DEPARTMENT OF
COMPUTER SCIENCE & ENGINEERING
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Assignment-3

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Branch: Computer Science & Engineering **Section/Group:** IOT-614/B
Semester: 6th **Date of Performance:** 14/02/2025
Subject Name: Advanced Programming Lab-2 **Subject Code:** 22CSP-351

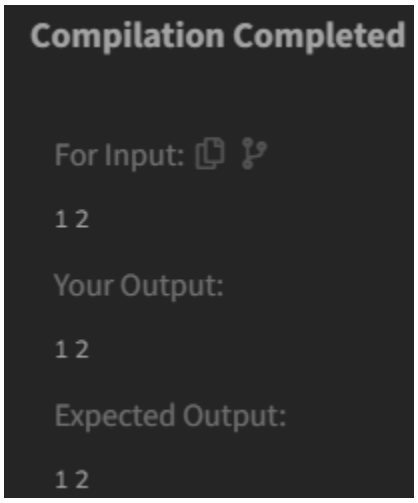
Q.1. Print Linked List

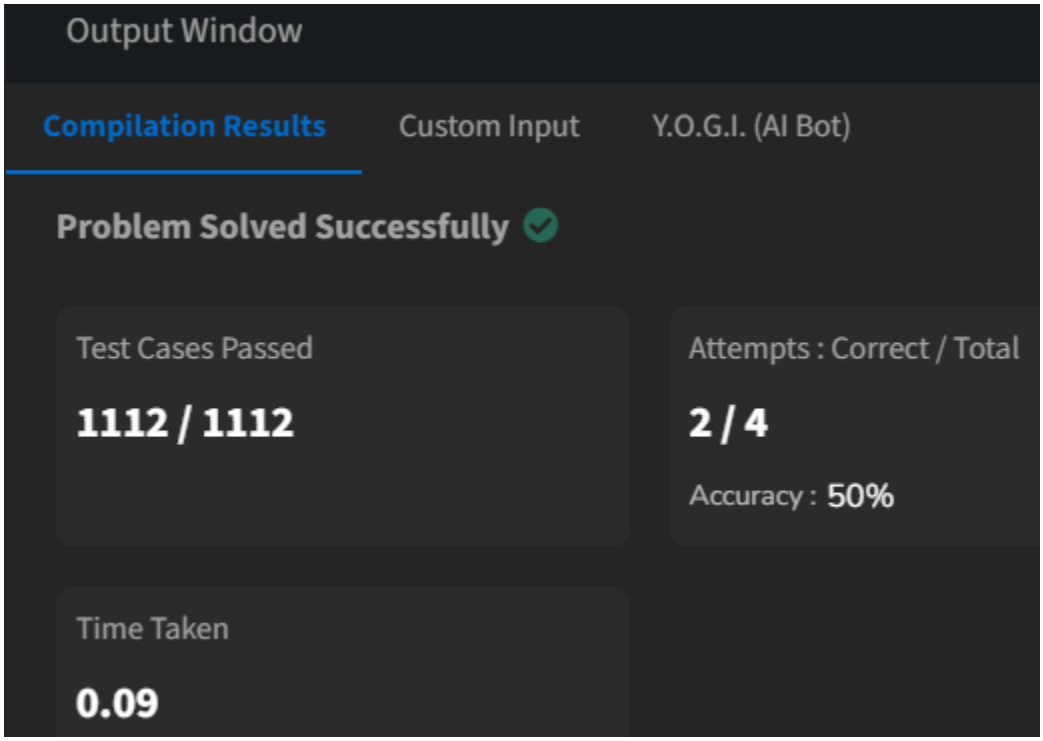
Given a linked list. Print all the elements of the linked list separated by space followed.

Code:

```
class Solution
{
  public:
    void printList(Node *head)
    {
        while (head != NULL)
        {
            cout << head->data;
            if (head->next) cout << " ";
            head = head->next;
        }
    }
};
```

Output:


Compilation Completed
For Input:
1 2
Your Output:
1 2
Expected Output:
1 2


Output Window
Compilation Results
Custom Input
Y.O.G.I. (AI Bot)
Problem Solved Successfully
Test Cases Passed
1112 / 1112
Attempts : Correct / Total
2 / 4
Accuracy : 50%
Time Taken
0.09

Q.2. Remove Duplicates from Sorted List

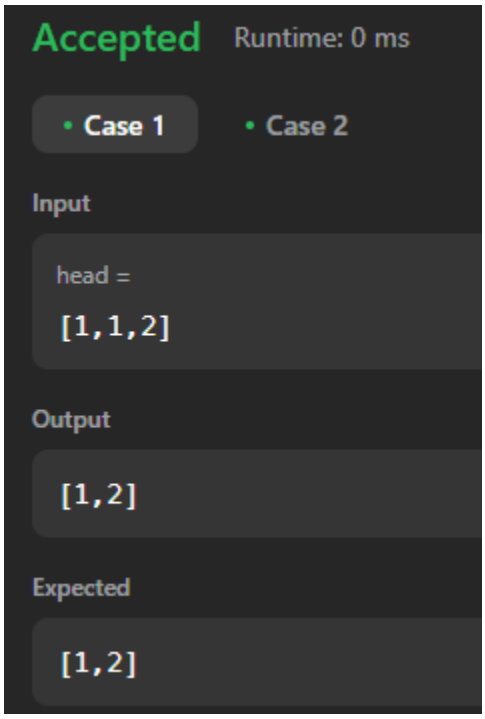
Given the head of a sorted linked list, delete all duplicates such that each element appears only once. Return the linked list sorted as well.

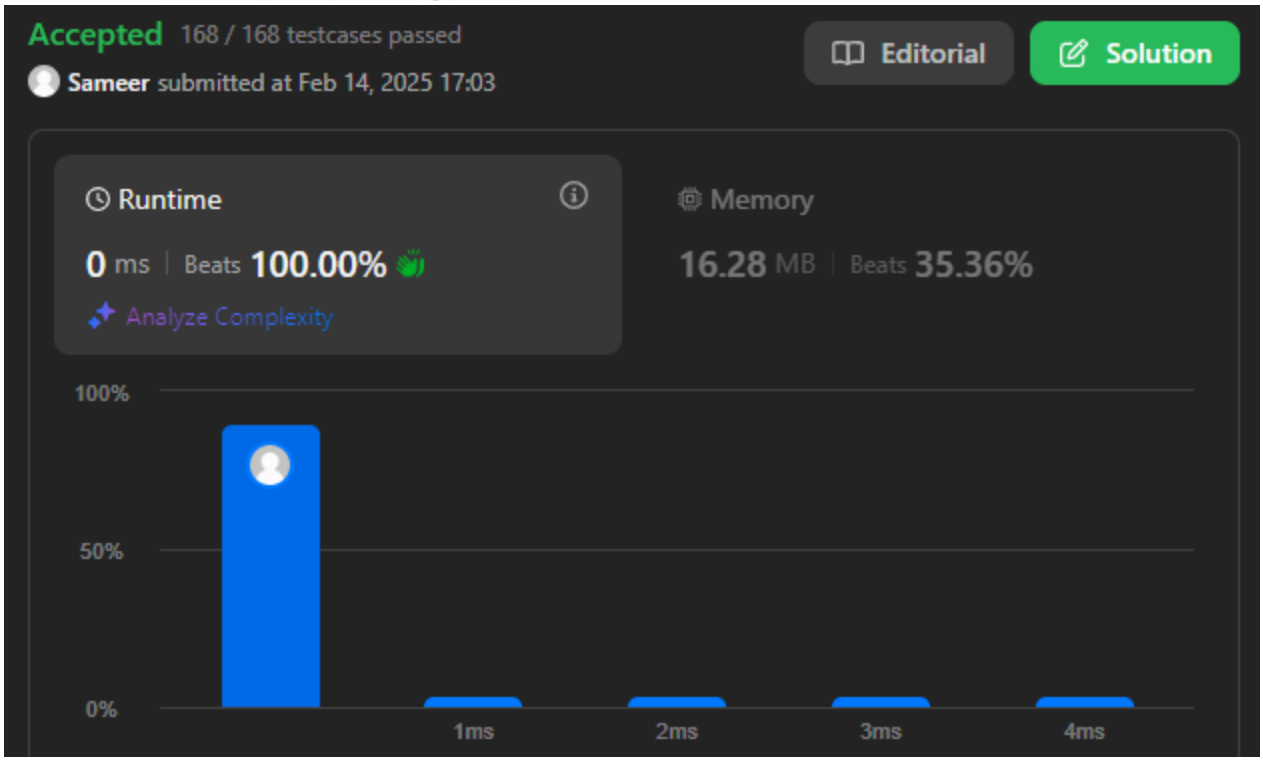
Code:

```
class Solution
{
public:
   ListNode* deleteDuplicates(ListNode* head)
   {
      if (head == NULL  ||  head->next == NULL)
      {
         return head ;
      }

      ListNode* temp = head ;
      ListNode* after = head->next ;

      while(after != NULL)
      {
         if ((temp->val) == (after->val))
         {
            temp->next = after->next ;
            after->next = NULL ;
            delete after ;

            if (temp->next == NULL)
            {
               return head ;
            }
         }
```

```
        else
        {
            temp = temp->next ;
        }

        after = temp->next ;
    }

    return head ;
  }
};
```

Output:





Q.3. Reverse Linked List

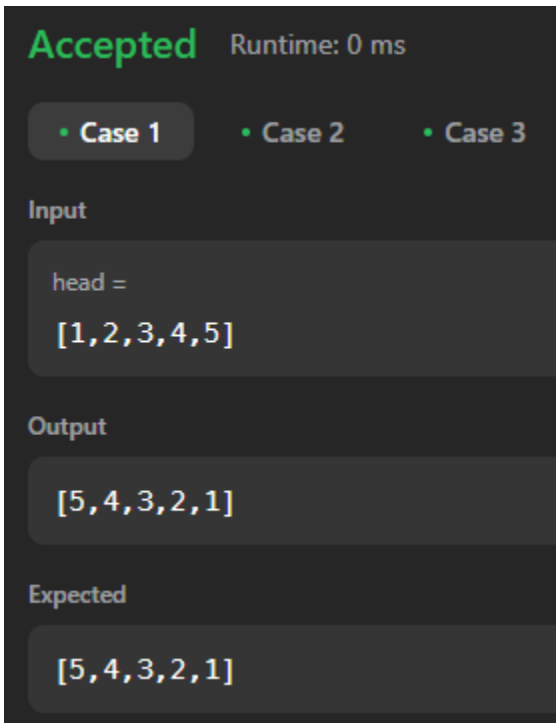
Given the head of a singly linked list, reverse the list, and return the reversed list.

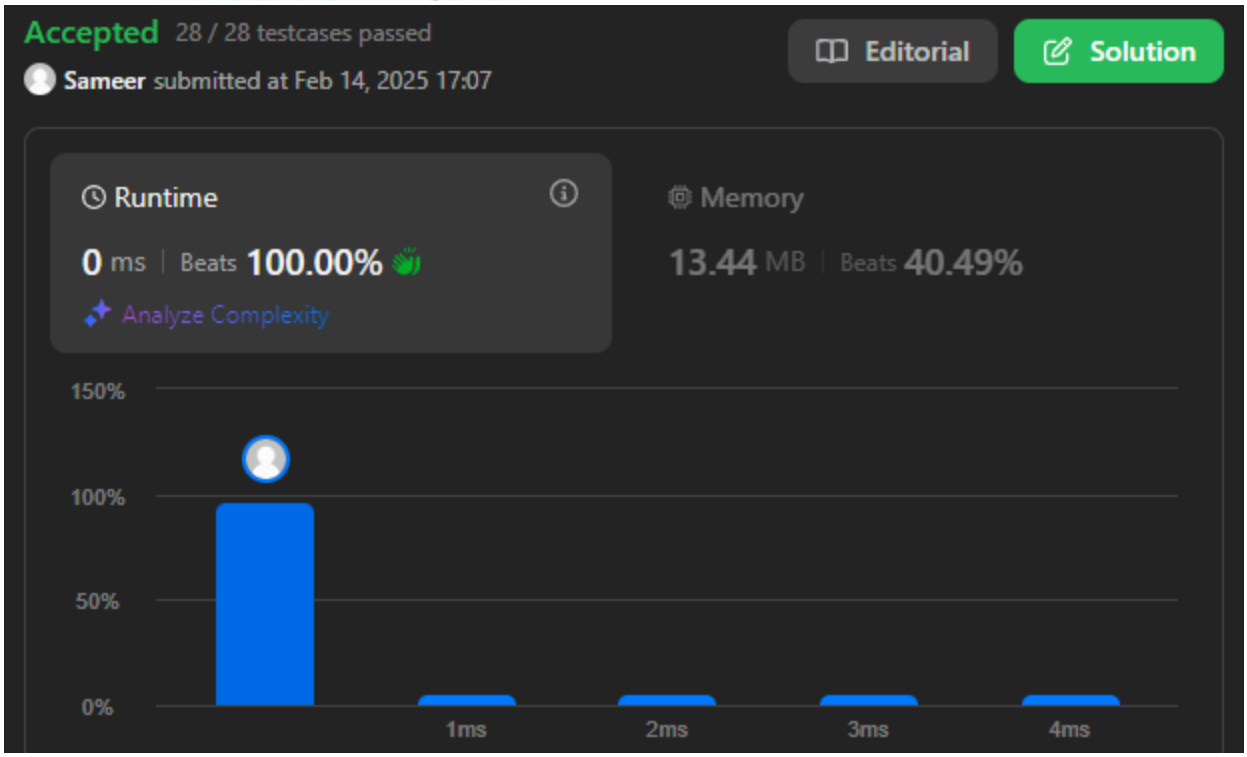
Code:

```
class Solution
{
public:
   ListNode* reverseList(ListNode* head)
   {
      ListNode* curr = head ;
      ListNode* prev = NULL ;
      ListNode* next = NULL ;

      while(curr != NULL)
      {
         next = curr->next ;
```

```
            curr->next = prev ;
            prev = curr ;
            curr = next ;
        }

        return prev ;
    }
};
```

Output:





Q.4. Delete the Middle Node of a Linked List

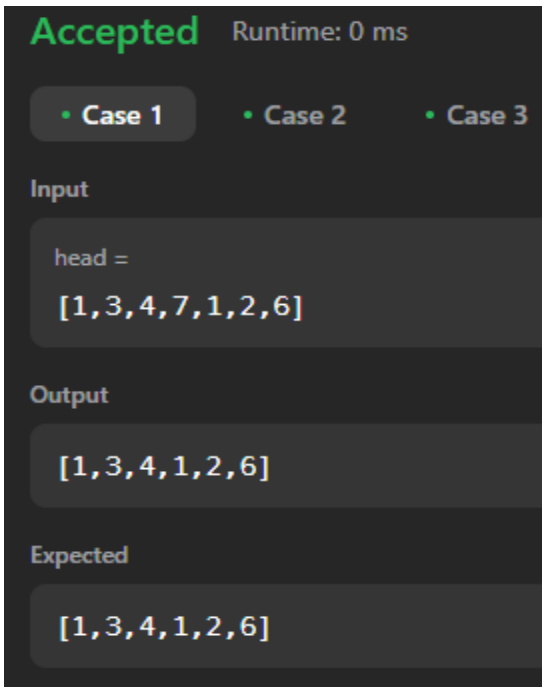
You are given the head of a linked list. Delete the middle node, and return the head of the modified linked list.

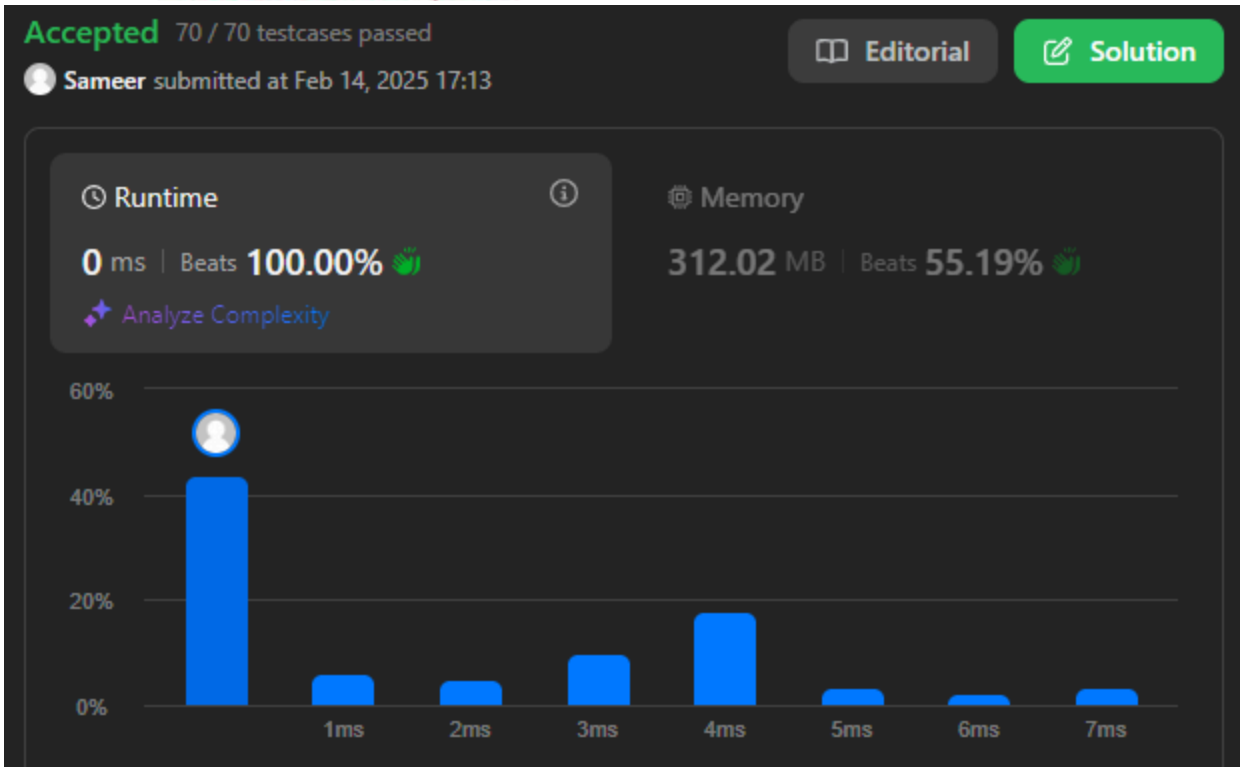
Code:

```
class Solution
{
public:
   ListNode* deleteMiddle(ListNode* head)
{
      if (!head || !head->next)
     {
         return nullptr;
      }

      ListNode* slow = head;
```

```
        ListNode* fast = head;
        ListNode* prev = nullptr;

        while (fast && fast->next)
       {
            fast = fast->next->next;
            prev = slow;
            slow = slow->next;
        }

        prev->next = slow->next;

        delete slow;

        return head;
    }
};
```

Output:





Q.5 Merge Two Sorted Lists

You are given the heads of two sorted linked lists list1 and list2. Merge the two lists into one sorted list. The list should be made by splicing together the nodes of the first two lists. Return the head of the merged linked list.

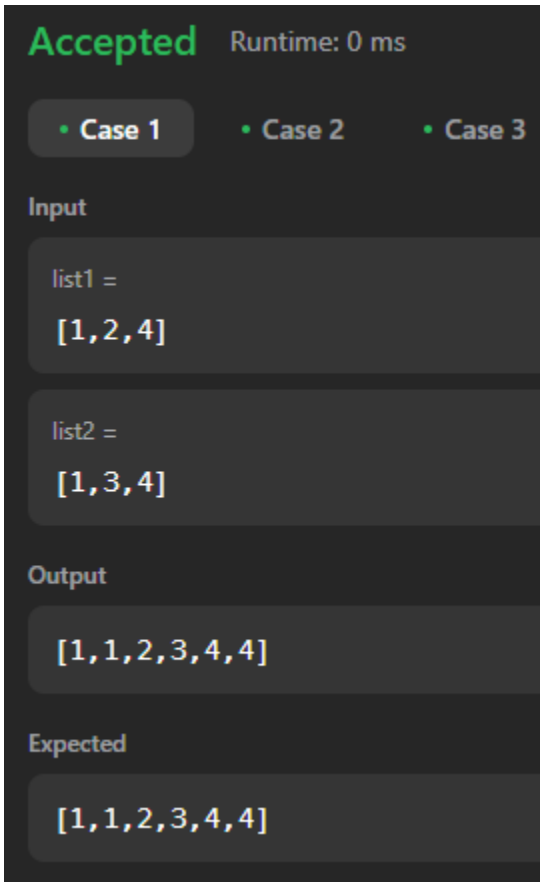
Code:

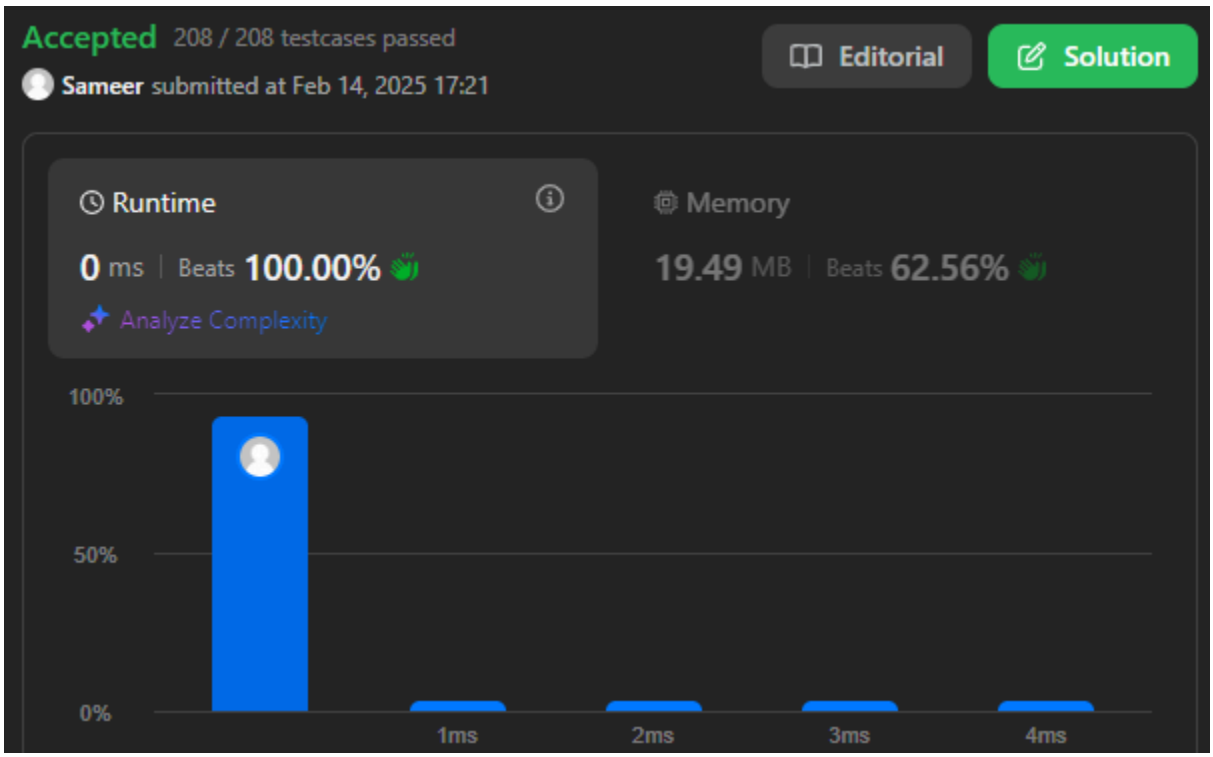
```
class Solution
{
public:

  ListNode* solve(ListNode* list1, ListNode* list2)
  {
    if (list1->next == NULL)
    {
      list1->next = list2 ;
      return list1 ;
    }
```

```
ListNode* curr1 = list1 ;
ListNode* next1 = curr1->next ;
ListNode* curr2 = list2 ;
ListNode* next2 = curr2->next ;

while (curr2 != NULL  &&  next1 != NULL)
{
   if (curr2->val >= curr1->val  &&  curr2->val <= next1->val)
   {
      curr1->next = curr2 ;
      next2 = curr2->next ;
      curr2->next = next1 ;

      curr1 = curr2 ;
      curr2 = next2 ;
   }

   else
   {
      curr1 = next1 ;
      next1 = next1->next ;

      if (next1 == NULL)
      {
         curr1->next = curr2 ;
         return list1 ;
      }
   }
}
return list1 ;
```

```
    }

    ListNode* mergeTwoLists(ListNode* list1, ListNode* list2)
    {
        if (list1 == NULL)
        {
            return list2 ;
        }

        if (list2 == NULL)
        {
            return list1 ;
        }

        if (list1->val <= list2->val)
        {
            return solve(list1, list2) ;
        }

        else
        {
            return solve(list2, list1) ;
        }
    }
};
```

Output:


Accepted
Runtime: 0 ms
Case 1
Case 2
Case 3
Input
list1 =
[1,2,4]
list2 =
[1,3,4]
Output
[1,1,2,3,4,4]
Expected
[1,1,2,3,4,4]


Accepted
208 / 208 testcases passed
Sameer submitted at Feb 14, 2025 17:21
Editorial
Solution
Runtime
0 ms | Beats 100.00%
Analyze Complexity
Memory
19.49 MB | Beats 62.56%
100%
50%
0%
1ms
2ms
3ms
4ms

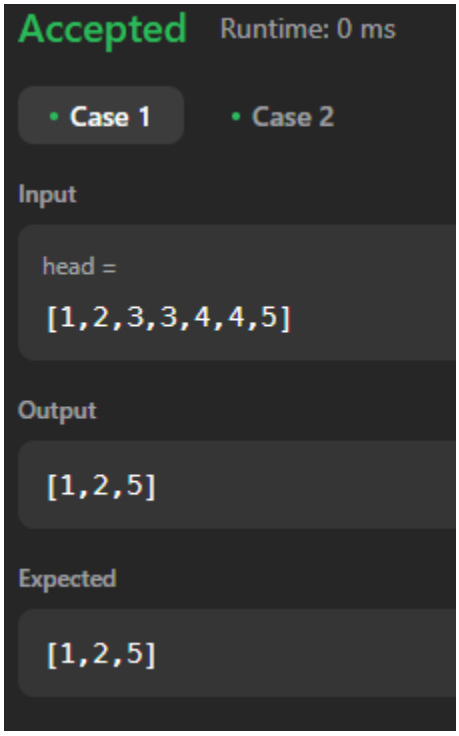
Q.6. Remove Duplicates from Sorted List II

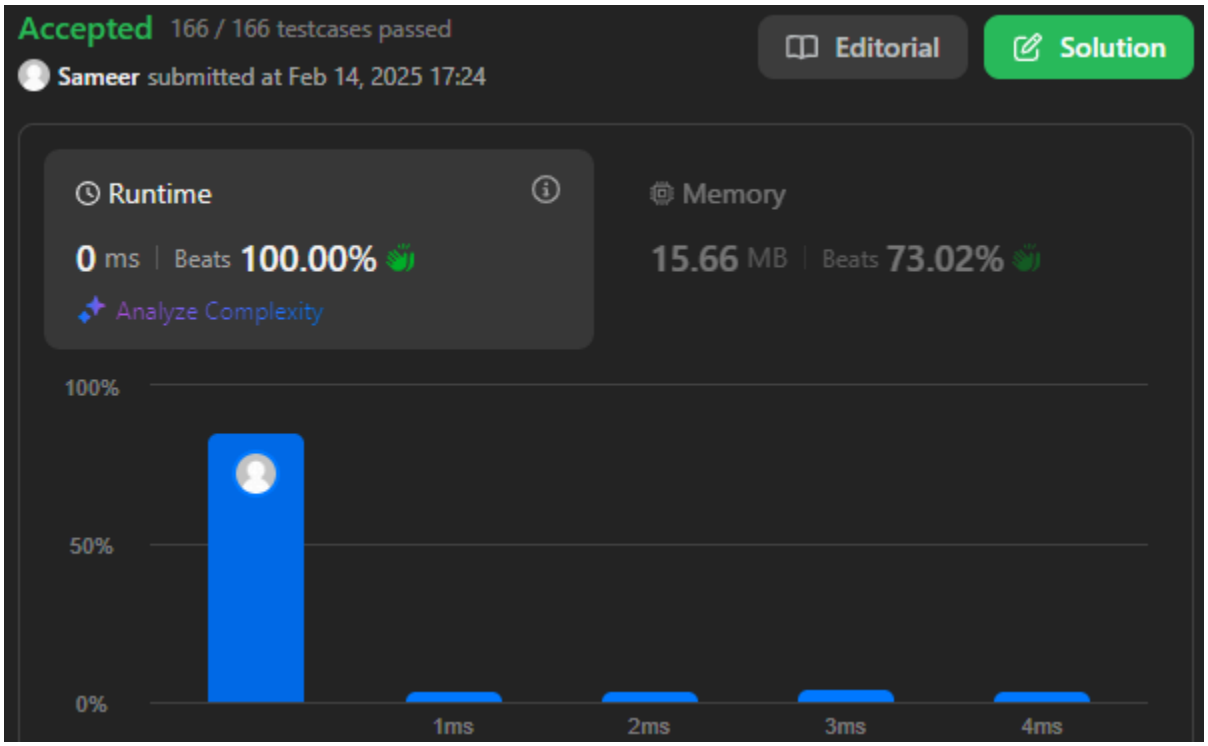
Given the head of a sorted linked list, delete all nodes that have duplicate numbers, leaving only distinct numbers from the original list. Return the linked list sorted as well.

Code:

```
class Solution {
public:
    ListNode* deleteDuplicates(ListNode* head) {
        ListNode* dummy = new ListNode(0);
        dummy->next = head;
        ListNode* prev = dummy;
        ListNode* current = head;

        while (current) {
            bool hasDuplicates = false;
            while (current->next && current->val == current->next->val) {
                current = current->next;
                hasDuplicates = true;
            }
            if (hasDuplicates) {
                prev->next = current->next;
            } else {
                prev = prev->next;
            }
            current = current->next;
        }
        return dummy->next;
    }
};
```

Output:


Accepted
Runtime: 0 ms
Case 1
Case 2
Input
head =
[1,2,3,3,4,4,5]
Output
[1,2,5]
Expected
[1,2,5]


Accepted
166 / 166 testcases passed
Sameer submitted at Feb 14, 2025 17:24
Editorial
Solution
Runtime
0 ms | Beats 100.00%
Analyze Complexity
Memory
15.66 MB | Beats 73.02%
100%
50%
0%
1ms
2ms
3ms
4ms

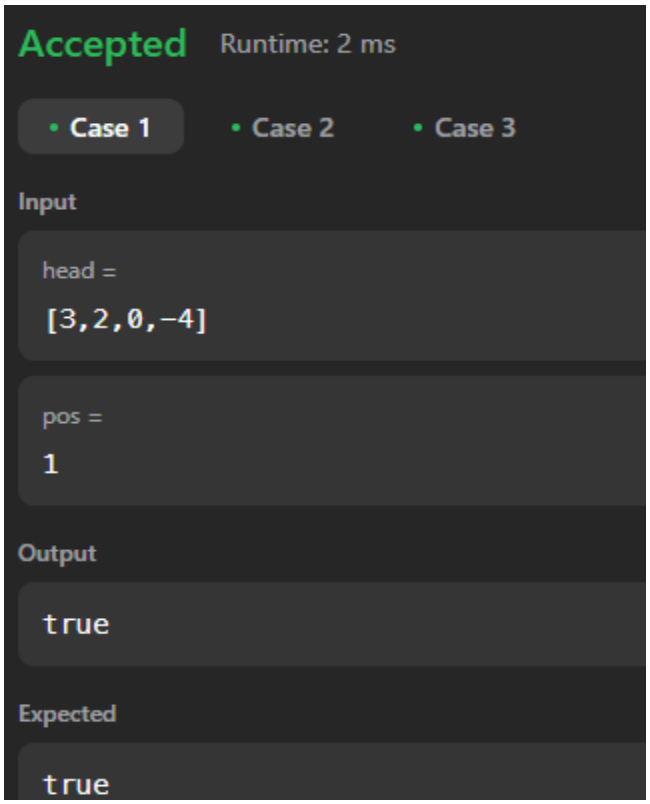
Q.7 Linked List Cycle

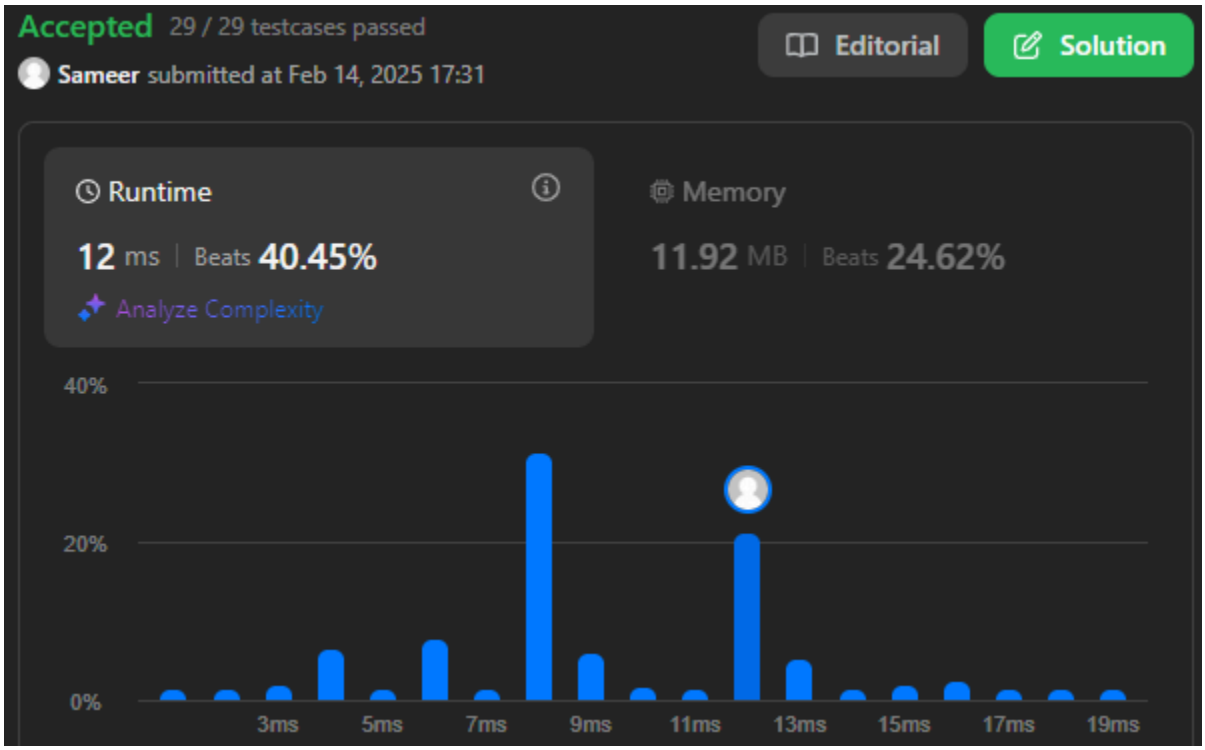
Given head, the head of a linked list, determine if the linked list has a cycle in it. There is a cycle in a linked list if there is some node in the list that can be reached again by continuously following the next pointer. Return true if there is a cycle in the linked list. Otherwise, return false.

Code:

```
class Solution
{
public:
   bool hasCycle(ListNode *head)
   {
      if (head == NULL  ||  head->next == NULL)
      {
         return false ;
      }

      ListNode* slow = head ;
      ListNode* fast = head ;

      while (slow != NULL  &&  fast != NULL  &&  fast->next != NULL)
      {
         slow = slow->next ;
         fast = fast->next->next ;

         if (slow == fast)
         {
            return true ;
         }
      }
      return false ;
   }
};
```

Output:


Accepted
Runtime: 2 ms
Case 1
Case 2
Case 3
Input
head =
[3,2,0,-4]
pos =
1
Output
true
Expected
true


Accepted
29 / 29 testcases passed
Sameer submitted at Feb 14, 2025 17:31
Editorial
Solution
Runtime
12 ms | Beats 40.45%
Analyze Complexity
Memory
11.92 MB | Beats 24.62%
40%
20%
0%
3ms
5ms
7ms
9ms
11ms
13ms
15ms
17ms
19ms

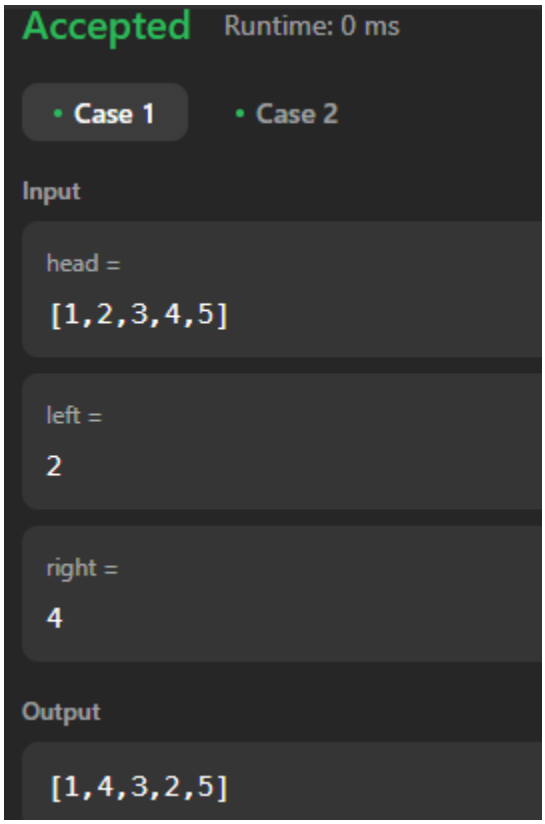
Q.8 Reverse Linked List II

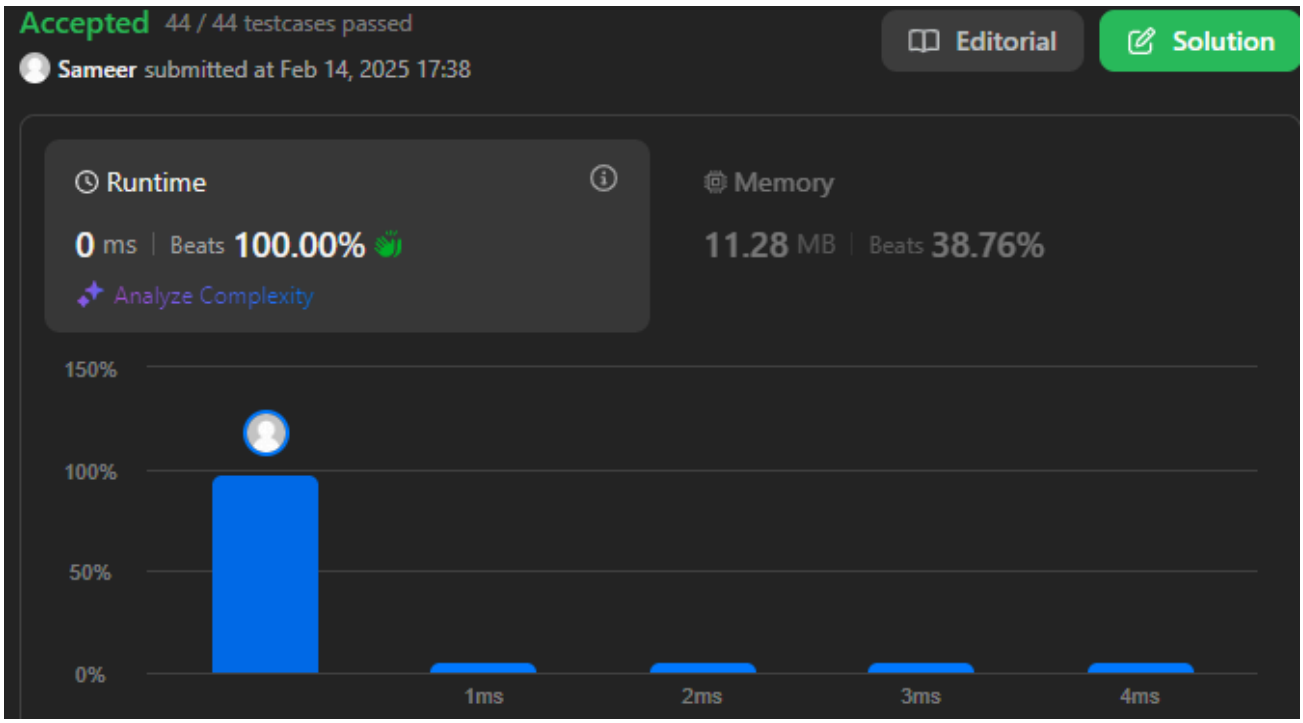
Given the head of a singly linked list and two integers left and right where left <= right, reverse the nodes of the list from position left to position right, and return the reversed list.

Code:

```
class Solution {
public:
    ListNode* reverseBetween(ListNode* head, int left, int right)
    {
        if (!head || left == right) return head;

        ListNode* dummy = new ListNode(0);
        dummy->next = head;
        ListNode* prev = dummy;

        for (int i = 1; i < left; ++i)
        {
            prev = prev->next;
        }
        ListNode* start = prev->next;
        ListNode* then = start->next;

        for (int i = left; i < right; ++i)
        {
            start->next = then->next;
            then->next = prev->next;
            prev->next = then;
            then = start->next;
        }
        return dummy->next;
}
};
```

Output:


Accepted
Runtime: 0 ms
Case 1
Case 2
Input
head =
[1,2,3,4,5]
left =
2
right =
4
Output
[1,4,3,2,5]


Accepted
44 / 44 testcases passed
Sameer submitted at Feb 14, 2025 17:38
Editorial
Solution
Runtime
0 ms | Beats 100.00%
Analyze Complexity
Memory
11.28 MB | Beats 38.76%
150%
100%
50%
0%
1ms
2ms
3ms
4ms

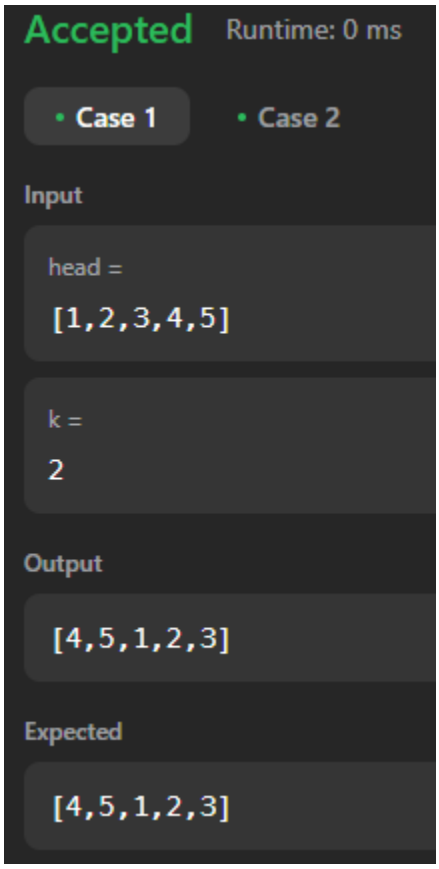
Q.9. Rotate List

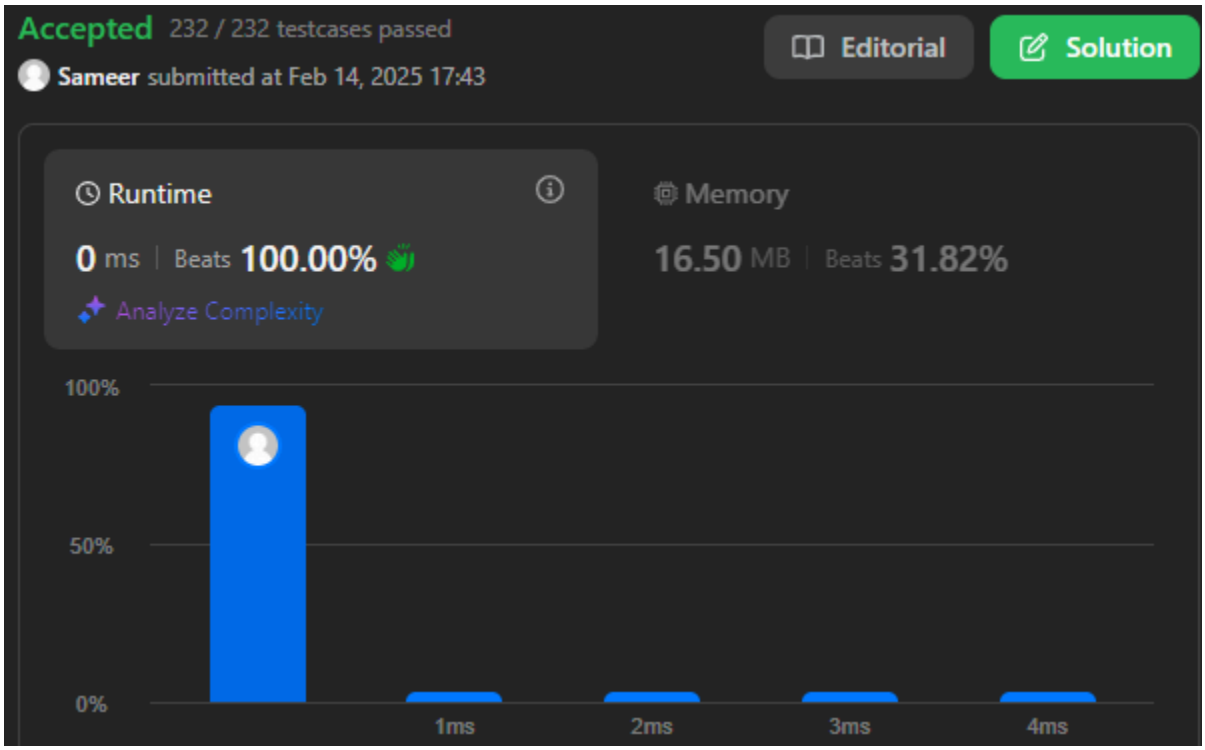
Given the head of a linked list, rotate the list to the right by k places.

Code:

```
class Solution {
public:
    ListNode* rotateRight(ListNode* head, int k)
    {
        if (!head || !head->next || k == 0) return head;
        ListNode* curr = head;
        int length = 1;

        while (curr->next)
        {
            curr = curr->next;
            length++;
        }

        k = k % length;
        if (k == 0) return head;
        curr->next = head;  // Form a cycle

        for (int i = 0; i < length - k; ++i)
        {
            curr = curr->next;
        }
        ListNode* newHead = curr->next;
        curr->next = nullptr;

        return newHead;
    }
};
```

Output:


Accepted
Runtime: 0 ms
Case 1
Case 2
Input
head =
[1,2,3,4,5]
k =
2
Output
[4,5,1,2,3]
Expected
[4,5,1,2,3]


Accepted
232 / 232 testcases passed
Sameer submitted at Feb 14, 2025 17:43
Editorial
Solution
Runtime
0 ms | Beats 100.00%
Analyze Complexity
Memory
16.50 MB | Beats 31.82%
100%
50%
0%
1ms
2ms
3ms
4ms

Q.10. Sort List

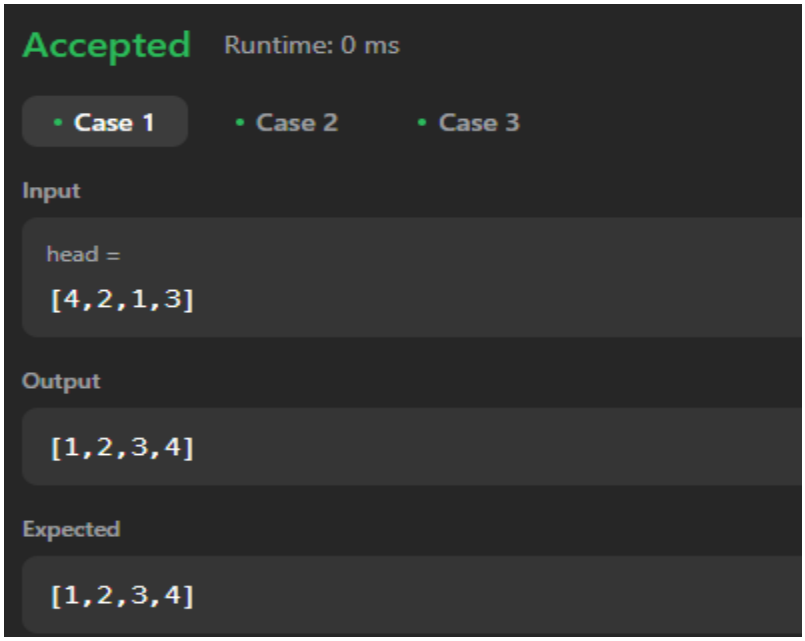
Given the head of a linked list, return the list after sorting it in ascending order.

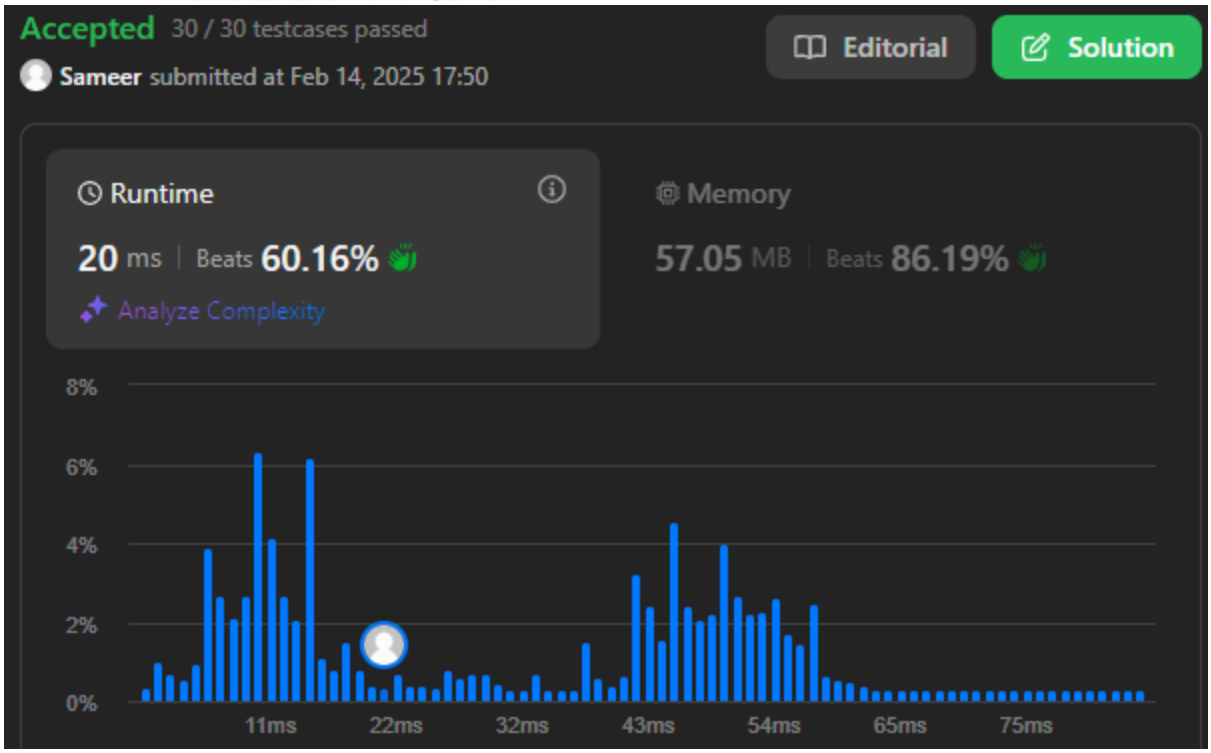
Code:

```
class Solution {
public:
   ListNode* sortList(ListNode* head)
   {
      if (!head || !head->next)
      return head;

      ListNode* slow = head;
      ListNode* fast = head;
      ListNode* prev = nullptr;

      while (fast && fast->next)
      {
         prev = slow;
         slow = slow->next;
         fast = fast->next->next;
      }
      prev->next = nullptr;
      ListNode* l1 = sortList(head);
      ListNode* l2 = sortList(slow);
      return merge(l1, l2);
   }

   ListNode* merge(ListNode* l1, ListNode* l2)
   {
      ListNode dummy(0);
      ListNode* curr = &dummy;
```

```
        while (l1 && l2)
        {
            if (l1->val < l2->val)
            {
                curr->next = l1;
                l1 = l1->next;
            }
            else
            {
                curr->next = l2;
                l2 = l2->next;
            }
            curr = curr->next;
        }
        curr->next = l1 ? l1 : l2;
        return dummy.next;
    }
};
```

Output:





Q.11 Linked List Cycle II

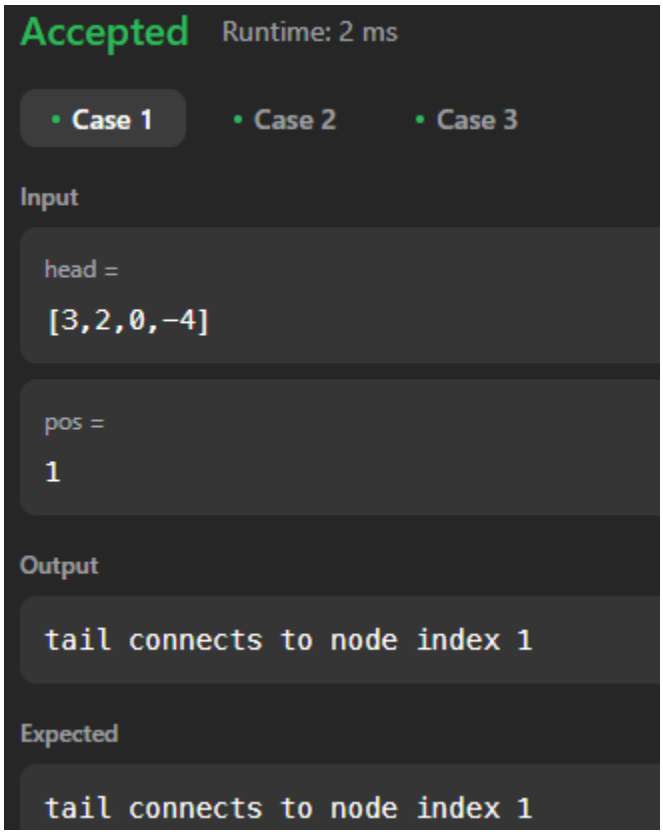
Given the head of a linked list, return the node where the cycle begins. If there is no cycle, return null.

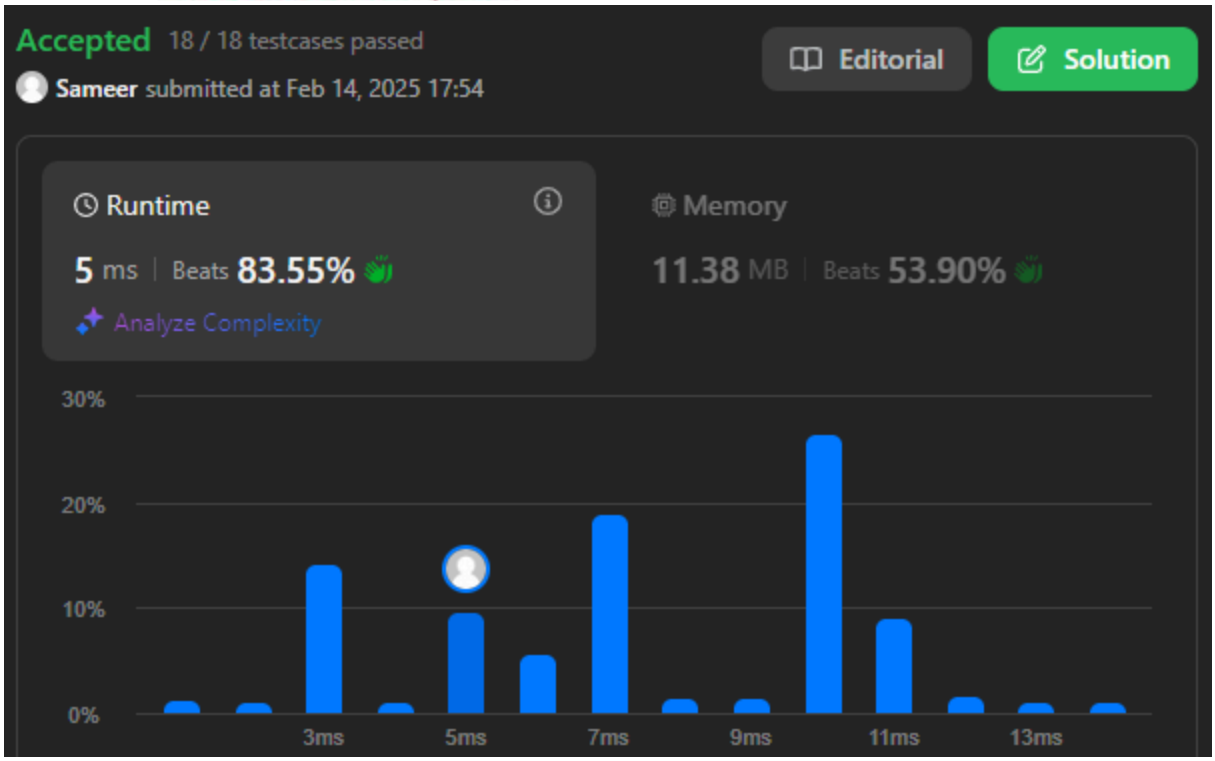
Code:

```
class Solution {
public:
    ListNode *detectCycle(ListNode *head)
    {
        if (!head || !head->next)
        return nullptr;

        ListNode *slow = head, *fast = head;

        while (fast && fast->next)
        {
```

```
        slow = slow->next;
        fast = fast->next->next;

        if (slow == fast)
        {
            slow = head;
            while (slow != fast)
            {
                slow = slow->next;
                fast = fast->next;
            }
            return slow;
        }
    }
```

Output:




Accepted 18 / 18 testcases passed
Sameer submitted at Feb 14, 2025 17:54
Editorial
Solution
Runtime
5 ms | Beats 83.55%
Analyze Complexity
Memory
11.38 MB | Beats 53.90%
30%
20%
10%
0%
3ms
5ms
7ms
9ms
11ms
13ms