AP ASSIGNMENT 3

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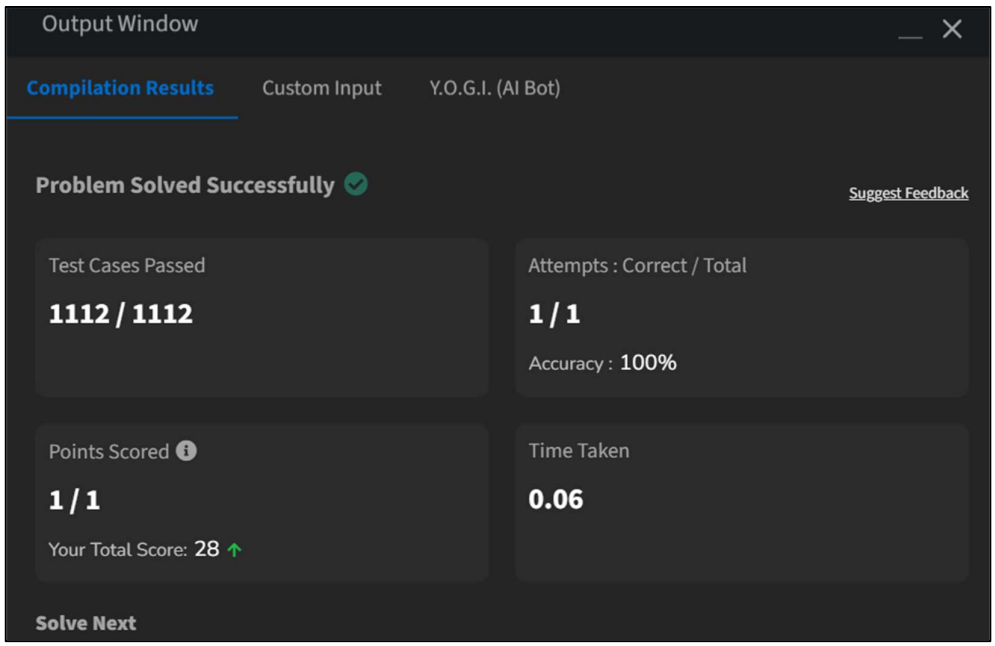
1. Print Linked List:

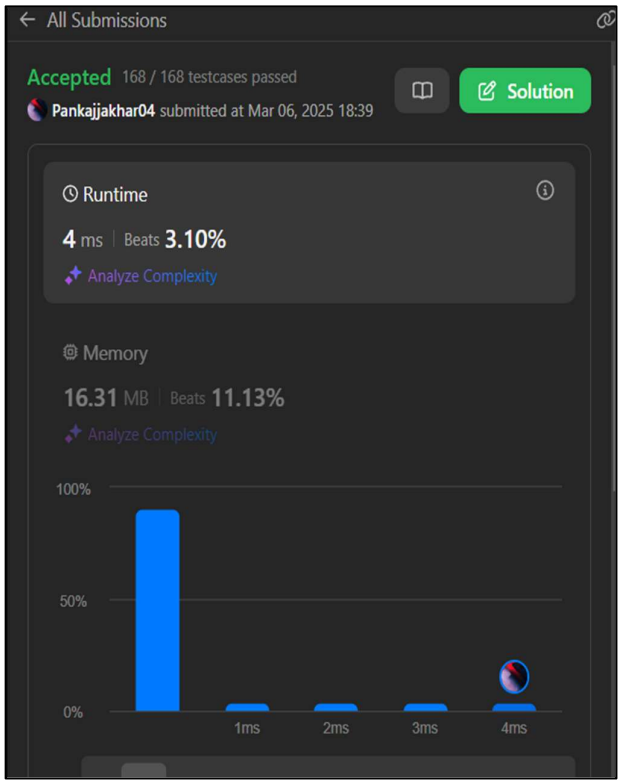
```
class Solution {
  public:
    // Function to display the elements of a linked list in same line
    void printList(Node *head) {
        while(head!=nullptr){
            cout<<head->data<<" ";
            head=head->next;
        }
    }
};
```



2. Remove duplicates from a sorted list:

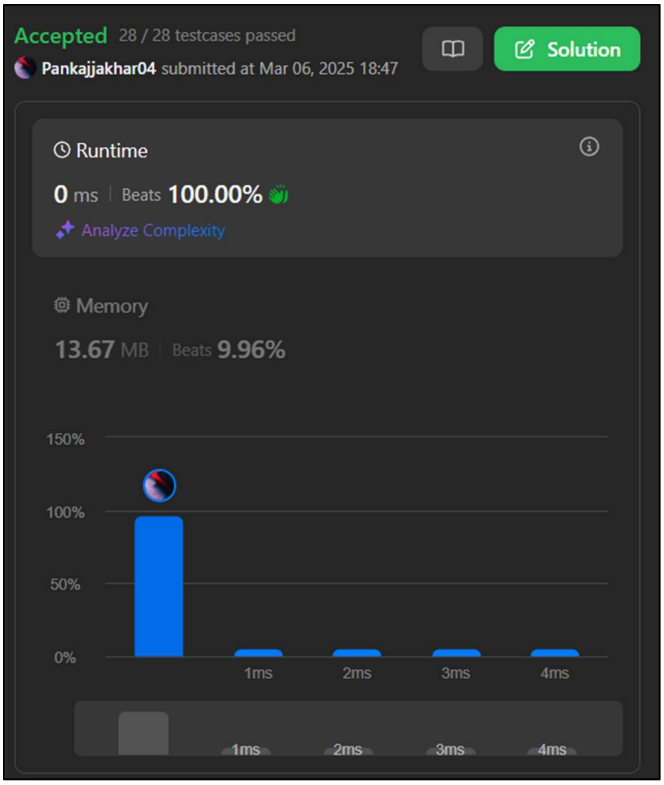
```
class Solution {
public:
    ListNode* deleteDuplicates(ListNode* head) {
        if(!head || !head->next){
            return head;
        }
        ListNode* current = head;
```

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



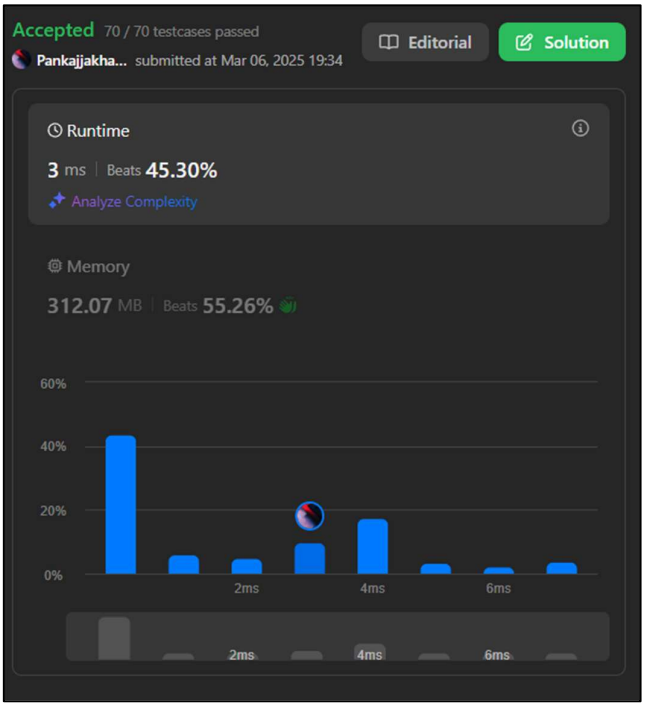
3. Reverse a linked list:

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



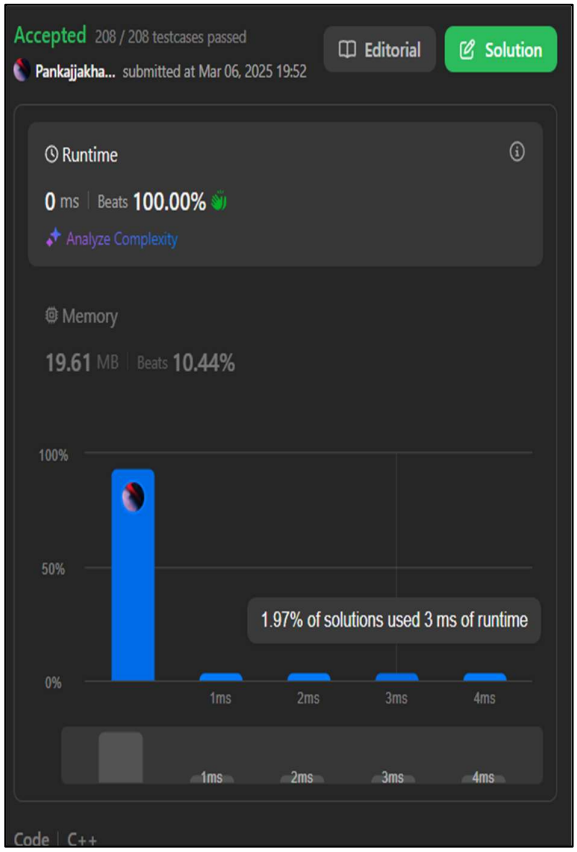
4. Delete middle node of a list:

```
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;
  }
};
```



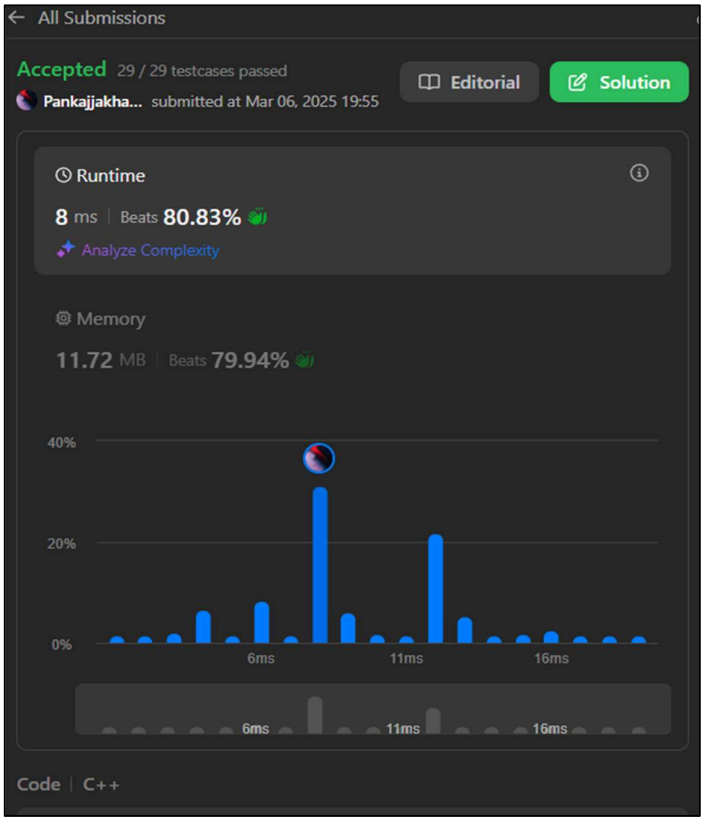
5. Merge two sorted linked lists:

```
class Solution {
public:
  ListNode* mergeTwoLists(ListNode* list1,
ListNode* list2) {
    if (!list1) return list2;
    if (!list2) return list1;

    if (list1->val <= list2->val) {
      list1->next = mergeTwoLists(list1->next, list2);
      return list1;
    } else {
      list2->next = mergeTwoLists(list1, list2->next);
      return list2;
    }
  }

};
```



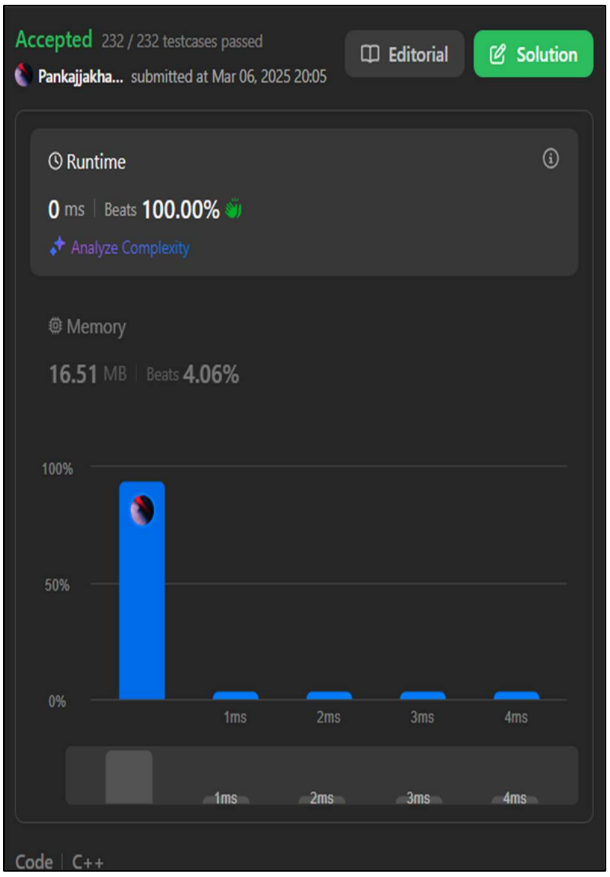
6. Detect a cycle in a linked list:

```
class Solution {
public:
    bool hasCycle(ListNode *head) {
        ListNode* slow=head;
        ListNode* fast=head;
        while(slow && fast && fast->next){
            slow=slow->next;
            fast=fast->next->next;
            if(slow==fast){
                return true;
            }
        }
        return false;
    }
};
```



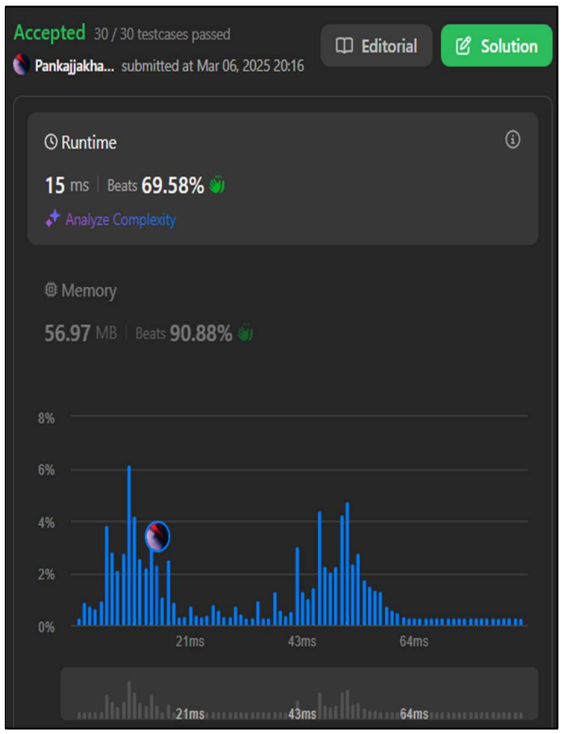
7. Rotate a list:

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

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

        k = k % length;
        if (k == 0) {
            return head;
        }

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



```
        }

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

        return newHead;
    }
};
```

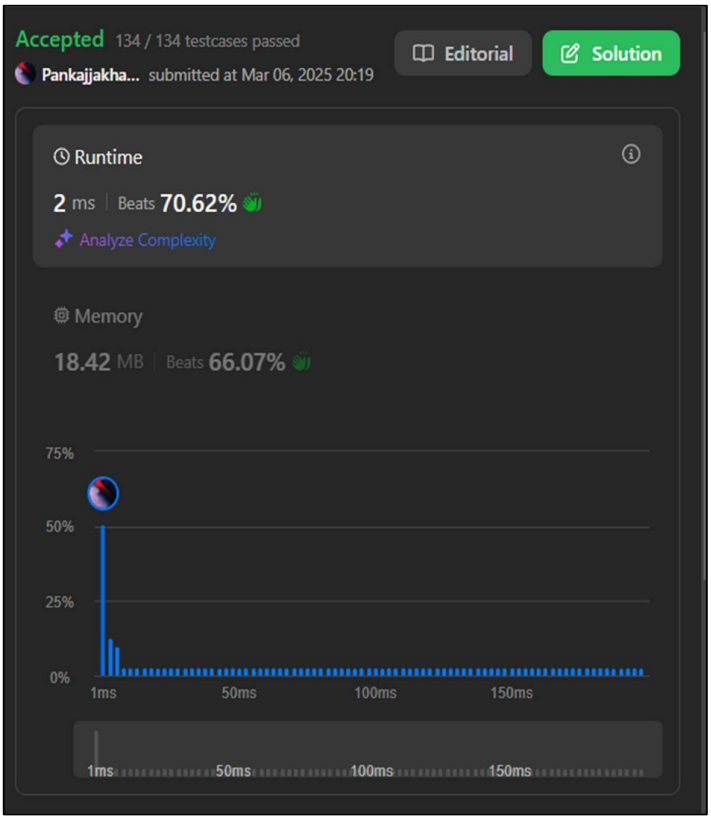
8. Sort List:




```
class Solution {
public:
    ListNode* sortList(ListNode* head) {
        if (!head || !head->next) return head;
        ListNode* mid = getMiddle(head);
        ListNode* left = head;
        ListNode* right = mid->next;
        mid->next = nullptr;
        left = sortList(left);
        right = sortList(right);
        return merge(left, right);
    }

private:
    ListNode* getMiddle(ListNode* head) {
        ListNode* slow = head;
        ListNode* fast = head->next;
        while (fast && fast->next) {
            slow = slow->next;
            fast = fast->next->next;
        }
        return slow;
    }

    ListNode* merge(ListNode* l1, ListNode* l2) {
        ListNode dummy(0);
        ListNode* tail = &dummy;
        while (l1 && l2) {
            if (l1->val <= l2->val) {
                tail->next = l1;
                l1 = l1->next;
            } else {
                tail->next = l2;
                l2 = l2->next;
            }
```

```
            tail = tail->next;
        }
        tail->next = l1 ? l1 : l2;
        return dummy.next;
    }
};
```

9. Merge K Sorted List:




```
class Solution {
public:
    struct Compare {
        bool operator()(ListNode* a, ListNode*
b) {
            return a->val > b->val;
        }
    };

    ListNode*
mergeKLists(vector<ListNode*>& lists) {
        priority_queue<ListNode*,
vector<ListNode*>, Compare> pq;

        for (auto list : lists) {
            if (list) pq.push(list);
        }

        ListNode dummy(0);
        ListNode* tail = &dummy;

        while (!pq.empty()) {
            ListNode* node = pq.top();
            pq.pop();
            tail->next = node;
            tail = tail->next;

            if (node->next) pq.push(node->next);
        }

        return dummy.next;
    }
};
```