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EXPERIMENT:-3

NAME: Mandeep Sharma **UID: 22BET10014**

BRANCH: IT **SECTION: 702(A)**

SEMESTER: 6th **DOP: 13/02/2025**

SUBJECT: AP II **SUBJECT CODE: 22ITP-351**

Aim: Detect a cycle in a linked list

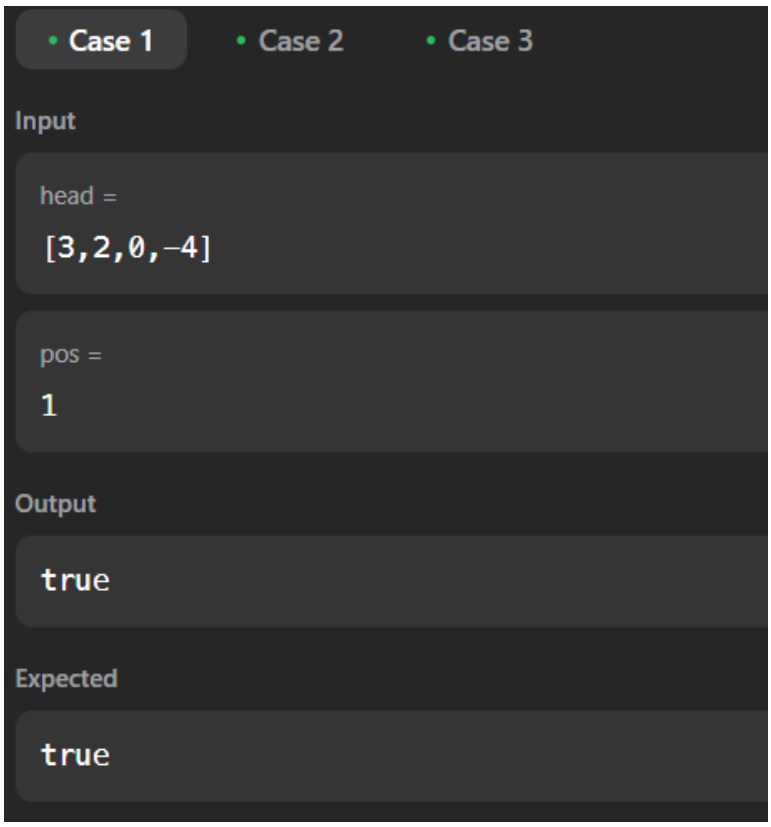
Objective: There is a cycle in a linked list if there is some node in the list that can be reached again by continuously following
the next pointer. Internally, pos is used to denote the index of the node that tail's next pointer is connected to. Note that pos is not passed as a parameter.

Code:

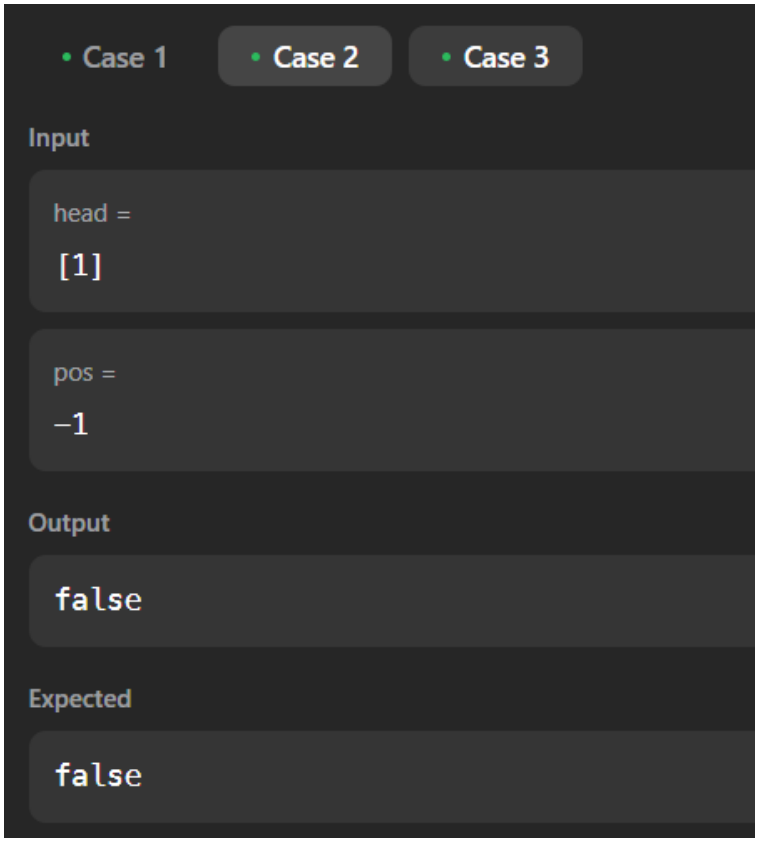
```
class ListNode:
    def __init__(self, val=0, next=None):
        self.val = val
        self.next = next


class Solution:
    def hasCycle(self, head):
        slow = head
        fast = head
```

```
        while fast and fast.next:
            slow = slow.next
            fast = fast.next.next
            if slow == fast:
            return True

    return False
```

OUTPUT:




Case 1
Case 2
Case 3
Input
head =
[1,2]
pos =
0
Output
true
Expected
true


Case 1
Case 2
Case 3
Input
head =
[1]
pos =
-1
Output
false
Expected
false

Aim: Reverse linked list 2

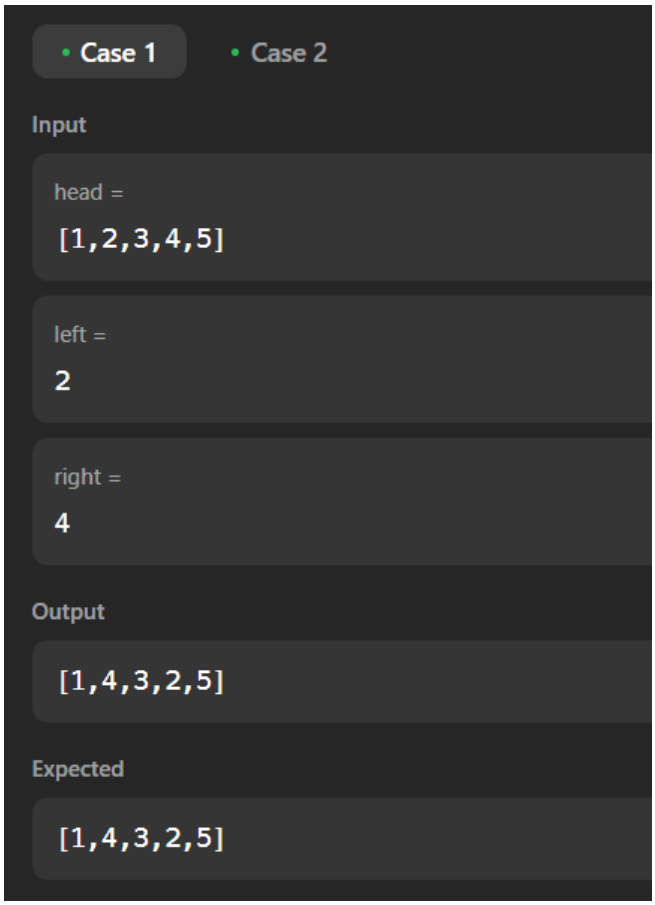
Objective: Given the head of a singly linked list and two integers left and right where left <= right, reverse the nodes of the list from position left to position right, and return *the reversed list*.

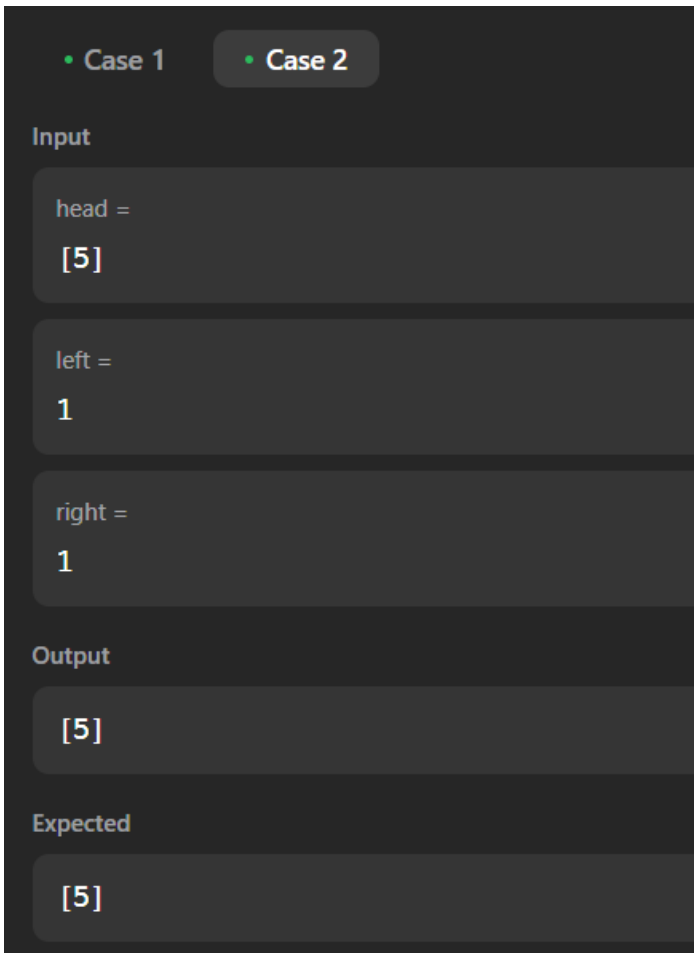
Code:

```
class ListNode:
    def __init__(self, val=0, next=None):
        self.val = val
        self.next = next


class Solution:
    def reverseBetween(self, head, left, right):
        if not head or left == right:
            return head


        dummy = ListNode(0)
        dummy.next = head
        prev = dummy


        for _ in range(left - 1):
            prev = prev.next


        curr = prev.next
```

```
        next_node = None

        for _ in range(right - left):
            next_node = curr.next
            curr.next = next_node.next
            next_node.next = prev.next
            prev.next = next_node

        return dummy.next
```

OUTPUT:





Aim: rotate a list

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

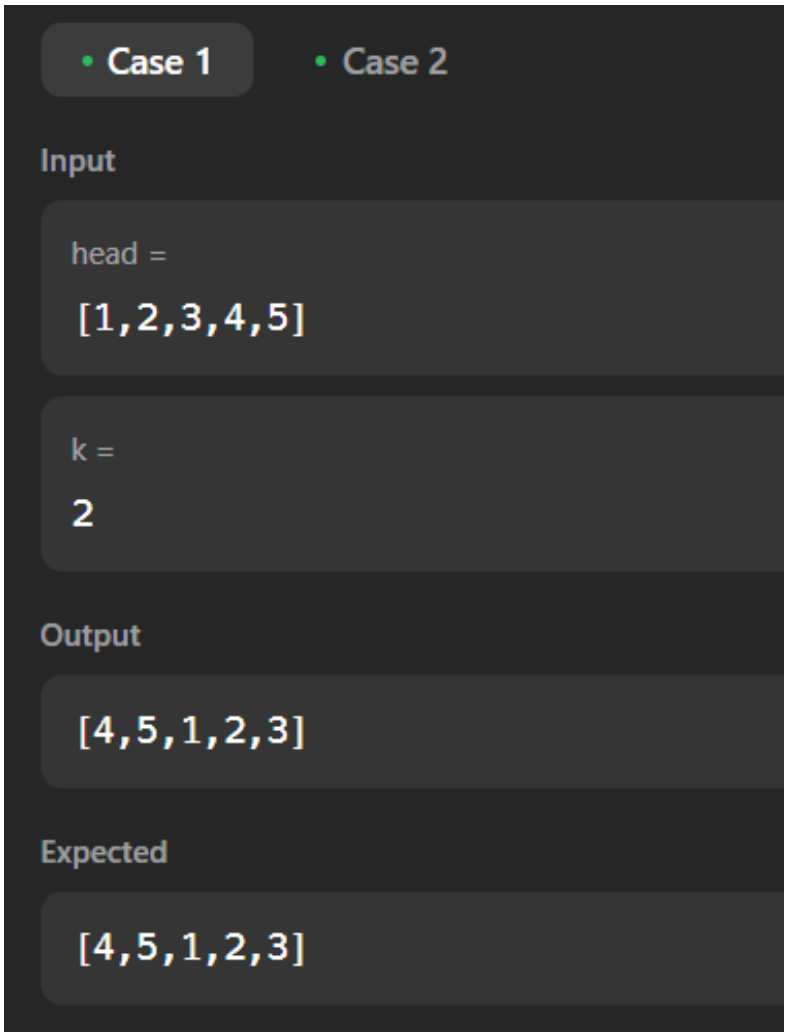
Code:

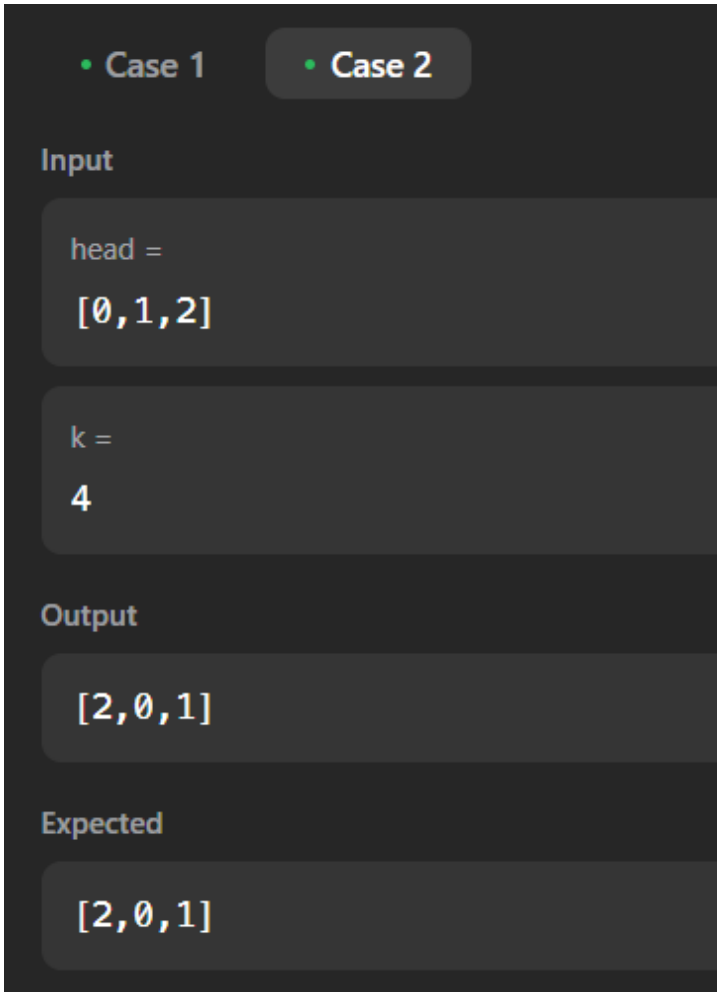
```
class ListNode:
    def __init__(self, val=0, next=None):
        self.val = val
        self.next = next
```

```
class Solution:
    def rotateRight(self, head, k):
        if not head or not head.next or k == 0:
            return head

        # Compute the length of the list
        length = 1
        tail = head
        while tail.next:
            tail = tail.next
            length += 1

        # Make it a circular list
        tail.next = head

        # Find the new tail position
        k = k % length
        steps_to_new_tail = length - k
        new_tail = head
        for _ in range(steps_to_new_tail - 1):
            new_tail = new_tail.next

        # Break the circle and set the new head
        new_head = new_tail.next
```

```
        new_tail.next = None

        return new_head
```

OUTPUT:





Aim: Merge k sorted lists

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

Merge all the linked-lists into one sorted linked-list and return it.

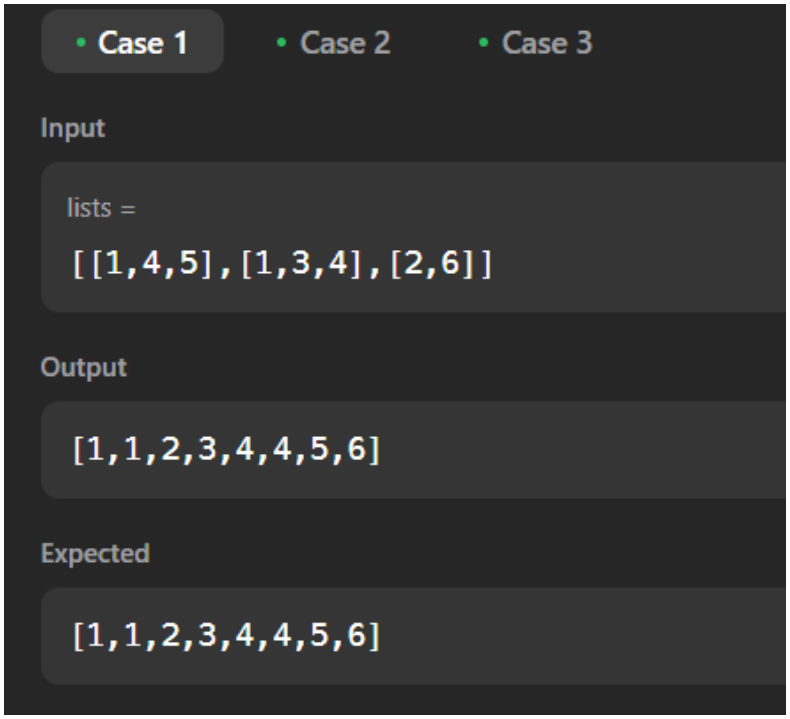
Code:

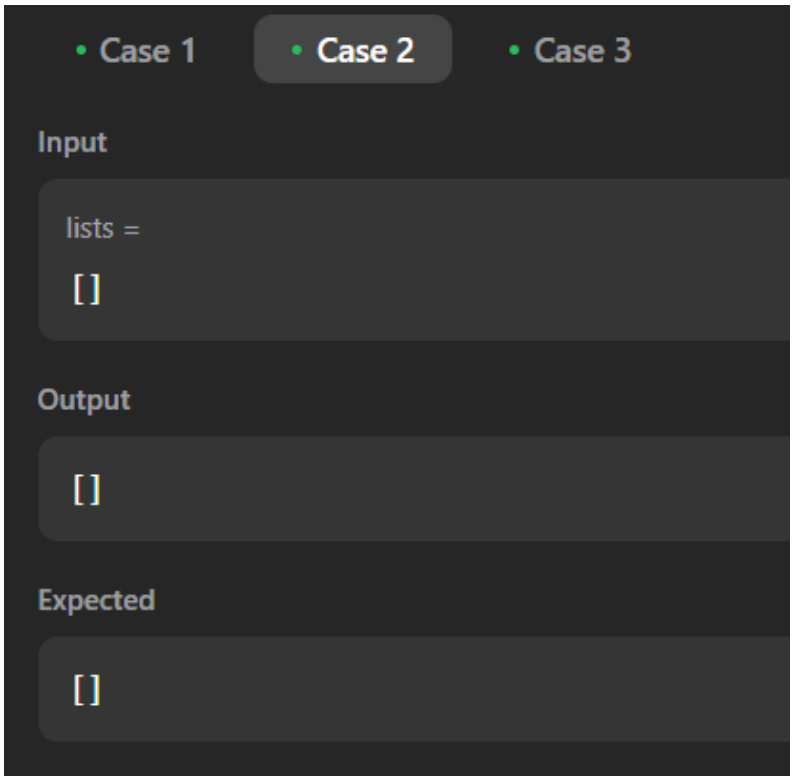
```
import heapq


class ListNode:
```

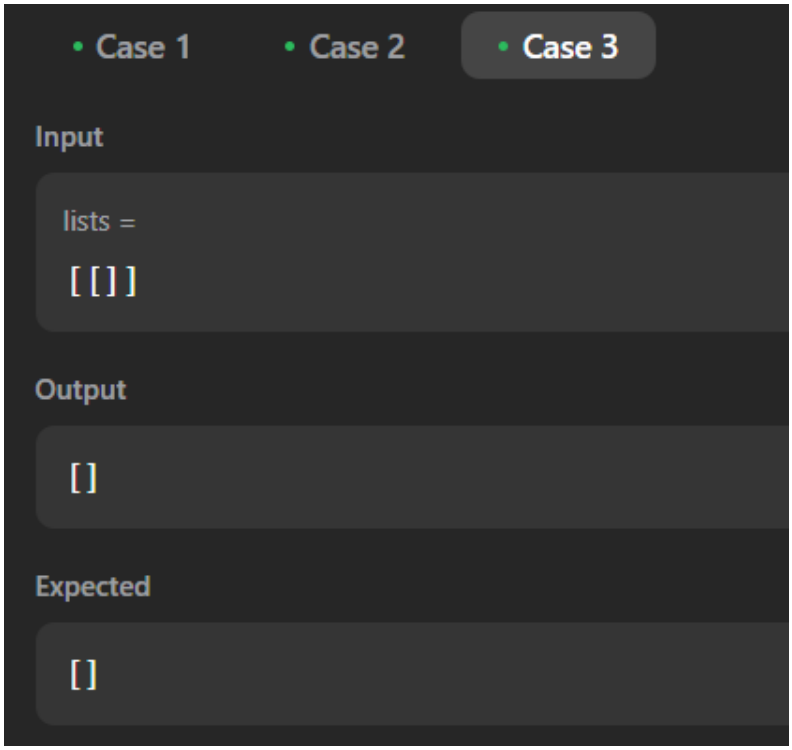
```
    def __init__(self, val=0, next=None):
        self.val = val
        self.next = next

class Solution:
    def mergeKLists(self, lists):
        heap = []

        # Push the head nodes of all lists into the heap
        for i, node in enumerate(lists):
            if node:
                heapq.heappush(heap, (node.val, i, node))

        dummy = ListNode(0)
        curr = dummy

        while heap:
            val, i, node = heapq.heappop(heap)
            curr.next = node
            curr = curr.next

            if node.next:
                heapq.heappush(heap, (node.next.val, i, node.next))
```

return dummy.next

OUTPUT:







Aim: Sort List

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

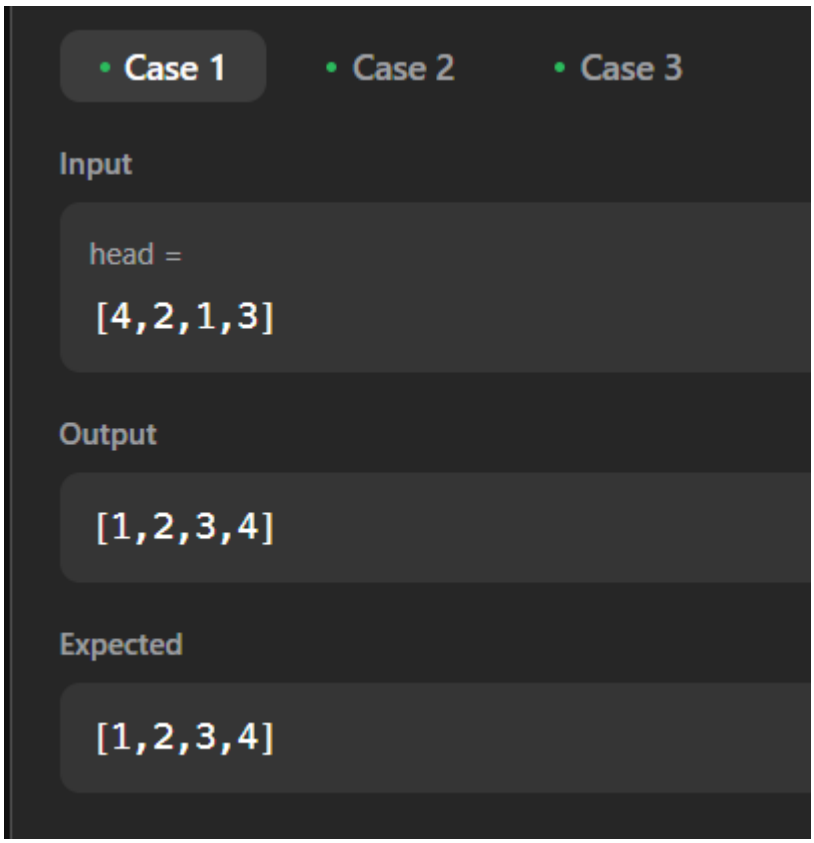
CODE:

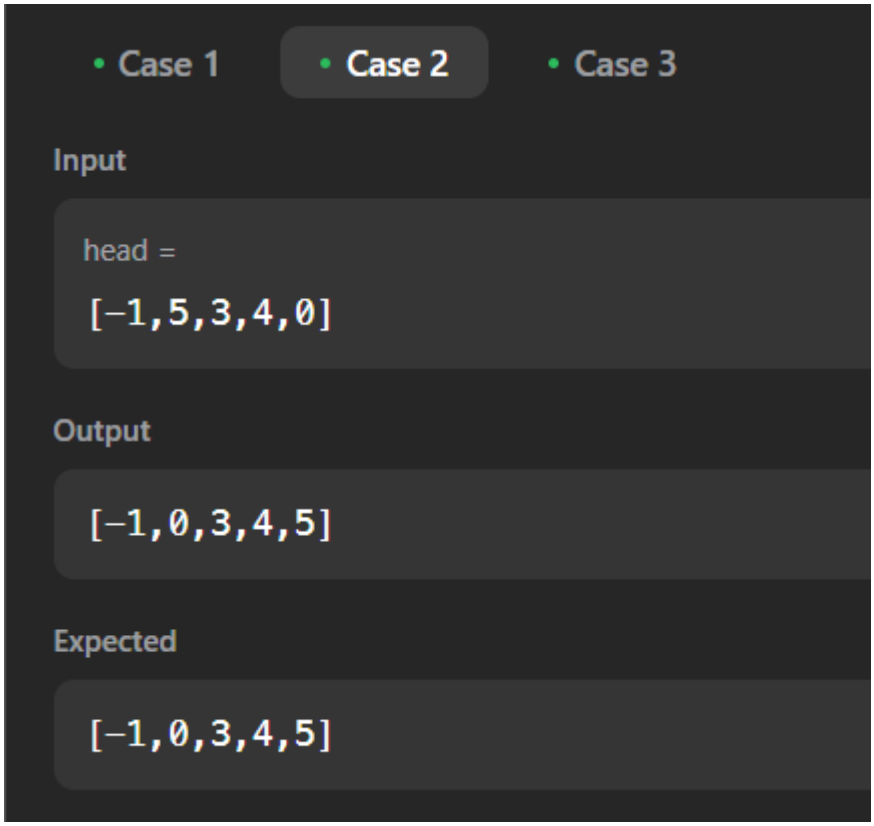
```
class ListNode:
    def __init__(self, val=0, next=None):
        self.val = val
        self.next = next


class Solution:
    def sortList(self, head):
        if not head or not head.next:
            return head
```

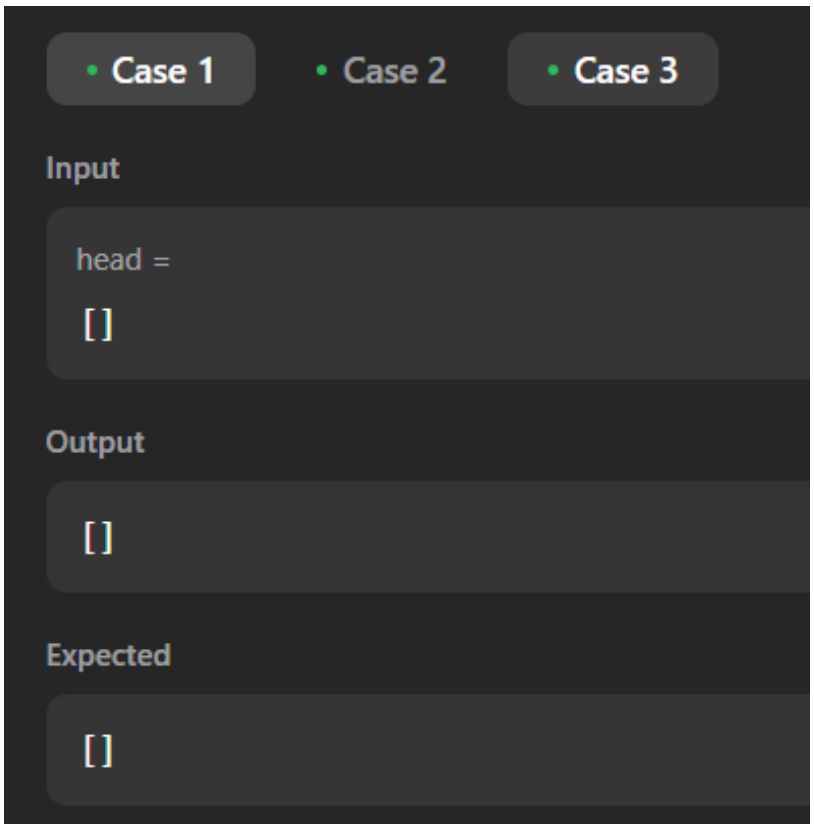
```
        # Split the list into halves
        slow, fast = head, head.next
        while fast and fast.next:
            slow = slow.next
            fast = fast.next.next

        mid = slow.next
        slow.next = None

        # Recursively sort both halves
        left = self.sortList(head)
        right = self.sortList(mid)

        # Merge the sorted halves
        return self.merge(left, right)

    def merge(self, l1, l2):
        dummy = ListNode(0)
        curr = dummy

        while l1 and 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 if l1 else l2

    return dummy.next
```

OUTPUT:




Case 1
Case 2
Case 3
Input
head =
[-1,5,3,4,0]
Output
[-1,0,3,4,5]
Expected
[-1,0,3,4,5]


Case 1
Case 2
Case 3
Input
head =
[]
Output
[]
Expected
[]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