94. Binary Tree Inorder Traversal

```
# Definition for a binary tree node.
# class TreeNode:
#     def __init__(self, val=0, left=None, right=None):
#         self.val = val
#         self.left = left
#         self.right = right
class Solution:
    def inorderTraversal(self, root: Optional[TreeNode]) -> List[int]:
        # res = []

        # def inOrder(root : Optional[TreeNode]):
        #     if root is None:
        #         return None
        #     #inorder Traversal
        #     inOrder(root.left)
        #     res.append(root.val)
        #     inOrder(root.right)

            # preorder Traversal
            # res.append(root.val)
            # inOrder(root.left)
            # inOrder(root.right)


            # post Order Traversal
            # inOrder(root.left)
            # inOrder(root.right)
            # res.append(root.val)

        # inOrder(root)
        # return res


        #inorder Traversal using iteration
        stack = []
        res = []
        cur = root
        # while stack or cur:
        #     while cur:
        #         stack.append(cur)
        #         cur = cur.left
        #     cur = stack.pop()
        #     res.append(cur.val)
        #     cur = cur.right
        while stack or cur:
            if cur is not None:
```

```
                stack.append(cur)
                cur = cur.left
            elif stack:
                cur = stack.pop()
                res.append(cur.val)
                cur = cur.right
        return res

        # #preorder
        # if root is None:
        #     return None

        # stack.append(root)
        # while stack:
        #     cur = stack.pop()
        #     res.append(cur.val)

        #     if cur.right is not None:
        #         stack.append(cur.right)
        #     if cur.left is not None:
        #         stack.append(cur.left)
        # return res
```

104. Maximum Depth of Binary Tree

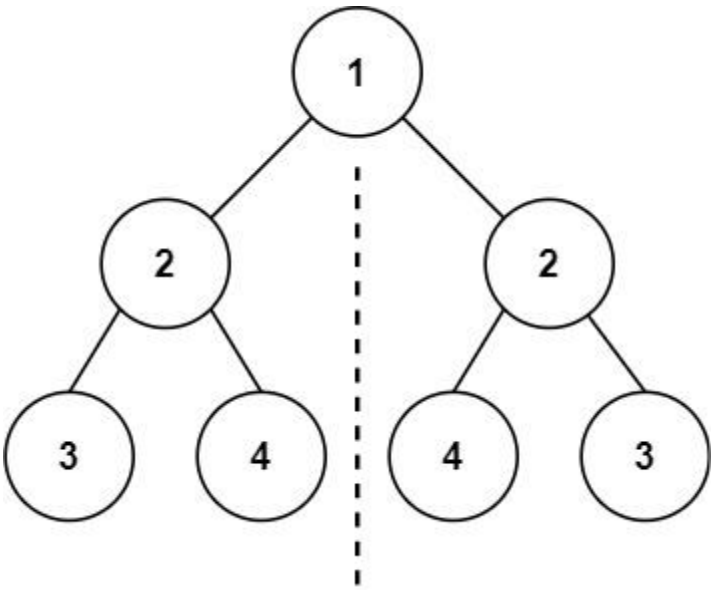
```
# Definition for a binary tree node.
# class TreeNode:
#     def __init__(self, val=0, left=None, right=None):
#         self.val = val
#         self.left = left
#         self.right = right
class Solution:
    def maxDepth(self, root: Optional[TreeNode]) -> int:
        if root is None:
            return 0
        # left = self.maxDepth(root.left)
        # right = self.maxDepth(root.right)

        # return 1 + max(left, right)
        # stack = [[root, 1]]
        # res = 1
        # while stack:
        #     root, depth = stack.pop()
        #     if root:
        #         res = max(res, depth)
        #         stack.append([root.right, depth + 1])
        #         stack.append([root.left, depth + 1])
        # return res
```

```
cur = root
stack = []
stack.append([root, 1])
res = 1
while stack:
    cur , depth = stack.pop()
    if cur.right is not None:
        stack.append([cur.right, depth + 1])
    if cur.left is not None:
        stack.append([cur.left, depth + 1])
    res = max(res, depth)
return res
```

```
# if root is None:
#     return 0
# res = []
# cur = root
# stack = []
# stack.append(root)
# depth = 1
# while stack:
#     found = False
#     cur = stack.pop()
#     res.append(cur.val)

#     if cur.right is not None:
#         stack.append(cur.right)
#         found = True
#     if cur.left is not None:
#         stack.append(cur.left)
#         found = True
#     if found:
#         depth += 1
# return depth
```

101. Symmetric Tree

Example 1:



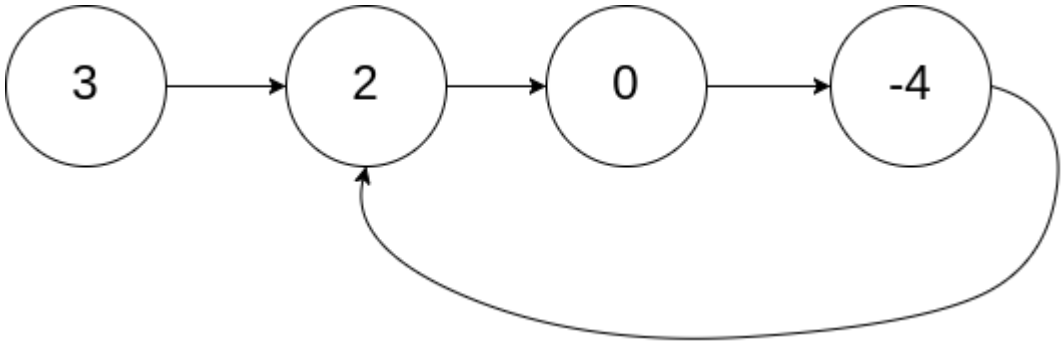

```
# Definition for a binary tree node.
# class TreeNode:
#     def __init__(self, val=0, left=None, right=None):
#         self.val = val
#         self.left = left
#         self.right = right
class Solution:
    def isSymmetric(self, root: Optional[TreeNode]) -> bool:

        # def symmetric(left : Optional[TreeNode], right: Optional[TreeNode]) ->
bool:
            # if left is None or right is None:
            #     return left == right
            # elif left.val != right.val:
            #     return False
        #     if left is None and right is None:
        #         return True
        #     if left is None or right is None or left.val != right.val:
        #         return False
        #     # if left.val != right.val:
        #     #     return False

        #     return symmetric(left.right, right.left) and symmetric(left.left,
right.right)




        # if root is None:
        #     return True
        # else:
```

```
        #     return symmetric(root.left, root.right)

        #iterative approach
        if root is None:
            return True
        stack = [[root.left, root.right]]
        # stack = []
        # stack.append([root.left, root.right])
        while stack:
            l, r = stack.pop()
            if l is None and r is None:
                continue
            if l is None or r is None or (l.val != r.val):
                return False
            stack.append([l.left, r.right])
            stack.append([l.right, r.left])
        return True
```

```
    #same tree
# class Solution:
#     def isSameTree(self, p : TreeNode, q: TreeNode) -> bool:
#         if p is None and q is None:
#             return True
#         if p is None or q is None:
#             return False
#         if p.val != q.val:
#             return False
#         return isSameTree(p.left, q.left) and isSameTree(p.right,
q.right)
```

141. Linked List Cycle

Example 1:

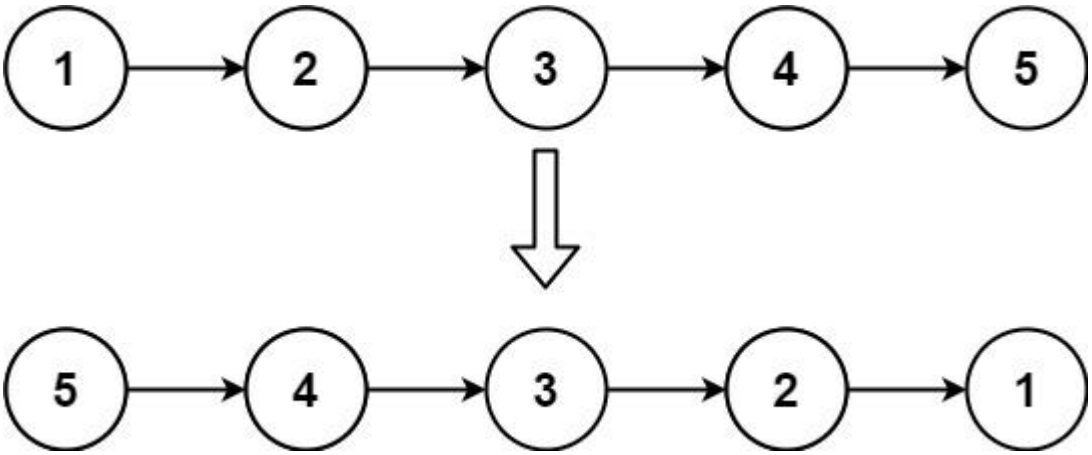



```
# Definition for singly-linked list.
# class ListNode:
#     def __init__(self, x):
#         self.val = x
#         self.next = None

class Solution:
    def hasCycle(self, head: Optional[ListNode]) -> bool:
        # if head is None:
        #     return False
        # if head.next is None:
        #     return False
        # cur = head
        # s = set()
        # while cur:
        #     if cur in s:
        #         return True
        #     s.add(cur)
        #     cur = cur.next
        # return False

        #to use less memory
        fast, slow = head, head
        while fast and fast.next:
            slow = slow.next
            fast = fast.next.next
            if fast == slow:
                return True
        return False



        # f , s= head, head
        # while f:
        #     if s is not None:
        #         s = s.next
        #     if f is None:
        #         return False
```

```
        #     else:
        #         f = f.next
        #         if f is None:
        #             return False
        #         else:
        #             f = f.next
        #     if f == s:
        #         return True
```

206. Reverse Linked List

Example 1:

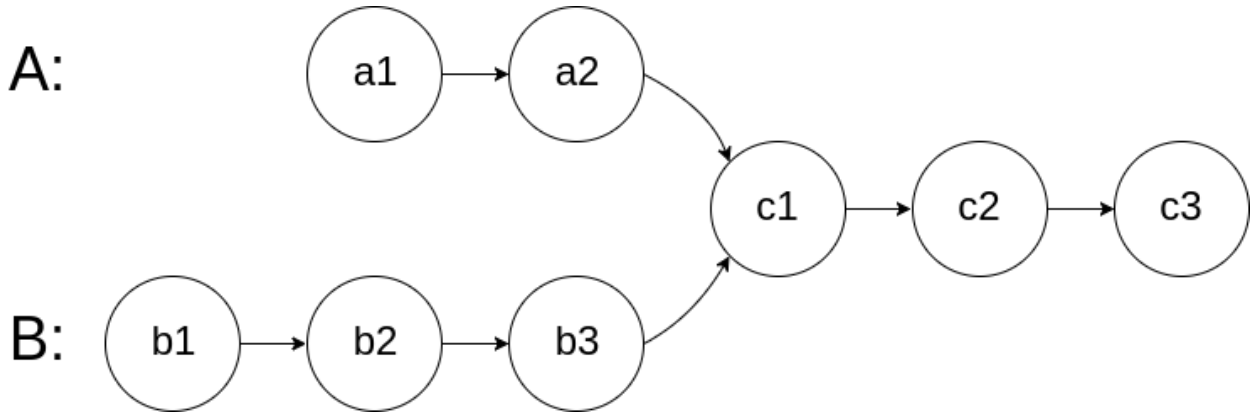



```
# Definition for singly-linked list.
# class ListNode:
#     def __init__(self, val=0, next=None):
#         self.val = val
#         self.next = next
class Solution:
    def reverseList(self, head: Optional[ListNode]) -> Optional[ListNode]:
        # if head is None:
        #     return None
        # if head.next is None:
        #     return head

        #iterative approach
        prev, cur = None, head
        while cur:
            temp = cur.next
            cur.next = prev
            prev = cur
            cur = temp
        return prev

        #recursion
```

```
        # def reverse(cur, prev):
        #     if cur is None:
        #         return prev
        #     next = cur.next
        #     cur.next = prev
        #     return reverse(next, cur)

        # # if head is None:
        # #     return None
        # return reverse(head, None)
```

160. Intersection of Two Linked Lists

For example, the following two linked lists begin to intersect at node c1:




```
# Definition for singly-linked list.
# class ListNode:
#     def __init__(self, x):
#         self.val = x
#         self.next = None

class Solution:
    def getIntersectionNode(self, headA: ListNode, headB: ListNode) ->
Optional[ListNode]:

        if headA is None or headB is None:
            return False
        # s = set()
        # while headA or headB:
        #     if headA is not None:
        #         if headA in s:
        #             return headA
        #         s.add(headA)
        #         headA = headA.next
        #     if headB is not None:
```

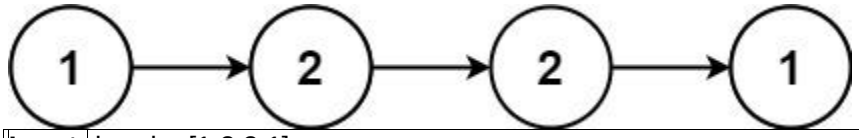
```
#         if headB in s:
#             return headB
#         s.add(headB)
#         headB = headB.next
# return None

# s = set()
# while headA:
#     s.add(headA)
#     headA = headA.next
# while headB:
#     if headB in s:
#         return headB
#     headB = headB.next
# return None

#using less memory
A, B = headA, headB
while A != B:
    if A is not None:
        A = A.next
    else:
        A = headB

    if B is not None:
        B = B.next
    else:
        B = headA
return A

# A, B = headA, headB
# while A or B:
#     if A == B:t
#         return A
#     if A is not None:
#         A = A.next
#     else:
#         A = headB

#     if B is not None:
#         B = B.next
#     else:
#         B = headA
# return A

# A, B = headA, headB
# while A != B:
#     A = A.next if A else headB
```

```
#     B = B.next if B else headA
# return A
```

```
# l, r = headA, headB
# A, B = headA, headB
# a, b = 1, 1
# while headA:
#     headA = headA.next
#     a += 1
# while headB:
#     headB = headB.next
#     b += 1
# if a < b:
#     for i in range(b-a):
#         B = B.next
#     while B:
#         if B == l:
#             return B
#         B = B.next
#         l = l.next
#     return None
# else:
#     for i in range(a-b):
#         A = A.next
#     while A:
#         if A == r:
#             return A
#         A = A.next
#         r = r.next
#     return None
```

234. Palindrome Linked List

Example 1:



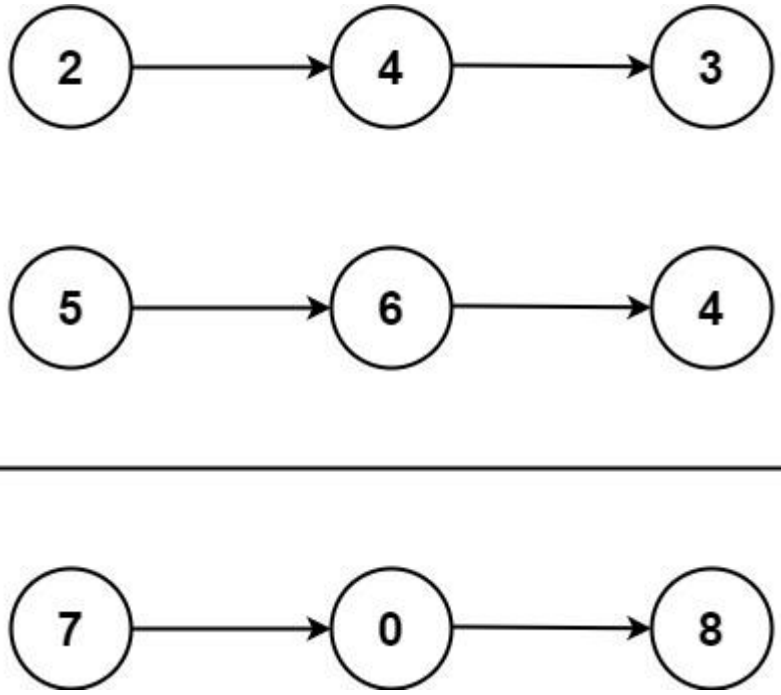
Input: head = [1,2,2,1]
Output: true

```
# Definition for singly-linked list.
# class ListNode:
#     def __init__(self, val=0, next=None):
#         self.val = val
#         self.next = next
class Solution:
    def isPalindrome(self, head: Optional[ListNode]) -> bool:
        # using array so requires extra memory
        # nums = []
        # while head:
        #     nums.append(head.val)
        #     head = head.next
        # l, r = 0, len(nums) - 1
        # while l < r:
        #     if nums[l] != nums[r]:
        #         return False
        #     l, r = l + 1, r - 1
        # return True

        #using less memory
        #finding mid point - slow
        fast, slow = head, head
        while fast and fast.next:
            slow = slow.next
            fast = fast.next.next
        #reversing second half of the list
        prev = None
        while slow:
            temp = slow.next
            slow.next = prev
            prev = slow
            slow = temp
        #now find if palindrome or not
        left, right = head, prev
        # while prev:
        #     if left.val != prev.val:
        #         return False
        #     left = left.next
        #     prev = prev.next
        # return True
        while right:
            if left.val != right.val:
```

```
                return False
            left = left.next
            right = right.next
        return True
```

2. Add Two Numbers (Medium)

Example 1:



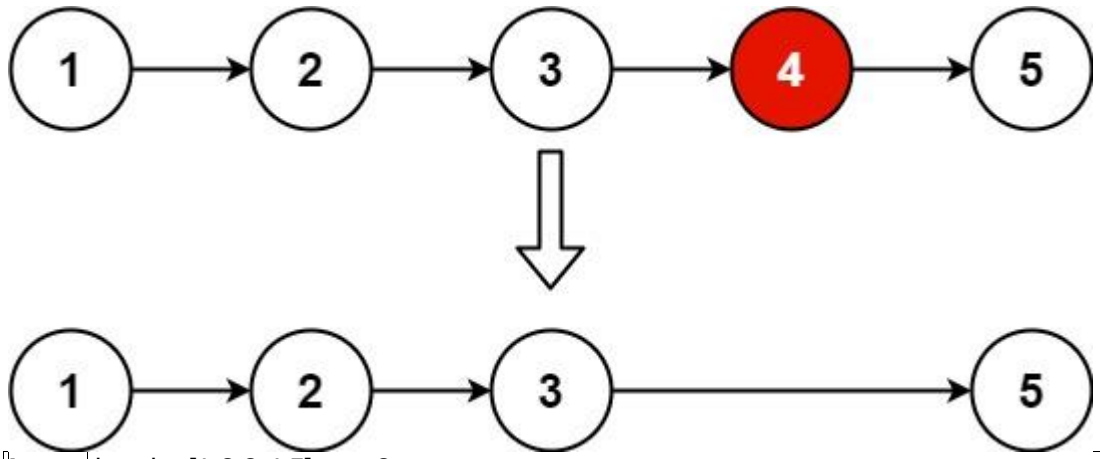
Input: l1 = [2,4,3], l2 = [5,6,4]
Output: [7,0,8]
Explanation: 342 + 465 = 807.

```
# Definition for singly-linked list.
# class ListNode:
#     def __init__(self, val=0, next=None):
#         self.val = val
#         self.next = next
class Solution:
    def addTwoNumbers(self, l1: Optional[ListNode], l2: Optional[ListNode]) ->
Optional[ListNode]:
        temp = cur = ListNode()
        carry = 0
        while l1 or l2 or carry:
            if l1 is not None:
                v1 = l1.val
            else:
                v1 = 0
            v2 = l2.val if l2 else 0
```

```
            #new digit
            val = v1 + v2 + carry
            carry = val // 10
            val = val % 10

            cur.next = ListNode(val)

            #update pointers
            cur = cur.next
            l1 = l1.next if l1 else None
            if l2:
                l2 = l2.next
            else:
                l2 = None

        return temp.next
```

19. Remove Nth Node from End of List (Medium)

Example 1:



Input: head = [1,2,3,4,5], n = 2
Output: [1,2,3,5]

```
# Definition for singly-linked list.
# class ListNode:
#     def __init__(self, val=0, next=None):
#         self.val = val
#         self.next = next
class Solution:
    def removeNthFromEnd(self, head: Optional[ListNode], n: int) ->
Optional[ListNode]:
        temp = ListNode(0, head)
        left = temp
        right = head
        for i in range(n):
```

```
    print(right.val)
    right = right.next

# if right:
#     print(right.val)
while right:
    left = left.next
    right = right.next
print(left.val)
left.next = left.next.next

return temp.next
```

```
# if head is None:
#     return None
# if head.next is None:
#     return None
# a = head; b = head
# x = 0
# print(head.val)
# while a:
#     x += 1
#     a = a.next
# print(x)
# if n == x:
#     b = b.next
# for i in range(x - n - 1):
#     head = head.next
# print(head.val)
# temp = head.next
# head.next = temp.next

# return b
```