Experiment 3

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Subject Name: Advanced Programming Lab-2 **Subject Code: 22ITP-351**

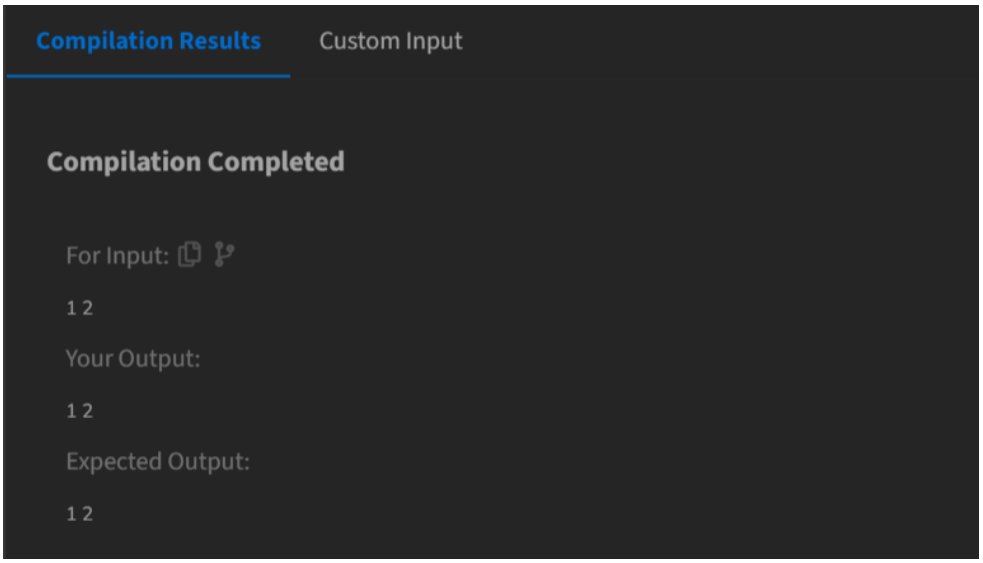
Problem 1. Given a linked list. Print all the elements of the linked list separated by space followed.

Code:

```
class Solution {
  public:
    // Function to display the elements of a linked list in same line
    void printList(Node *head) {
        Node * ptr = head;

        while(ptr != NULL){
            cout << ptr -> data << " ";
            ptr = ptr -> next;
        }
    }
};
```

Output:

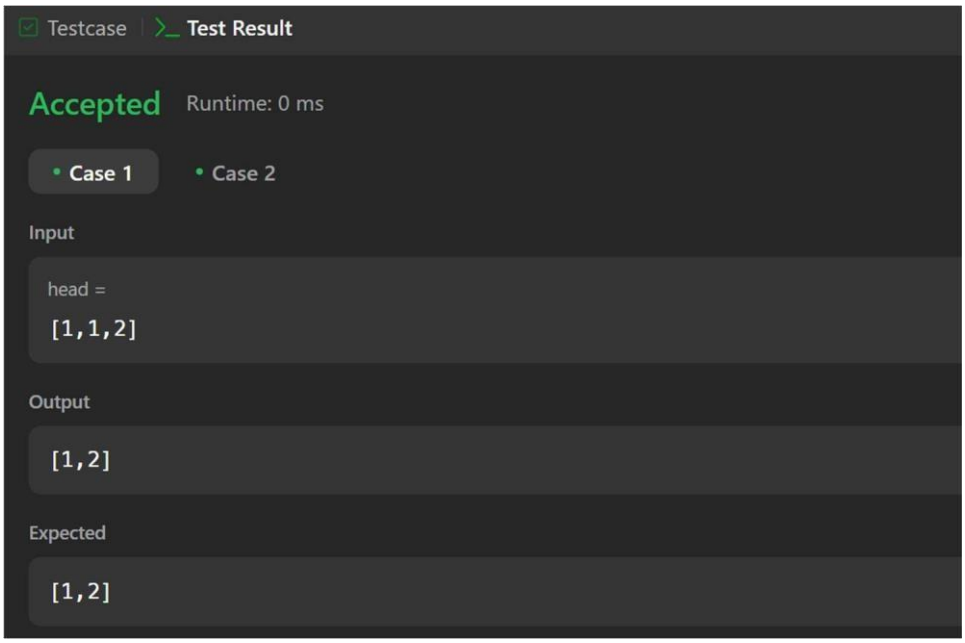


Problem 2. Given the head of a sorted linked list, *delete all duplicates such that each element appears only once*. Return *the linked list sorted as well*.

Code:

```
class Solution {
public:
    ListNode* deleteDuplicates(ListNode* head) {
        ListNode* current = head;
        while(current && current-> next){
            if(current->val == current->next->val){
                ListNode* temp = current->next;
                current->next = current->next->next;
                delete temp;
            }
            else
            current = current->next;
        }
        return head;
    }
};
```

Output:

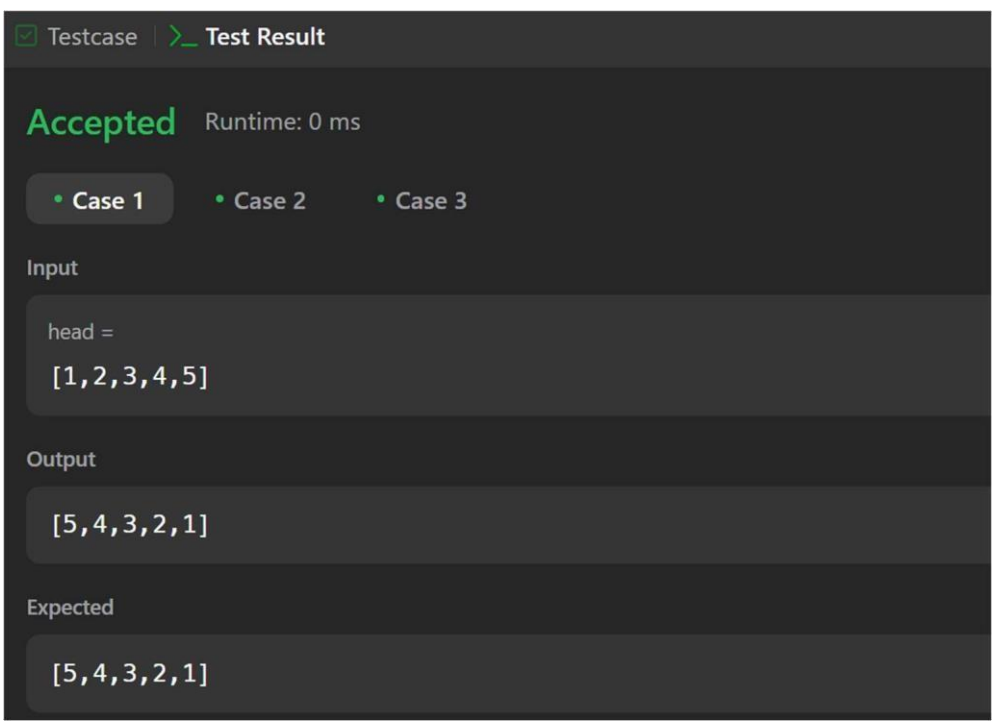


Problem 3. Given the head of a singly linked list, reverse the list, and return *the reversed list*.

Code:

```
class Solution {
public:
    ListNode* reverseList(ListNode* head) {
        ListNode* prev = nullptr;
        ListNode* next = nullptr;
        ListNode* curr = head;
        while (curr != nullptr) {
            next = curr->next;
            curr->next = prev;
            prev = curr;
            curr = next;
        }
        return prev;
    }
};
```

Output:

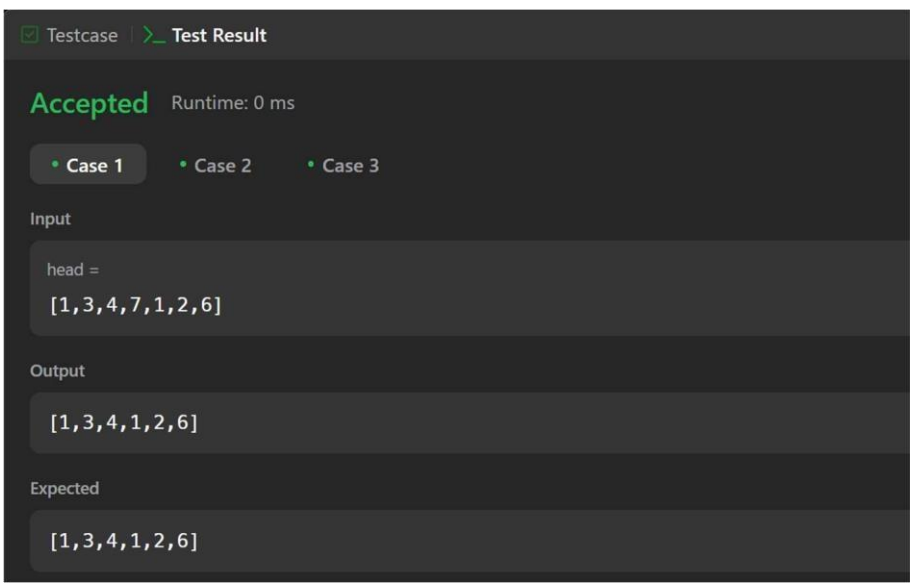


Problem 4. You are given the head of a linked list. Delete the middle node, and return *the* head *of the modified linked list*.

Code:

```
class Solution { public:
  ListNode* deleteMiddle(ListNode* head) { if
    (head == nullptr || head->next == nullptr) {
    return nullptr;
    }
    ListNode* slow = head;
    ListNode* fast = head;
    ListNode* prev = nullptr;
    while (fast != nullptr && fast->next != nullptr) {
      prev = slow; slow = slow->next; fast = fast-
      >next->next;
    }
    prev->next = slow->next;
    delete slow;
    return head;
  }
};
```

Output:



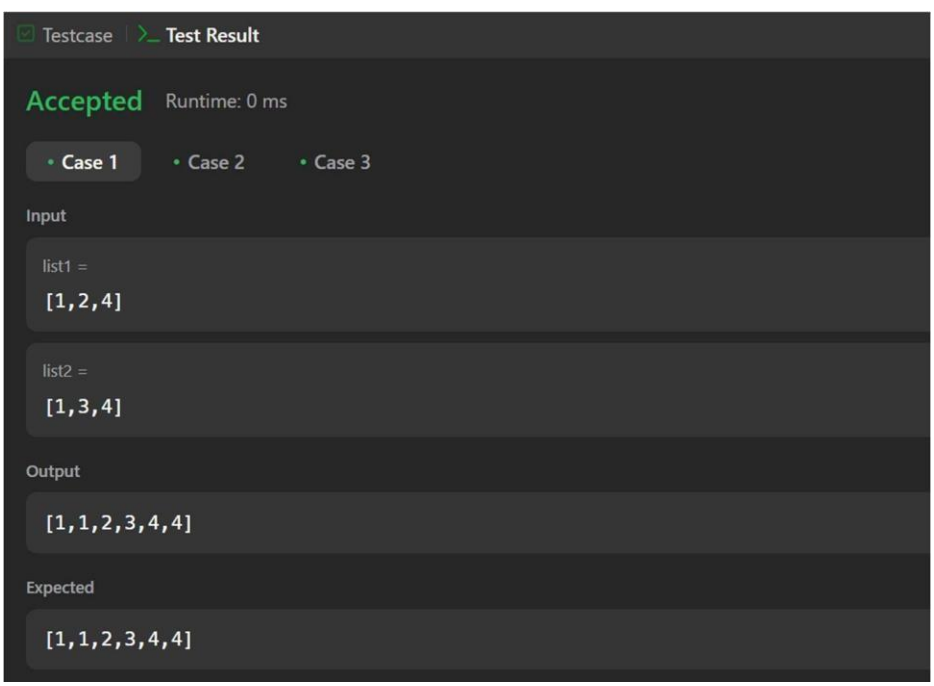
Problem 5. You are given the heads of two sorted linked lists list1 and list2.

Code:

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

       while (list1 != nullptr && list2 != nullptr) {
           if (list1->val <= list2->val) {
               tail->next = list1; list1
               = list1->next;
           } else { tail->next =
               list2; list2 = list2-
               >next;
           }
           tail = tail->next;
       }
tail->next = (list1 != nullptr) ? list1 : list2;
       return dummy.next;
   }
};
```

Output:

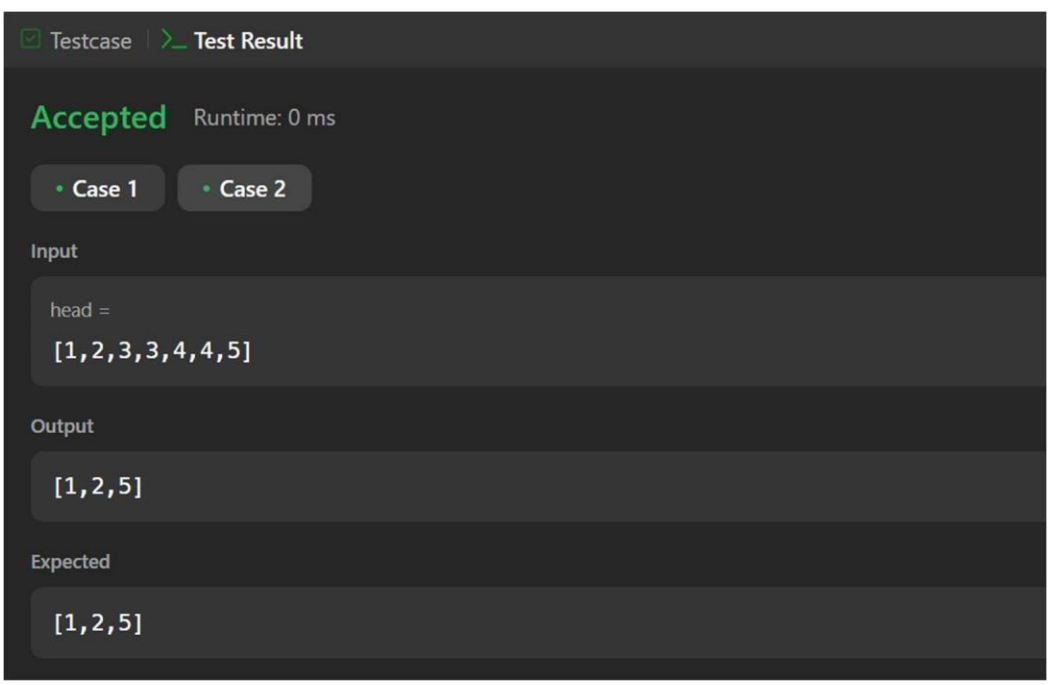


Problem 6. Given the head of a sorted linked list, *delete all nodes that have duplicate numbers, leaving only distinct numbers from the original list*. Return *the linked list sorted as well*.

Code:

```
class Solution {
public:
   ListNode* deleteDuplicates(ListNode* head) {
      ListNode *dummy=new ListNode(0,head);
     ListNode *prev=dummy;
      while(head!=NULL){
      if(head->next!=NULL && head->val==head->next->val){
while(head->next!=NULL && head->val==head->next->val)head=head->next;
                prev->next=head->next;
            }
         else prev=prev->next;
         head=head->next;
      }
   return dummy->next;
   }
};
```

Output:

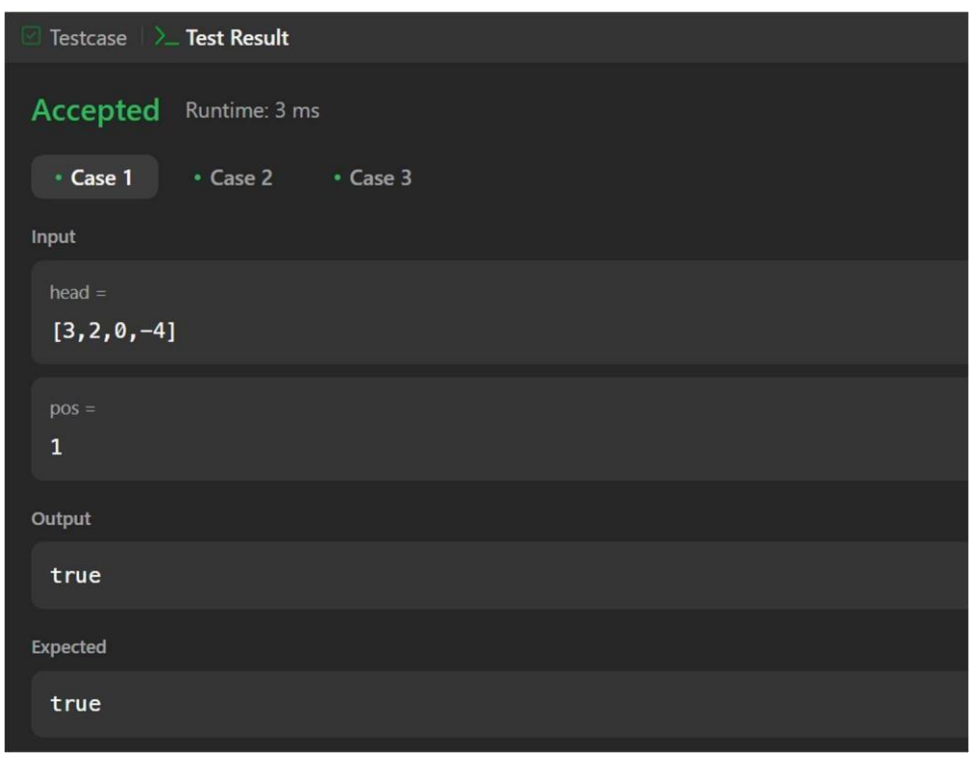


Problem 7. Given head, the head of a linked list, determine if the linked list has a cycle in it.

Code:

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

Output:

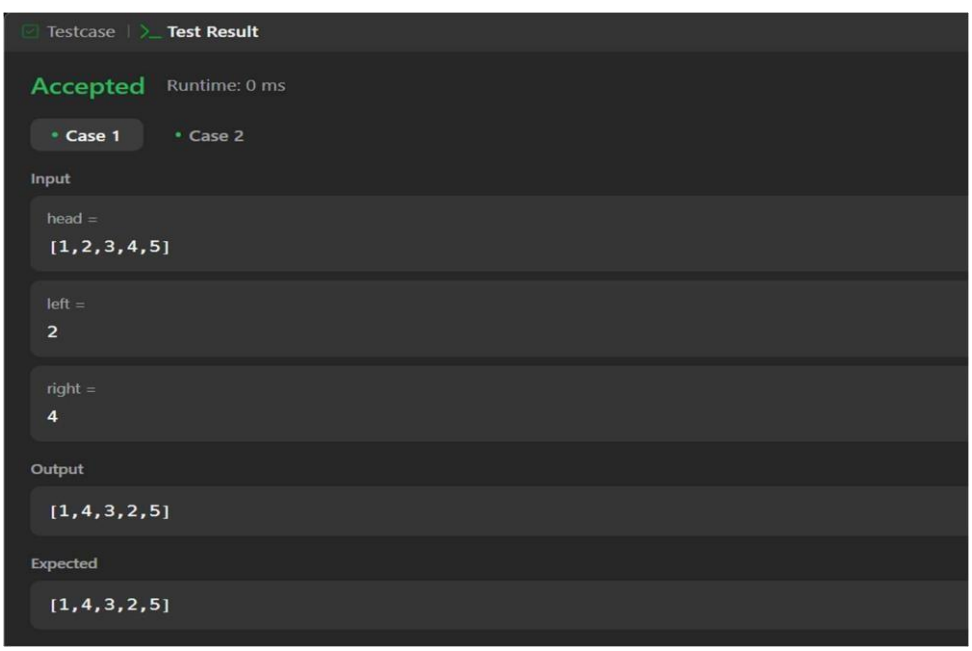


Problem 8. Given the head of a singly linked list and two integers left and right where left <= right, reverse the nodes of the list from position left to position right, and return *the reversed list*.

Code:

```
class Solution { public:
   ListNode* reverseBetween(ListNode* head, int left, int right) {
     if (head == nullptr || 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;
      for (int i = 0; i < right - left; ++i) {
         next = curr->next; curr->next =
         next->next; next->next = prev-
         >next; prev->next = next;
      }
      return dummy->next;
   }
};
```

Output:



Problem 9. 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
      == nullptr || head->next == nullptr || k == 0) { return
      head;
      }
      ListNode* current = head;
      int length = 1;
      while (current->next != nullptr) {
         current      =      current->next;
         length++;
      }
      current->next =Head;
      k = k % length; if (k == 0)
      { current->next = nullptr;
      return head;
      }
      ListNode* newTail = head;
      for (int i = 1; i < length - k; i++) {
         newTail = newTail->next;
      }
      ListNode* newHead = newTail->next;
      newTail->next = nullptr;

      return newHead;
   }
};
```

Output:

Problem 10. You are given an array of k linked-lists lists, each linked-list is sorted in ascending order.

Code:

```
class Solution { public:
    ListNode* mergeKLists(vector<ListNode*>& lists) { if
        (lists.empty()) return nullptr;
        auto compare = [](ListNode* a, ListNode* b) { return
            a->val > b->val;
        };
priority_queue<ListNode*, vector<ListNode*>, decltype(compare)> minHeap(compare);
        for (ListNode* list : lists) { if
            (list) {
                minHeap.push(list);
            }
        }
        ListNode* dummy = new ListNode(0);
        ListNode* current = dummy;
        while (!minHeap.empty()) {
            ListNode* node = minHeap.top();
            minHeap.pop(); current->next =
            node; current = current->next; if
            (node->next) {
            minHeap.push(node->next);
            }
        }
        return dummy->next;
    }
};
```

Output: