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Grokking the Coding Interview: Patterns for Coding Questions

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Pattern: In-place Reversal of a LinkedList

Introduction
Reverse a LinkedList (easy)
Reverse a Sub-list (medium)

Reverse a LinkedList (easy)

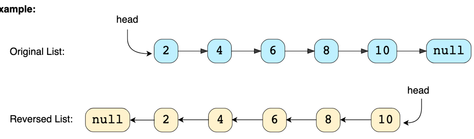
We'll cover the following

- Problem Statement
- Try it yourself
- Solution
  - Code
- Time complexity
- Space complexity

Problem Statement

Given the head of a Singly LinkedList, reverse the LinkedList. Write a function to return the new head of the reversed LinkedList.

Example:



Try it yourself

Try solving this question here:

Java | Python3 | JS | C++

```
ListNode(int value) {
  this.value = value;
 }
}

class ReverseLinkedList {

 public static ListNode reverse(ListNode head) {
  // TODO: Write your code here
  return head;
 }

 public static void main(String[] args) {
  ListNode head = new ListNode(2);
  head.next = new ListNode(4);
  head.next.next = new ListNode(6);
  head.next.next.next = new ListNode(8);
  head.next.next.next.next = new ListNode(10);

  ListNode result = ReverseLinkedList.reverse(head);
  System.out.print("Nodes of the reversed LinkedList are: ");
  while (result != null) {
   System.out.print(result.value + " ");
   result = result.next;
  }
 }
}
```

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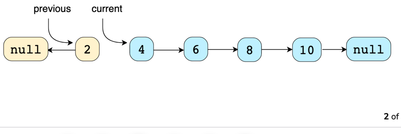
Solution

To reverse a LinkedList, we need to reverse one node at a time. We will start with a variable `current` which will initially point to the head of the LinkedList and a variable `previous` which will point to the previous node that we have processed; initially `previous` will point to `null`.

In a stepwise manner, we will reverse the `current` node by pointing it to the `previous` before moving on to the next node. Also, we will update the `previous` to always point to the previous node that we have processed. Here is the visual representation of our algorithm:



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Code

Here is what our algorithm will look like:

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```
  ListNode next = null; // will be used to temporarily store the next node

  while (current != null) {
   next = current.next; // temporarily store the next node
   current.next = previous; // reverse the current node
   previous = current; // before we move to the next node, point previous to the current
   current = next; // move on the next node
  }
  // after the loop current will be pointing to 'null' and 'previous' will be the new head
  return previous;
 }

 public static void main(String[] args) {
  ListNode head = new ListNode(2);
  head.next = new ListNode(4);
  head.next.next = new ListNode(6);
  head.next.next.next = new ListNode(8);
  head.next.next.next.next = new ListNode(10);

  ListNode result = ReverseLinkedList.reverse(head);
  System.out.print("Nodes of the reversed LinkedList are: ");
  while (result != null) {
   System.out.print(result.value + " ");
   result = result.next;
  }
 }
}
```

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Time complexity

The time complexity of our algorithm will be $O(N)$ where 'N' is the total number of nodes in the LinkedList.

Space complexity

We only used constant space, therefore, the space complexity of our algorithm is $O(1)$.

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