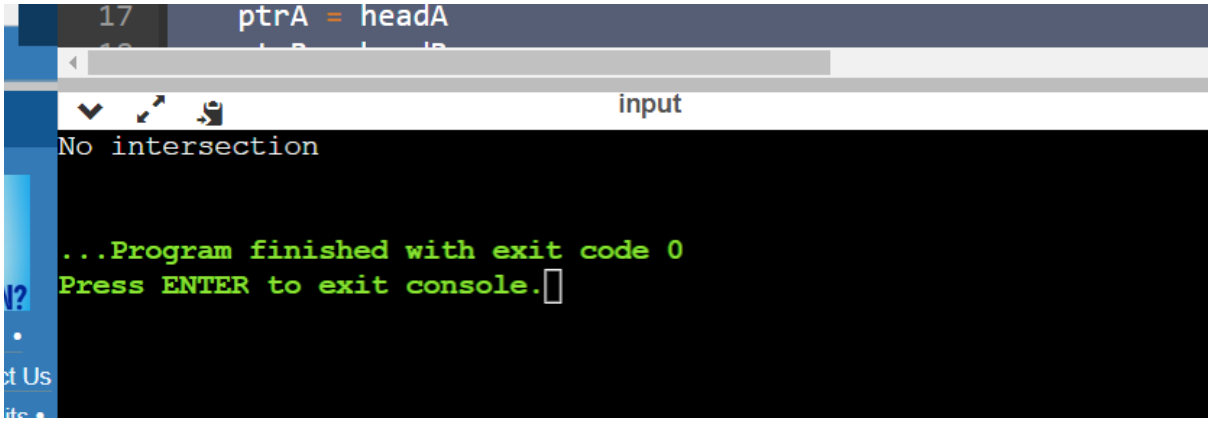
Day – 6 : Linked List -II

Problem 1: Given the heads of two singly linked-lists **headA** and **headB**, return **the node at which the two lists intersect**. If the two linked lists have no intersection at all, return **null**.

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


def getIntersectionNode(headA, headB):
    def getLength(node):
        length = 0
        while node:
            length += 1
            node = node.next
        return length

    lenA = getLength(headA)
    lenB = getLength(headB)

    ptrA = headA
    ptrB = headB

    diff = abs(lenA - lenB)
    if lenA > lenB:
        for _ in range(diff):
            ptrA = ptrA.next
    else:
        for _ in range(diff):
            ptrB = ptrB.next
```

```
    while ptrA and ptrB:
        if ptrA == ptrB:
            return ptrA
        ptrA = ptrA.next
        ptrB = ptrB.next

    return None



def createLinkedList(lst):
    if not lst:
        return None
    head = ListNode(lst[0])
    current = head
    for i in range(1, len(lst)):
        current.next = ListNode(lst[i])
        current = current.next
    return head



list1 = createLinkedList([1, 3, 1, 2, 4])
list2 = createLinkedList([3, 2, 4])
intersection_node = getIntersectionNode(list1, list2)
if intersection_node:
    print(intersection_node.val)
else:
    print("No intersection")
```

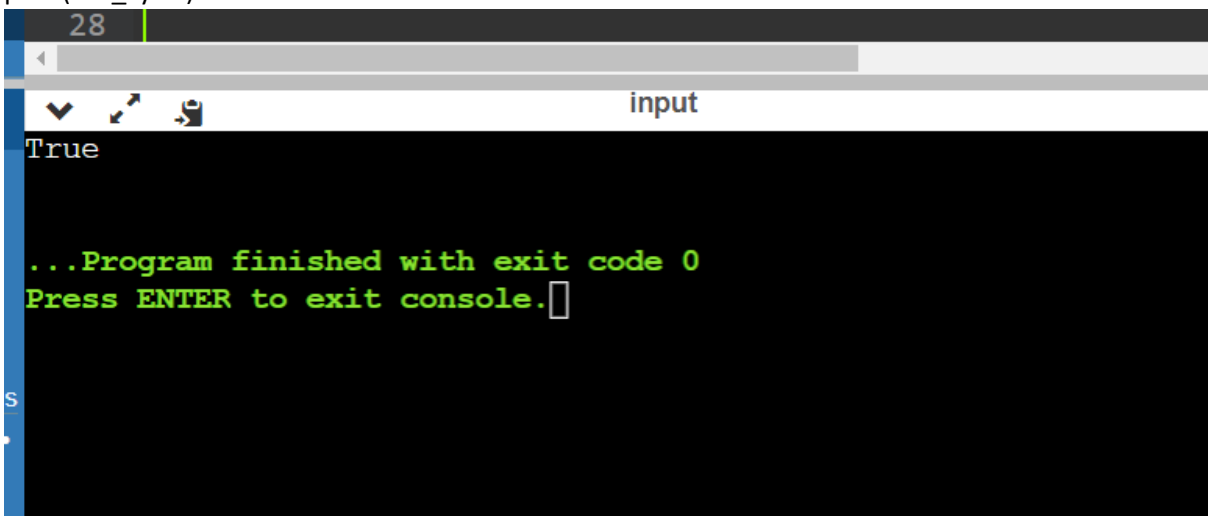


Problem 2: Given *head*, the head of a linked list, determine if the linked list has a cycle in it. There is a cycle in a linked list if there is some node in the list that can be reached again by continuously following the next pointer.

Return *true* if there is a cycle in the linked list. Otherwise, return *false*.

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

def hasCycle(head):
    if not head or not head.next:
        return False

    slow = head
    fast = head.next

    while slow != fast:
        if not fast or not fast.next:
            return False
        slow = slow.next
        fast = fast.next.next
```

```
    return True
head = ListNode(1)
head.next = ListNode(2)
head.next.next = ListNode(3)
head.next.next.next = ListNode(4)
head.next.next.next.next = head.next

has_cycle = hasCycle(head)
print(has_cycle)
```



Problem 3: Given the head of a linked list, reverse the nodes of the list k at a time, and return *the modified list*. k is a positive integer and is less than or equal to the length of the linked list. If the number of nodes is not a multiple of k then left-out nodes, in the end, should remain as it is.

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

def reverseKGroup(head, k):
    def reverse_group(start, end):
```

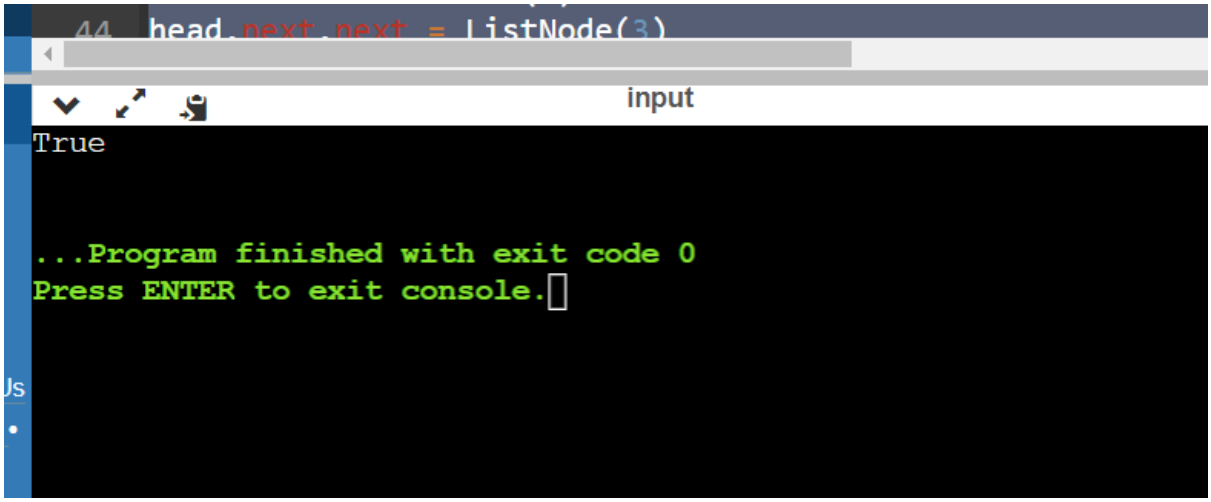
```
    prev, curr = None, start
    while curr != end:
        temp = curr.next
        curr.next = prev
        prev = curr
        curr = temp
    return prev

def find_kth_node(node, k):
    for i in range(k):
        if not node:
            return None
        node = node.next
    return node

dummy = ListNode(0)
dummy.next = head
prev_group_tail = dummy
current = head

while current:
    group_end = find_kth_node(current, k)
    if not group_end:
        break
    next_group_head = group_end.next
    new_group_head = reverse_group(current, group_end)
    prev_group_tail.next = new_group_head
    current.next = next_group_head
    prev_group_tail = current
    current = next_group_head
```

```
    return dummy.next


def create_linked_list(lst):
    dummy = ListNode(0)
    current = dummy
    for val in lst:
        current.next = ListNode(val)
        current = current.next
    return dummy.next


def linked_list_to_list(head):
    lst = []
    current = head
    while current:
        lst.append(current.val)
        current = current.next
    return lst


head = create_linked_list([1, 2, 3, 4, 5, 6, 7, 8])
k = 3
result = reverseKGroup(head, k)
print(linked_list_to_list(result))
```

Problem 4: Given the head of a singly linked list, return true if it is a palindrome.

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

def isPalindrome(head):
    if head is None or head.next is None:
        return True

    slow = fast = head
    while fast.next and fast.next.next:
        slow = slow.next
        fast = fast.next.next


    second_half = reverse_linked_list(slow.next)
    slow.next = None


    first_half = head
```

```
    while first_half and second_half:
        if first_half.val != second_half.val:
            return False
        first_half = first_half.next
        second_half = second_half.next

    return True

def reverse_linked_list(head):
    prev = None
    curr = head

    while curr:
        next_node = curr.next
        curr.next = prev
        prev = curr
        curr = next_node

    return prev



head = ListNode(1)
head.next = ListNode(2)
head.next.next = ListNode(3)
head.next.next.next = ListNode(3)
head.next.next.next.next = ListNode(2)
head.next.next.next.next.next = ListNode(1)

print(isPalindrome(head))
```

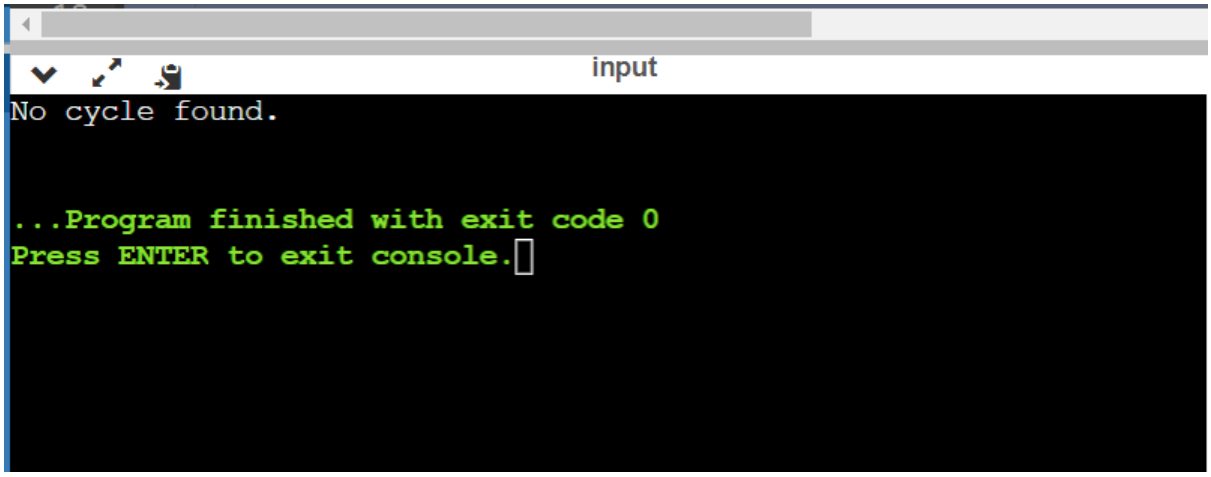


Problem 5: Given the head of a linked list, return *the node where the cycle begins. If there is no cycle, return* null.

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


def detectCycle(head):
    if not head or not head.next:
        return None

    slow = head
    fast = head
    while fast and fast.next:
        slow = slow.next
        fast = fast.next.next
        if slow == fast:
            break
    else:

        return None
```

```
    fast = head
    while slow != fast:
        slow = slow.next
        fast = fast.next

    return slow

def createLinkedList(values):
    head = None
    current = None
    for val in values:
        node = ListNode(val)
        if not head:
            head = node
            current = head
        else:
            current.next = node
            current = node
    return head


values = [1, 2, 3, 4, 3, 6, 10]
head = createLinkedList(values)
result = detectCycle(head)
if result:
    print("tail connects to node index", values.index(result.val))
else:
```

```
    print("No cycle found.")
```



Problem 6: Given a Linked List of size N, where every node represents a sub-linked-list and contains two pointers:

(i) a next pointer to the next node,

(ii) a bottom pointer to a linked list where this node is head.

```
class Node:
    def __init__(self, data):
        self.data = data
        self.next = None
        self.bottom = None


def merge_lists(list1, list2):
    if not list1:
        return list2
    if not list2:
        return list1

    merged_list = None

    if list1.data < list2.data:
        merged_list = list1
```

```
        merged_list.bottom = merge_lists(list1.bottom, list2)
    else:
        merged_list = list2
        merged_list.bottom = merge_lists(list1, list2.bottom)

    merged_list.next = None
    return merged_list

def flatten_linked_list(head):
    if not head or not head.next:
        return head

    # Merge the first two lists
    head.next = merge_lists(head, head.next)

    # Flatten the remaining lists
    return flatten_linked_list(head.next)

def create_linked_list(arr, size_arr):
    head = None
    curr_node = None

    list_index = 0
    node_index = 0

    while list_index < len(size_arr):
        for _ in range(size_arr[list_index]):
            new_node = Node(arr[node_index])

            if not head:
                head = new_node
```

```
            curr_node = new_node
        else:
            curr_node.bottom = new_node
            curr_node = new_node

        node_index += 1

    list_index += 1

  return head

def print_linked_list(head):
  while head:
    print(head.data, end=" ")
    head = head.bottom
  print()



if __name__ == "__main__":
  arr = [5, 7, 8, 30, 10, 20, 19, 22, 50, 28, 35, 40, 45]
  size_arr = [4, 2, 3, 4]

  head = create_linked_list(arr, size_arr)
  print("Flattened Linked List:")
  flattened_head = flatten_linked_list(head)
```

print_linked_list(flattened_head)