# Ap-Assignment 3

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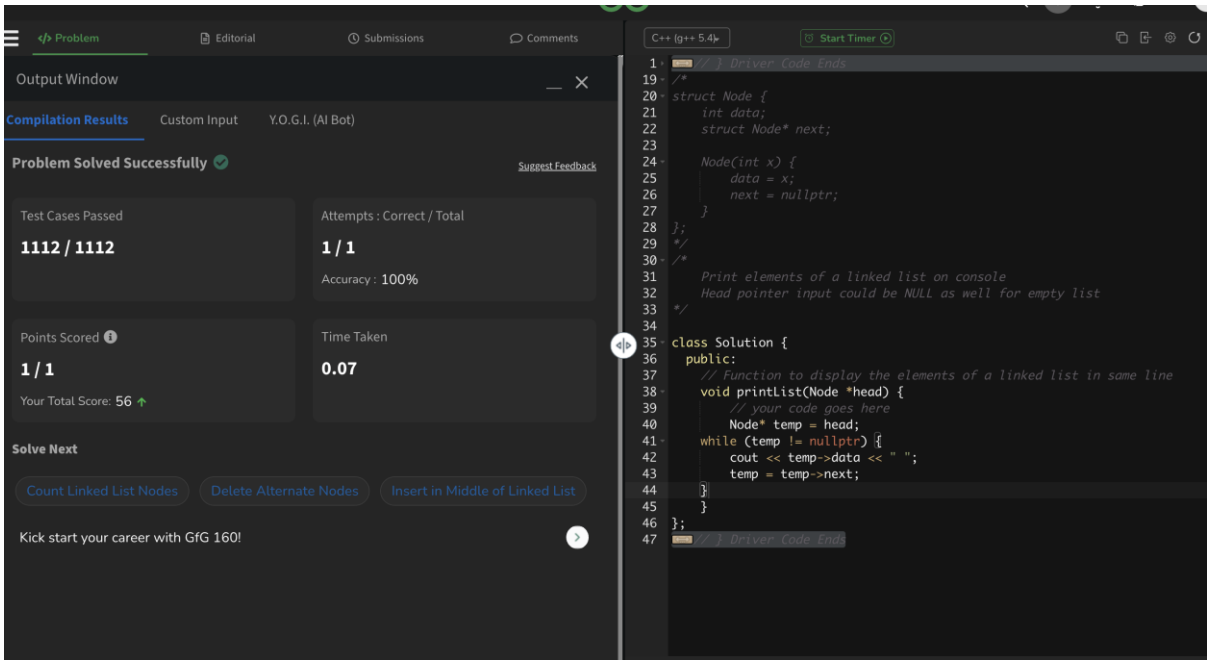
**Q1.Print Linkedlist:**

**a.Code:**

```
class Solution {
 public:
  // Function to display the elements of a linked list in same line
  void printList(Node *head) {
    // your code goes here
    Node* temp = head;
  while (temp != nullptr) {
    cout << temp->data << " ";
    temp = temp->next;
  }
  }
};
```

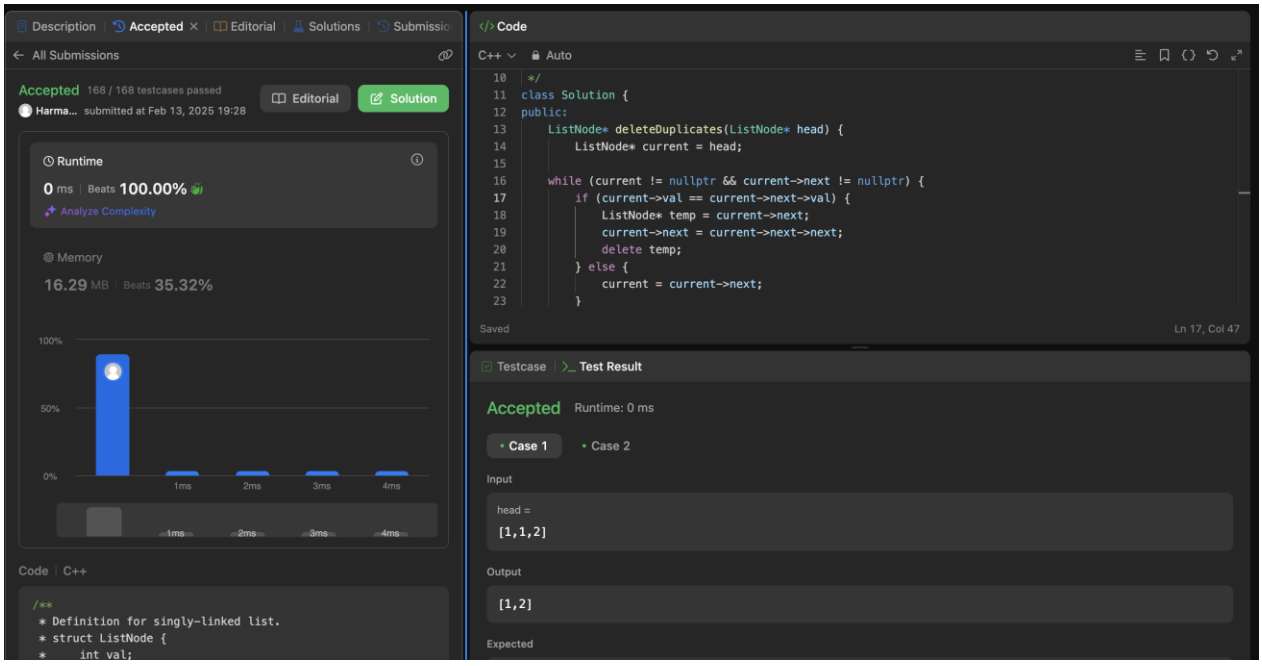



**Q2.Remove Duplicates from Sorted list**

**a.**

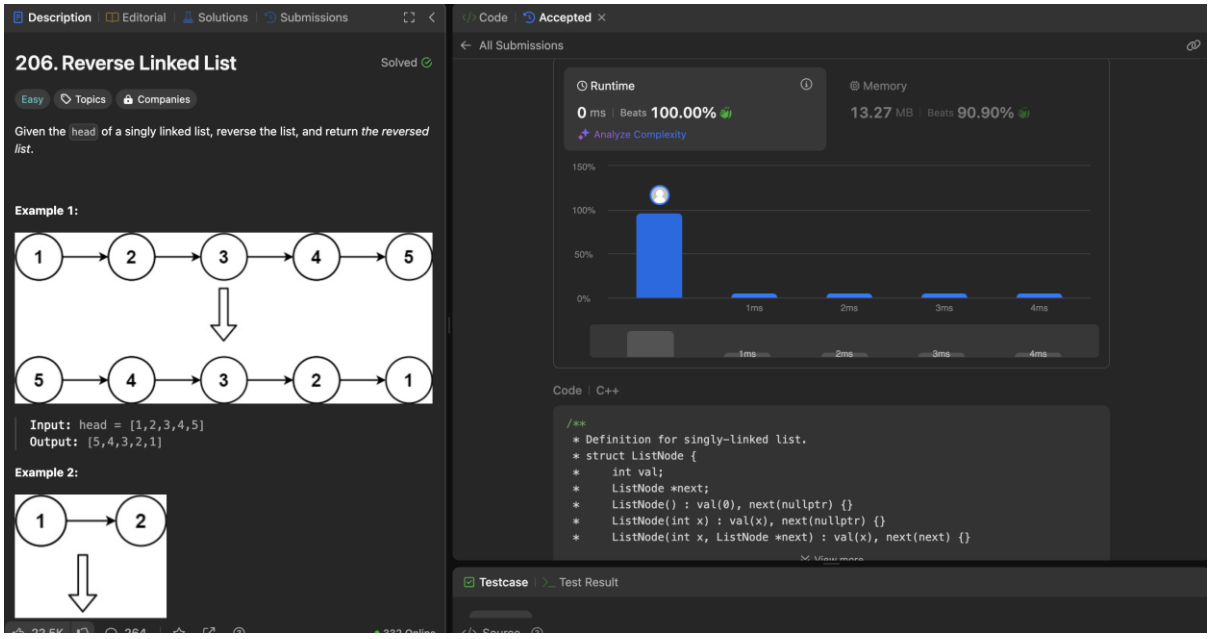
```
class Solution {
public:
    ListNode* deleteDuplicates(ListNode* head) {
        ListNode* current = head;

    while (current != nullptr && current->next != nullptr) {
        if (current->val == current->next->val) {
            ListNode* temp = current->next;
            current->next = current->next->next;
            delete temp;
        } else {
            current = current->next;
        }
    }
    return head;
    }
};
```

**b.Output**



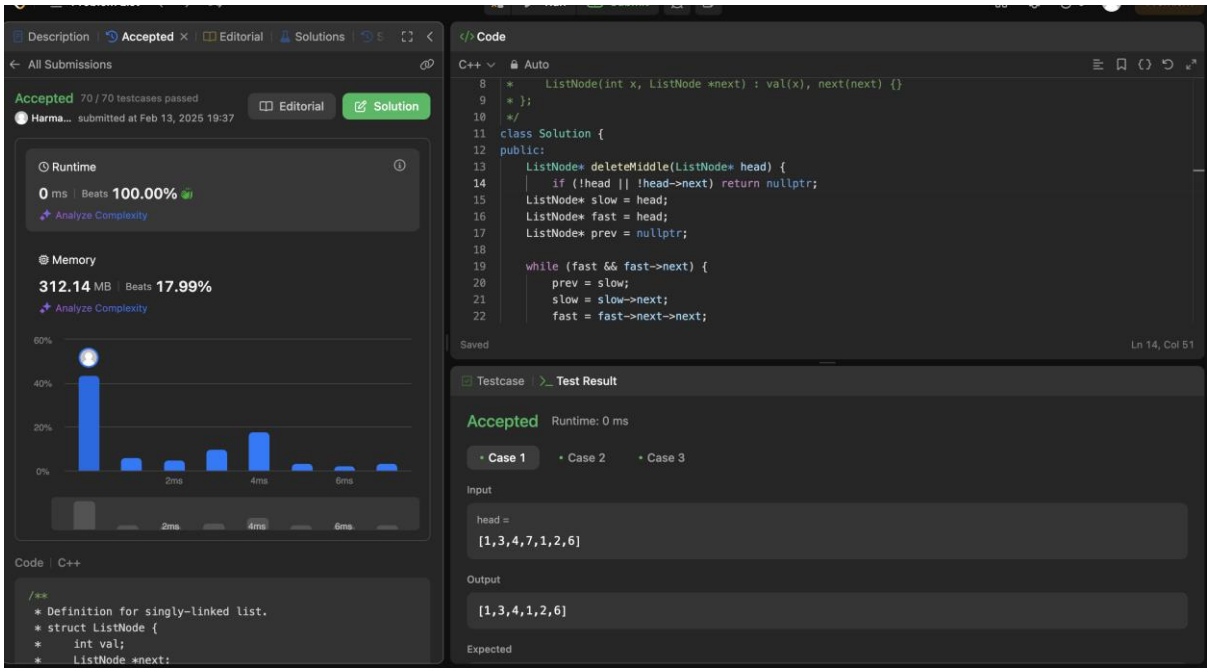

**Q3.Reverse Linkedlist**

```cpp
class Solution {
public:
    ListNode* reverseList(ListNode* head) {
        ListNode* prev = nullptr;
    ListNode* current = head;

    while (current) {
        ListNode* nextNode = current->next;
        current->next = prev;
        prev = current;
        current = nextNode;
    }

    return prev;
}

ListNode* createLinkedList(const vector<int>& nums) {
    if (nums.empty()) return nullptr;

    ListNode* head = new ListNode(nums[0]);
    ListNode* current = head;
    for (size_t i = 1; i < nums.size(); i++) {
        current->next = new ListNode(nums[i]);
        current = current->next;
    }
    return head;
}
```



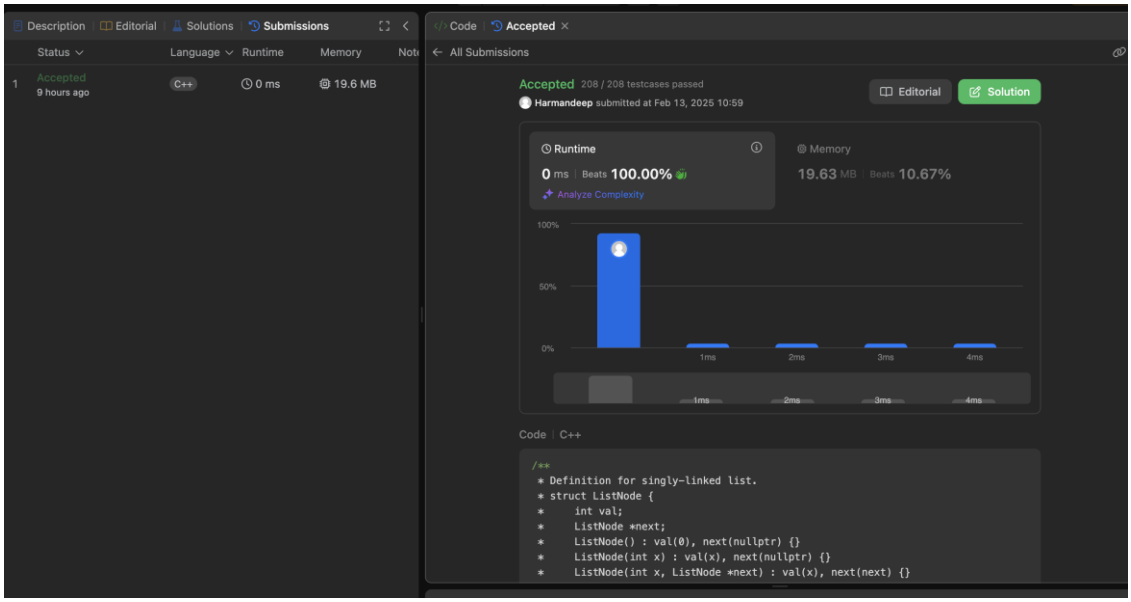

## Q4.Delete Middle Node

```cpp
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) {
        prev = slow;
        slow = slow->next;
        fast = fast->next->next;
    }


    prev->next = slow->next;
    delete slow;

    return head;
    }
};
```



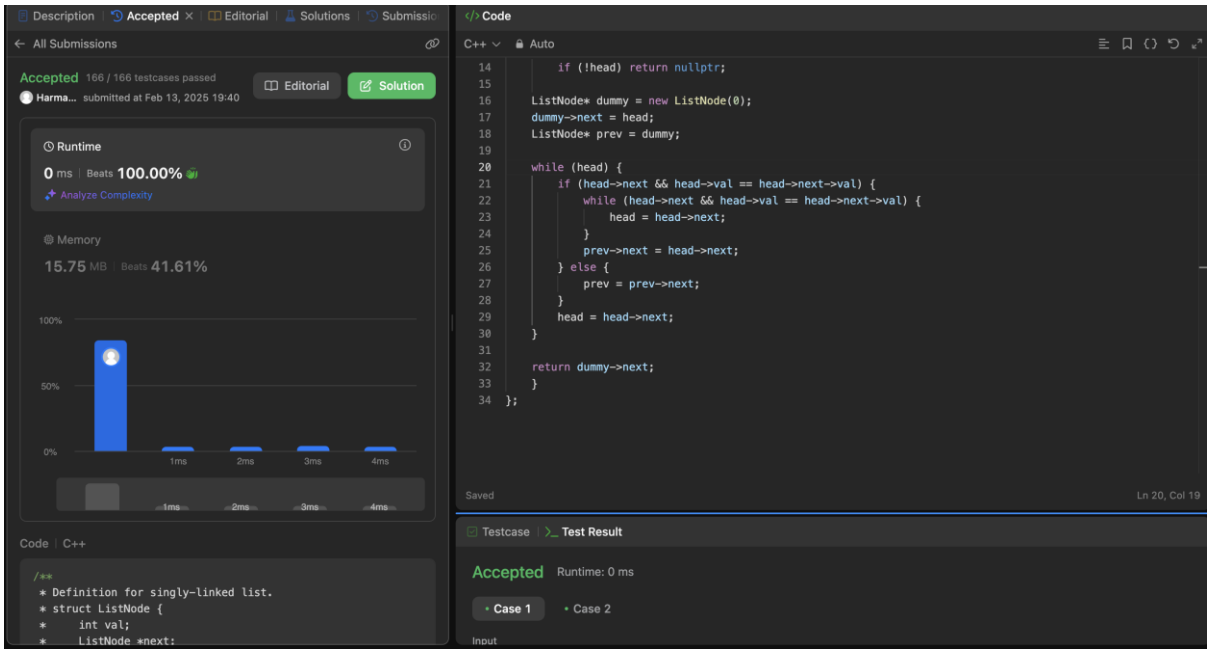

## Q5.Merge two Sorted linkedlist

```cpp
class Solution {
public:
    ListNode* mergeTwoLists(ListNode* list1, ListNode* list2) {
        ListNode dummy(0);
    ListNode* tail = &dummy;

    while (list1 && list2) {
        if (list1->val < list2->val) {
            tail->next = list1;
            list1 = list1->next;
        } else {
            tail->next = list2;
            list2 = list2->next;
        }
        tail = tail->next;
    }



    tail->next = list1 ? list1 : list2;

    return dummy.next;
}

void printList(ListNode* head) {
    while (head) {
        std::cout << head->val << " -> ";
        head = head->next;
    }
    std::cout << "NULL" << std::endl;

    }
};
```



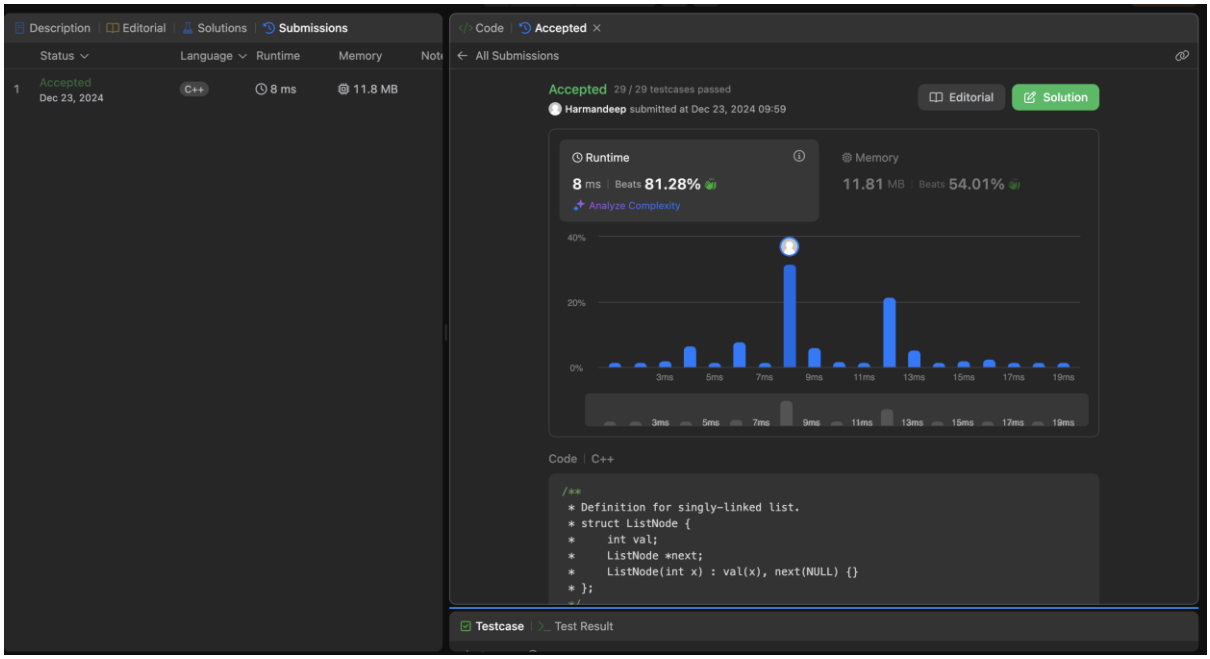
## Q6.Remove duplicates from sorted list2

```cpp
class Solution {
public:
    ListNode* deleteDuplicates(ListNode* head) {
        if (!head) return nullptr;

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

        while (head) {
            if (head->next && head->val == head->next->val) {
                while (head->next && head->val == head->next->val) {
                    head = head->next;
                }
                prev->next = head->next;
            } else {
                prev = prev->next;
            }
            head = head->next;
        }

        return dummy->next;
    }
};
```




## Q7.Detect Cycle in Linkedlist

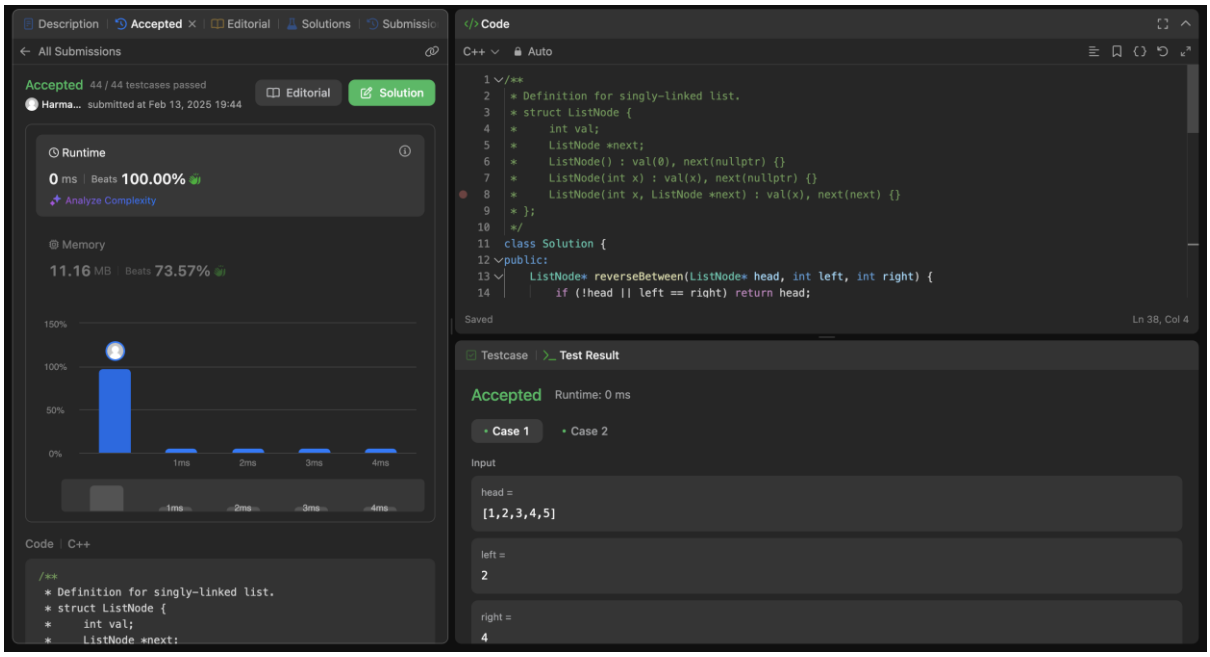
```cpp
class Solution {
public:
    bool hasCycle(ListNode *head) {
        if (!head || !head->next) return false;

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

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

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

        return false;
}
ListNode* createCycleList(const vector<int>& nums, int pos) {
    if (nums.empty()) return nullptr;

    ListNode* head = new ListNode(nums[0]);
    ListNode* current = head;
    ListNode* cycleNode = nullptr;

    for (size_t i = 1; i < nums.size(); i++) {
        current->next = new ListNode(nums[i]);
        current = current->next;
        if (static_cast<int>(i) == pos) {
            cycleNode = current;
        }
    }

    if (pos >= 0) {
        current->next = cycleNode;
    }

    return head;
    }
};
```




## Q8.Reverse LinkedList 2

```
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* curr = prev->next;
        ListNode* next = nullptr;


        ListNode* prevReversed = nullptr;
        for (int i = 0; i <= right - left; i++) {
            next = curr->next;
            curr->next = prevReversed;
            prevReversed = curr;
            curr = next;
        }


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

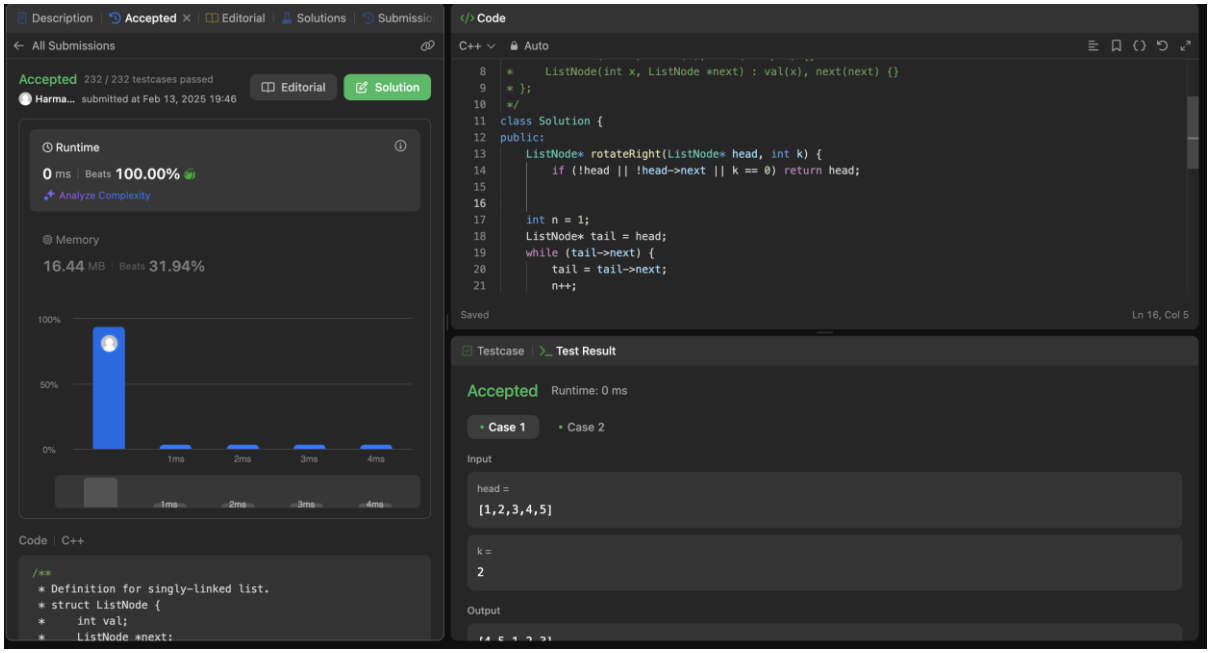
```
    prev->next = prevReversed;

    return dummy->next;
    }
};
```




## Q9.Rotate a list

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


    int n = 1;
    ListNode* tail = head;
    while (tail->next) {
        tail = tail->next;
        n++;
    }


    k = k % n;
    if (k == 0) return head;


    ListNode* newTail = head;
    for (int i = 0; i < n - k - 1; i++) {
        newTail = newTail->next;
    }
```

```
    ListNode* newHead = newTail->next;
    newTail->next = nullptr;
    tail->next = head;

    return newHead;
    }
};
```




## Q10.Detect a cycle in Linkedlist 2

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

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


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


    if (!fast || !fast->next) return nullptr;
```

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

    return slow;
}

void createCycle(ListNode* head, int pos) {
    if (pos == -1) return;

    ListNode* cycleNode = head;
    ListNode* tail = head;
    int index = 0;

    while (tail->next) {
        if (index == pos) cycleNode = tail;
        tail = tail->next;
        index++;
    }

    tail->next = cycleNode;
    }
};
```