         ListNode* slow = head;  
6  
7         while(fast->next && fast->next->next)  
8         {  
9             fast=fast->next->next;  
10            slow =slow->next;  
11        }  
12        if(fast->next!=NULL)  
13            slow=slow->next;  
14        return slow;  
15    }  
16 };  
17 /* TC= O(N)  
18   SC= O(1)  
19 */
```

## 21. Merge Two Sorted Lists:

1. Using extra space for creating new nodes:

```
● ● ●

1 class Solution {
2 public:
3     ListNode* mergeTwoLists(ListNode* l1, ListNode* l2) {
4
5         if(l1==NULL) return l2;
6
7         if(l2==NULL) return l1;
8
9         ListNode* dummy=new ListNode(-500);
10    ListNode* head=dummy;
11
12    while(l1!=NULL && l2!=NULL){
13        if(l1->val<=l2->val){
14            ListNode* newnode = new ListNode(l1->val);
15            head->next=newnode;
16            l1=l1->next;
17        }
18        else{
19            ListNode* newnode = new ListNode(l2->val);
20            head->next=newnode;
21            l2=l2->next;
22        }
23        head=head->next;
24    }
25    head->next=(l1!=NULL) ? l1 : l2;
26
27    return dummy->next;
28 }
29
30 /*
31     TC = O(l1+l2) or max(l1,l2)
32     SC = O(l1+l2)
33 */
```

## 2. Using O(1) extra space:

```
● ● ●  
1 //Using O(1) extra space  
2 class Solution {  
3 public:  
4     ListNode* mergeTwoLists(ListNode* l1, ListNode* l2) {  
5         if(l1==NULL) return l2;  
6         if(l2==NULL) return l1;  
7         ListNode* dummy=new ListNode();  
8         ListNode* head=dummy;  
9         while(l1!=NULL && l2!=NULL){  
10             if(l1->val<=l2->val){  
11                 head->next=l1;  
12                 l1=l1->next;  
13             }  
14             else{  
15                 head->next=l2;  
16                 l2=l2->next;  
17             }  
18             head=head->next;  
19         }  
20         head->next=(l1!=NULL) ? l1 : l2;  
21         return dummy->next;  
22     }  
23 };  
24 /* TC= O(l1+l2)  
25 SC = O(1)  
26 */  
27
```



### 3. Using Recursion with O(1) space:

```
1 class Solution {
2 public:
3     ListNode* mergeTwoLists(ListNode* l1, ListNode* l2) {
4         if(l1 == NULL){
5             return l2;
6         }
7         if(l2 == NULL){
8             return l1;
9         }
10        if(l1->val < l2->val){
11            l1->next = mergeTwoLists(l1->next, l2);
12            return l1;
13        }
14        else{
15            l2->next = mergeTwoLists(l1, l2->next);
16            return l2;
17        }
18    }
19 };
20 //recursive code : tc  O(l1+l2)
```

### [237. Delete Node in a Linked List](#)

```
1 class Solution {
2 public:
3     void deleteNode(ListNode* node) {
4         node->val= node->next->val;
5         node->next = node->next->next;
6     }
7 }
8 };
```

## 83. Remove Duplicates from Sorted List

### 1. Iterative solution:

```
1 class Solution {
2 public:
3     ListNode* deleteDuplicates(ListNode* head) {
4         ListNode* curr = head;
5         ListNode* temp = NULL;
6         while(curr && curr -> next){
7             if(curr -> val == curr -> next -> val){
8                 temp = curr -> next;
9                 curr -> next = curr -> next -> next;
10                delete temp;
11            }
12            else{
13                curr = curr -> next;
14            }
15        }
16        return head;
17    }
18 };
```

### 2. Recursive solution:

```
1 class Solution {
2 public:
3     ListNode* deleteDuplicates(ListNode* head) {
4         if(!head || !(head -> next)){
5             return head;
6         }
7         if(head -> val == head -> next -> val){
8             ListNode* temp = head -> next;
9             head -> next = head -> next -> next;
10            delete temp;
11            deleteDuplicates(head);
12        }
13        else{
14            deleteDuplicates(head -> next);
15        }
16        return head;
17    }
18 };
```

**NOTE :** There can be more than two duplicates so if we get the duplicate elements, we have to compare the next elements with current elements so we are calling deleteDuplicates(head) in the if condition.

### [1290. Convert Binary Number in a Linked List to Integer](#)

```
1 class Solution {
2 public:
3     int getDecimalValue(ListNode* head) {
4         int ans=0;
5         while(head!=NULL)
6         {
7             ans*=2;
8             ans+=(head->val);
9             head=head->next;
10        }
11        return ans;
12    }
13};
```

## 148. Sort List

Using Merge Sort:

```
1 class Solution {
2 public:
3     ListNode* sortList(ListNode* head) {
4         if(head==NULL || head->next==NULL)
5             return head;
6
7         ListNode* fast= head;
8         ListNode* slow= head;
9
10        while(fast->next && fast->next->next)
11        {
12            fast=fast->next->next;
13            slow= slow->next;
14        }
15        ListNode* list2 = slow->next;
16        slow->next=NULL;
17        ListNode* list1 = head;
18
19        listNode* left = sortList(list1);
20        listNode* right = sortList(list2);
21        listNode* answer = mergeTwoLists(left,right);
22        return answer;
23
24    }
25    listNode* mergeTwoLists(listNode* list1, listNode* list2) {
26        if(list1==nullptr && list2==nullptr) return nullptr;
27        if(list1==nullptr) return list2;
28        if(list2==nullptr) return list1;
29        listNode* l1=list1;
30        listNode* l2=list2;
31        listNode* nH=new listNode(-1);
32        listNode* nC=nH;
33        while(l1!=nullptr && l2!=nullptr){
34            if((l1->val)<(l2->val)){
35                listNode* curr=l1;
36                l1=l1->next;
37                nC->next=curr;
38                nC=curr;
39            }else{
40                listNode* curr=l2;
41                l2=l2->next;
42                nC->next=curr;
43                nC=curr;
44            }
45        }
46        if(l1==nullptr){
47            nC->next=l2;
48        }else if(l2==nullptr){
49            nC->next=l1;
50        }
51        return nH->next;
52    }
53}
54};
```

[2. Add Two Numbers](#)

```
1 class Solution {
2 public:
3     ListNode* addTwoNumbers(ListNode* l1, ListNode* l2) {
4
5         ListNode* dummysnode = new ListNode(-1);
6         /* if(l1==NULL)
7             return l2;
8             if(l2==NULL)
9                 return l1;
10            dummysnode will handle this case
11 */
12
13         ListNode* result = dummysnode;
14         int carry =0;
15         while(l1 && l2)
16         {   int ans = (l1->val + l2->val)+carry;
17
18             carry = ans/10;
19             ans = ans%10;
20
21             ListNode* newnode = new ListNode(ans);
22             dummysnode->next = newnode;
23             dummysnode= dummysnode->next;
24             l1=l1->next;
25             l2=l2->next;
26         }
27
28         while(l1 || l2)
29         {
30             int ans= l1? l1->val +carry: l2->val +carry;
31             carry = ans/10;
32             ans = ans%10;
33
34             ListNode* newnode2 = new ListNode(ans);
35             dummysnode->next = newnode2;
36             dummysnode= dummysnode->next;
37             if(l1)
38                 l1=l1->next;
39             else
40                 l2=l2->next;
41         }
42
43         if(carry!=0)
44         { ListNode* unitnode = new ListNode(carry);
45             dummysnode->next = unitnode;
46             dummysnode= dummysnode->next;
47         }
48         return result->next;
49     }
50 };
```

## [445. Add Two Numbers II](#)



```
1 class Solution {
2 public:
3
4     ListNode* reverseList(ListNode* head) {
5         ListNode* prev=NULL;
6         ListNode* current = head;
7         ListNode* Temp= NULL;
8
9         while(current!=NULL)
10        {
11             Temp= current->next;
12             current->next= prev;
13             prev= current;
14             current=Temp;
15        }
16        return prev;
17    }
18
19    ListNode* addTwoNumbers(ListNode* l1, ListNode* l2) {
20        ListNode* dummmynode = new ListNode(-1);
21
22        l1 = reverseList(l1);
23        l2=reverseList(l2);
24
25        /*  if(l1==NULL)
26            return l2;
27        if(l2==NULL)
28            return l1;
29        dummmynode will handle this case
30        */
31
32        ListNode* result = dummmynode;
33        int carry =0;
34        while(l1 && l2)
35        {   int ans = (l1->val + l2->val)+carry;
36
37            carry = ans/10;
38            ans = ans%10;
39
40            ListNode* newnode = new ListNode(ans);
41            dummmynode->next = newnode;
42            dummmynode= dummmynode->next;
43            l1=l1->next;
44            l2=l2->next;
45        }
46    }
```

```
1 while(l1 || l2)
2 {
3     int ans= l1? l1->val +carry: l2->val +carry;
4     carry = ans/10;
5     ans = ans%10;
6
7     ListNode* newnode2 = new ListNode(ans);
8     dummmynode->next = newnode2;
9     dummmynode= dummmynode->next;
10    if(l1)
11        l1=l1->next;
12    else
13        l2=l2->next;
14 }
15
16 if(carry!=0)
17 { ListNode* unitnode = new ListNode(carry);
18     dummmynode->next = unitnode;
19     dummmynode= dummmynode->next;
20 }
21
22 result = reverseList(result->next);
23 return result;
24 }
25
26
27 };
```



## 141. Linked List Cycle

```
● ● ●  
1 class Solution {  
2 public:  
3     bool hasCycle(ListNode *head) {  
4         if(head==NULL)  
5             return false;  
6  
7         set<ListNode*> elements;  
8         while(head!=NULL)  
9         {  
10             if(elements.count(head))  
11                 return true;  
12             elements.insert(head);  
13             head=head->next;  
14         }  
15         return false;  
16     }  
17 }  
18 };
```

### 3. Two pointer approach

```
● ● ●  
1 class Solution {  
2 public:  
3     bool hasCycle(ListNode *head) {  
4         if(head==NULL)  
5             return false;  
6  
7         ListNode* slow=head;  
8         ListNode* fast=head;  
9  
10        while(fast->next && fast->next->next)  
11        {  
12            slow= slow->next;  
13            fast= fast->next->next;  
14            if(slow==fast)  
15                return true;  
16        }  
17        return false;  
18    }  
19 };  
20 };  
21 // 2 corner cases - 1st : if no node 2nd : if only one node  
22 //TC = O(N)  
23 //SC = O(1)
```

## 19. Remove Nth Node From End of List

```
● ● ●
1 class Solution {
2 public:
3     ListNode* reverseList(ListNode* head) {
4         ListNode* prev=NULL;
5         ListNode* current = head;
6         ListNode* Temp= NULL;
7
8         while(current!=NULL)
9         {
10             Temp= current->next;
11             current->next= prev;
12             prev= current;
13             current=Temp;
14         }
15         return prev;
16     }
17
18     ListNode* removeNthFromEnd(ListNode* head, int n) {
19         ListNode* l1 = reverseList(head);
20         ListNode* dummysnode = new ListNode(-100);
21         dummysnode->next = l1;
22
23         ListNode* current = l1;
24         ListNode* prev = dummysnode;
25         int count=0;
26         while((count+1)!=n)
27         {
28             prev=current;
29             current=current->next;
30             count++;
31         }
32         prev->next = current->next;
33         delete current;
34         return reverseList(dummysnode->next);
35     }
36
37 };
```

## 234. Palindrome Linked List

*First approach:*



```
1 class Solution {
2 public:
3
4     ListNode* reverseList(ListNode* head) {
5         ListNode* prev=NULL;
6         ListNode* current = head;
7         ListNode* Temp= NULL;
8
9         while(current!=NULL)
10        {
11            Temp= current->next;
12            current->next= prev;
13            prev= current;
14            current=Temp;
15        }
16        return prev;
17    }
18
19    bool isPalindrome(ListNode* head) {
20
21        ListNode* copynode = head;
22        ListNode* dummmynode = new ListNode(-5000);
23        ListNode* currentnode = dummmynode;
24
25        while(copynode!=NULL)
26        {
27            ListNode* newnode = new ListNode(copynode->val);
28            currentnode->next = newnode;
29            currentnode= currentnode->next;
30            copynode=copynode->next;
31        }
32
33
34        ListNode* secondnode=dummmynode->next;
35        ListNode* firstnode = reverseList(head);
36
37        while(firstnode)
38        {
39            if((firstnode->val)==(secondnode->val))
40            {
41                firstnode=firstnode->next;
42                secondnode=secondnode->next;
43            }
44            else { return false;
45            }
46        }
47        return true;
48
49    }
50};
```

### 3. Using two pointers

```
 1 class Solution {
 2 public:
 3     ListNode* middleNode(ListNode* head) {
 4         ListNode* fast =head;
 5         ListNode* slow = head;
 6
 7         while(fast->next && fast->next->next)
 8         {
 9             fast=fast->next->next;
10             slow =slow->next;
11         }
12         return slow;
13     }
14     ListNode* reverseList(ListNode* head) {
15         ListNode* prev=NULL;
16         ListNode* current = head;
17         ListNode* Temp= NULL;
18
19         while(current!=NULL)
20         {
21             Temp= current->next;
22             current->next= prev;
23             prev= current;
24             current=Temp;
25         }
26         return prev;
27     }
28
29
30     bool isPalindrome(ListNode* head) {
31         if(head==NULL || head->next==NULL)
32             return true;
33
34         ListNode* middle = middleNode(head);
35         ListNode* tempnode = middle->next;
36         middle->next =NULL;
37
38         ListNode* templist = reverseList(tempnode);
39         return compare(head, templist);
40     }
41
42     bool compare(ListNode* l1, ListNode* l2)
43     {
44
45         while(l1 && l2)
46         {
47             if(l1->val!=l2->val)
48             {
49                 return false;
50             }
51             l1=l1->next;
52             l2=l2->next;
53         }
54         return true;
55     }
56
57 };
```

## 160. Intersection of Two Linked Lists



```
1 //brute force O(M*N)
2 class Solution {
3 public:
4     ListNode *getIntersectionNode(ListNode *headA, ListNode *headB) {
5         ListNode* temp;
6         while(headA)
7         {
8             temp=headB;
9             while(temp)
10            {
11                if(headA==temp)
12                {
13                    return headA;
14                }
15                temp=temp->next;
16            }
17            headA=headA->next;
18        }
19    }
20};
```

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## 203. Remove Linked List Elements

```
1 class Solution {
2 public:
3     ListNode* removeElements(ListNode* head, int val) {
4
5         ListNode* dummysnode = new ListNode(-1000);
6         dummysnode->next = head;
7
8
9         ListNode* current= dummysnode;
10
11        while(current->next!=NULL)
12        {
13            if(current->next->val==val)
14            {   ListNode* temp = current->next;
15                current->next = current->next->next;
16                delete temp;
17            }
18            else { current=current->next;
19                  }
20        }
21    }
22    return dummysnode->next;
23 }
24 };
```

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## [82. Remove Duplicates from Sorted List II](#)

```
1 class Solution {
2 public:
3     ListNode* deleteDuplicates(ListNode* head) {
4         ListNode* dummysnode = new ListNode(-101);
5         dummysnode->next= head;
6         ListNode* prev = dummysnode;
7         ListNode* current =head;
8
9         while(current)
10         {
11             if(prev->val==current->val)
12             {
13                 prev->next = current->next;
14             }
15             else    prev = current;
16             current = current->next;
17
18
19
20         }
21         return dummysnode->next;
22     }
23 };
24 }
```



```
1 class Solution {
2 public:
3     ListNode* deleteDuplicates(ListNode* head)
4     {
5         if(head==NULL||head->next==NULL) return head;
6         bool isDuplicate=false;
7         ListNode *curr=head,*prev=NULL;
8
9         while(curr!=NULL&&curr->next!=NULL)
10        {
11            if(curr->val==curr->next->val)
12            {
13                ListNode *temp=curr->next;
14                curr->next=curr->next->next;
15                delete temp;
16                isDuplicate=true;
17                continue;
18            }
19            else
20            {
21                if(isDuplicate)
22                {
23                    if(curr->next!=NULL)
24                    {
25                        curr->val=curr->next->val;
26                        ListNode *temp=curr->next;
27                        curr->next=curr->next->next;
28                        delete temp;
29                        isDuplicate=false;
30                    }
31                }
32                else
33                {
34                    prev=curr;
35                    curr=curr->next;
36                }
37            }
38        }
39
40        if(isDuplicate==true && curr->next==NULL)
41        {
42            if(prev==NULL)
43            {
44                delete curr;
45                return NULL;
46            }
47            else
48            {
49                prev->next=NULL;
50                delete curr;
51                return head;
52            }
53        }
54    return head;
55 }
56 };
```

## 1721. Swapping Nodes in a Linked List

```
● ● ●

1 class Solution {
2 public:
3     ListNode* swapNodes(ListNode* head, int k) {
4         ListNode* dummmynode = new ListNode(-1);
5         dummmynode->next = head;
6
7         if(head==NULL || head->next==NULL)
8             return head;
9
10        ListNode* slow = head;
11        ListNode* fast = head;
12
13        ListNode* n1 =NULL;
14
15        while(--k)
16        {
17            slow=slow->next;
18        }
19        n1 = slow;
20
21
22        while(slow->next)
23        {
24            slow=slow->next;
25            fast= fast->next;
26        }
27
28        ListNode* n2 = fast;
29
30
31        int temp = n1->val;
32        n1->val=n2->val;
33        n2->val=temp;
34
35        return dummmynode->next;
36
37    }
38 };
```

## 328. Odd Even Linked List

```
1 class Solution {
2 public:
3     ListNode* oddEvenList(ListNode* head) {
4         ListNode* dummmynode1 = new ListNode(-100);
5         ListNode* dummmynode2 = new ListNode(-1001);
6         ListNode* odd=dummmynode1;
7         ListNode* even=dummmynode2;
8
9         int count=1;
10        while(head)
11        {
12            if(count%2)
13            {   ListNode* newnode = new ListNode(head->val);
14                odd->next= newnode;
15                odd=odd->next;
16            }
17            else
18            {   ListNode* newnode = new ListNode(head->val);
19                even->next=newnode;
20                even=even->next;
21            }
22            head=head->next;
23            count++;
24        }
25        odd->next=dummmynode2->next;
26        return dummmynode1->next;
27    }
28 }
29 };
```



[LinkedIn](#)



## 24. Swap Nodes in Pairs

```
1 class Solution {
2 public:
3     ListNode* swapPairs(ListNode* head)
4     {
5         if(head==NULL || head->next==NULL)
6         {
7             return head;
8         }
9
10        ListNode* first = head;
11        ListNode* second = head->next;
12
13        ListNode* templist = swapPairs(head->next->next);
14
15        first->next = templist;
16        second->next = first;
17
18        return second;
19    }
20
21};
```

```
1 class Solution {
2 public:
3     ListNode* swapPairs(ListNode* head)
4     {
5         if(!head || !head->next) return head;
6
7         ListNode* temp;
8         temp = head->next;
9         head->next = swapPairs(head->next->next);
10        temp->next = head;
11
12        return temp;
13    }
14
15
16};
```

## 25. Reverse Nodes in k-Group

```
1 class Solution {
2 public:
3     ListNode* reverseKGroup(ListNode* head, int k) {
4         ListNode* currenthead = head;
5         int count=k;
6         while(count--){
7             if(currenthead == nullptr) return head;
8             currenthead = currenthead->next;
9         }
10
11         ListNode* current = head;
12         ListNode* prev = nullptr;
13         ListNode* next = nullptr;
14
15         //reverse a linkedlist of length k
16         for(int i = 0; i < k; i++){
17             next = current->next;
18             current->next = prev;
19             prev = current;
20             current = next;
21         }
22         head->next = reverseKGroup(current, k);
23         return prev;
24     }
25 }
```

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## [142. Linked List Cycle II](#)



```
1 class Solution {
2 public:
3     ListNode *detectCycle(ListNode *head) {
4
5         if(head==NULL || head->next==NULL)
6             return NULL;
7
8         ListNode* slow=head;
9         ListNode* fast=head;
10
11         while(fast && fast->next)
12         {
13             slow= slow->next;
14             fast= fast->next->next;
15             if(slow==fast)
16                 { break;
17                 }
18         }
19         if(slow!=fast)
20             return NULL;
21
22         slow=head;
23         while(slow!=fast)
24         {
25             slow=slow->next;
26             fast=fast->next;
27         }
28         return slow;
29     }
30 };
```



## [725. Split Linked List in Parts](#)

```
1 class Solution {
2 public:
3     vector<ListNode*> splitListToParts(ListNode* head, int k) {
4
5         ListNode* current=head;
6         int length=0;
7         while(current)
8             {   current=current->next;
9                 length++;
10            }
11         int nodesinagroup= length/k;
12         int extranodes = length%k;
13
14         vector<ListNode*> res;
15         current=head;
16
17         while(current)
18             {   res.push_back(current);
19                 int currentlength=1;
20                 while(currentlength<nodesinagroup)
21                     {
22                         current=current->next;
23                         currentlength++;
24                     }
25                 if(extranodes>0 && length>k)
26                 {
27                     current=current->next;
28                     extranodes--;
29                 }
30                 ListNode* temp=current->next;
31                 current->next=NULL;
32                 current=temp;
33             }
34
35         while(length<k)
36             {
37                 res.push_back(NULL);
38                 length++;
39             }
40         return res;
41     }
42 }
43 };
```

## Merge k Sorted Lists

```
● ● ●
```

```
1 class Solution {
2 public:
3     ListNode* mergeKLists(vector<ListNode*>& lists) {
4         int m=lists.size();
5
6         if(m==0)
7             return 0;
8         if(m==1)
9             return lists[0];
10
11        ListNode* l1= lists[0];
12        ListNode* l2 = lists[1];
13        ListNode* l= mergeTwoLists(l1,l2);
14
15        for(int i =2;i<m;i++)
16        {
17            l= mergeTwoLists(l,lists[i]);
18        }
19        return l;
20    }
21    ListNode* mergeTwoLists(ListNode* list1, ListNode* list2) {
22        if(list1==nullptr && list2==nullptr) return nullptr;
23        if(list1==nullptr) return list2;
24        if(list2==nullptr) return list1;
25        ListNode* l1=list1;
26        ListNode* l2=list2;
27        ListNode* nH=new ListNode(-1);
28        ListNode* nC=nH;
29        while(l1!=nullptr && l2!=nullptr){
30            if((l1->val)<(l2->val)){
31                ListNode* curr=l1;
32                l1=l1->next;
33                nC->next=curr;
34                nC=curr;
35            }else{
36                ListNode* curr=l2;
37                l2=l2->next;
38                nC->next=curr;
39                nC=curr;
40            }
41        }
42        if(l1==nullptr){
43            nC->next=l2;
44        }else if(l2==nullptr){
45            nC->next=l1;
46        }
47        return nH->next;
48    }
49 };
50
51 //not optimal TC= O(nk)
```

## 138. Copy List with Random Pointer

```
1 class Node {
2 public:
3     int val;
4     Node* next;
5     Node* random;
6
7     Node(int _val) {
8         val = _val;
9         next = NULL;
10        random = NULL;
11    }
12 };
13
14
15 class Solution {
16 public:
17     Node* copyRandomList(Node* head) {
18         unordered_map<Node*,Node*>mp;
19         Node* dummy = new Node(100001);
20         Node* runner = dummy;
21         Node* curr = head;
22         while(curr!=NULL)
23         {
24             Node* newnode = new Node(curr->val);
25             runner->next = newnode;
26             mp[curr] = newnode;
27             curr=curr->next;
28             runner=runner->next;
29         }
30         curr = head;
31         runner = dummy->next;
32         while(curr!=NULL)
33         {
34             if(curr->random!=NULL)
35                 runner->random = mp[curr->random];
36             runner = runner->next;
37             curr = curr->next;
38         }
39         return dummy->next;
40     }
41 };
```