In-place Reversal of a Linked List: Introduction

Let's go over the In-place Reversal of a Linked List pattern, its real-world applications and some problems we can solve with it.

We'll cover the following

Overview

The **in-place reversal of a linked list** pattern allows us to reverse a linked list without any additional memory, using only the given nodes.

Many problems require a reversal of a set of nodes in a linked list without using additional memory. In such cases, using the in-place reversal pattern is the simplest solution. Instead of making a new linked list with reversed links, we can do it in place, without using additional memory.

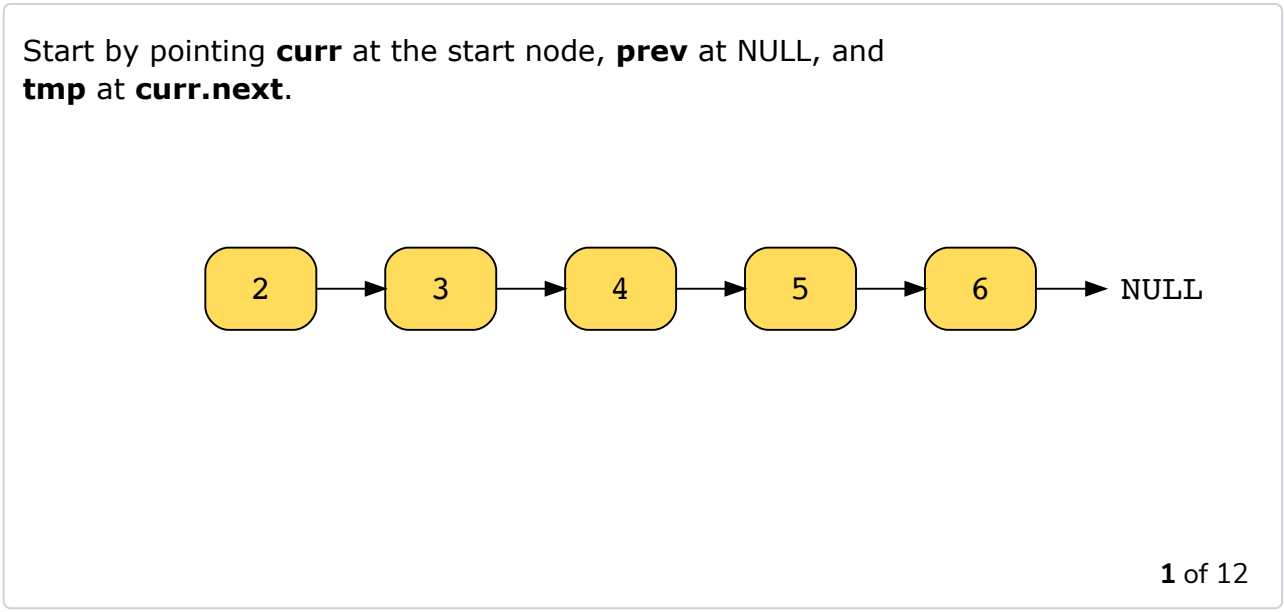
How can we achieve an in-place reversal of nodes? We iterate in a linked list and keep track of the current node, the next node, and the previous node simultaneously. Keeping track of the nodes allows us to easily change the links between them and make them point to a different node than before.

When solving such problems, the naive approach of iterating the linked list using nested loops takes $O(n^2)$ time. However, using the *in-place*

reversal pattern, the time complexity is $O(n)$ time, since we use a single loop to iterate the linked list.

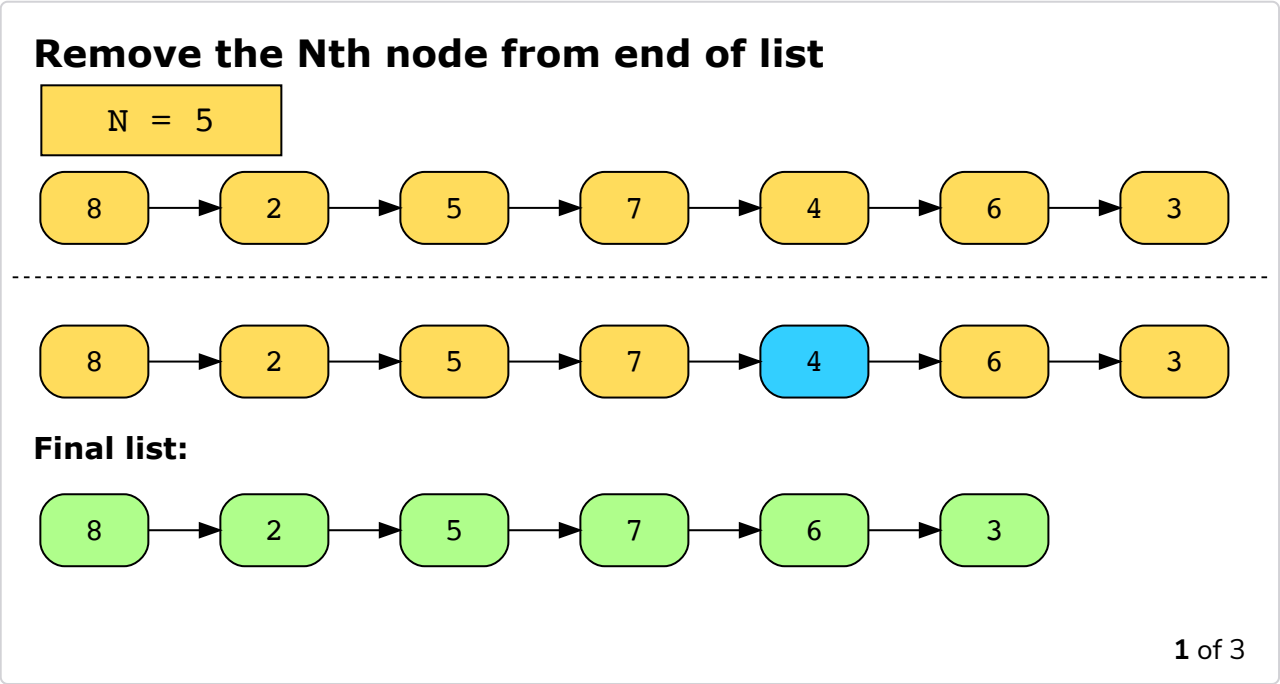
Similarly, for space complexity: the naive approach requires the use of additional memory—if a linked list contains thousands of nodes, we'd need to allocate a lot of additional memory resources to solve the problem. However, the in-place reversal of a linked pattern will use only $O(1)$ space.

The following illustration demonstrates the reversal of a linked list using the in-place pattern:



Examples

The following examples illustrate some problems that can be solved with this approach:



Does my problem match this pattern?

- Yes, if both of these conditions are fulfilled:
  - The problem requires reversing a given linked list, either as the end goal, or as an intermediate step of the solution.
  - The modifications to the linked list must be made in place, that is, we're not allowed to use more than $O(1)$ additional space in memory.

Additionally, this pattern also applies when the problem requires reversing selected portions of a given linked list.

- No, if any of these conditions is fulfilled:
  - The input data is not in the form of a linked list.
  - We specifically need to use additional memory.
  - We aren't allowed to modify the input linked list.

Real-world problems

Many problems in the real world use the in-place reversal of a linked lis
pattern. Let's look at some examples:

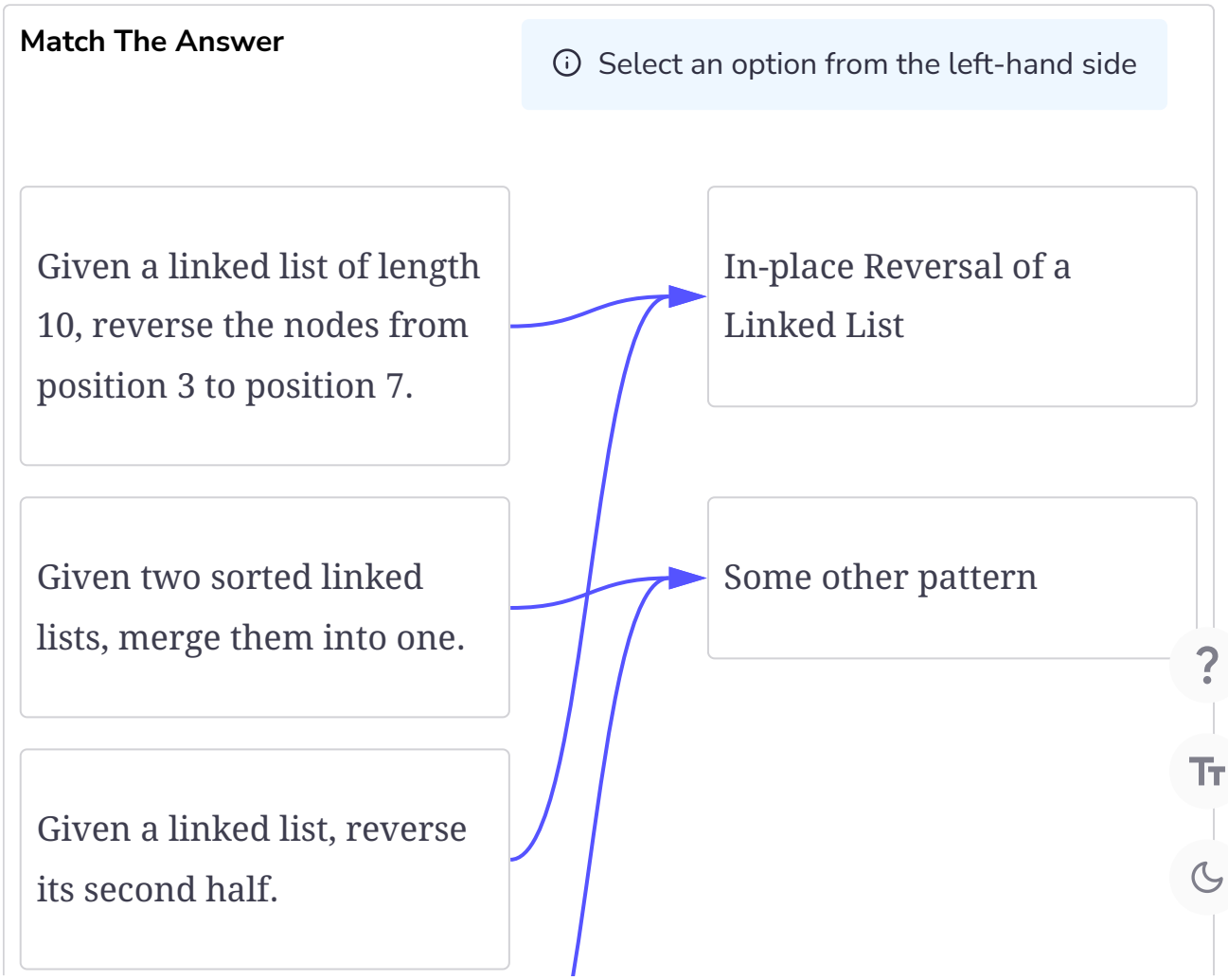
- **Stocks:** A total of N stock transactions need to be carried out by K brokers. We need to assign transactions to each broker that need to be carried out in the same order in which they arrived.
- **E-commerce:** A list of products is arranged such that the first half is in ascending order based on prices and the second half is in

displayed on a landing page in pairs of price and popularity such that the first product is cheaper and the second is the most popular.

Strategy time!

Match the problems that can be solved using the in-place reversal of a linked list pattern.

> **Note:** Select a problem in the left-hand column by clicking it, and then click one of the two options in the right-hand column.



Given two linked lists containing integers, find the linked list containing intersected elements.

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Reverse Linked List

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