

777. Swap Adjacent in LR String

[Leetcode Link](#)

In a string composed of 'L', 'R', and 'X' characters, like "RX~~XL~~RXRXL", a move consists of either replacing one occurrence of "XL" with "LX", or replacing one occurrence of "RX" with "XR". Given the starting string `start` and the ending string `end`, return `True` if and only if there exists a sequence of moves to transform one string to the other.

Example 1:

Input: `start = "RXXLRXRXL"`, `end = "XRLXXRRLX"`

Output: `true`

Explanation: We can transform start to end following these steps: RX~~XL~~RXRXL → XR~~XL~~RXRXL → XRLXRXRXL → XRLXXRRLX → XRLXXRRLX

Example 2:

Input: `start = "X"`, `end = "L"`

Output: `false`

Solution

Solution

The first observation we can make is that the two moves can be described as the following: shift **L** to the left and shift **R** to the right. Since **L** and **R** cannot be swapped with each other, the relative order of **L** and **R** letters will **never** change.

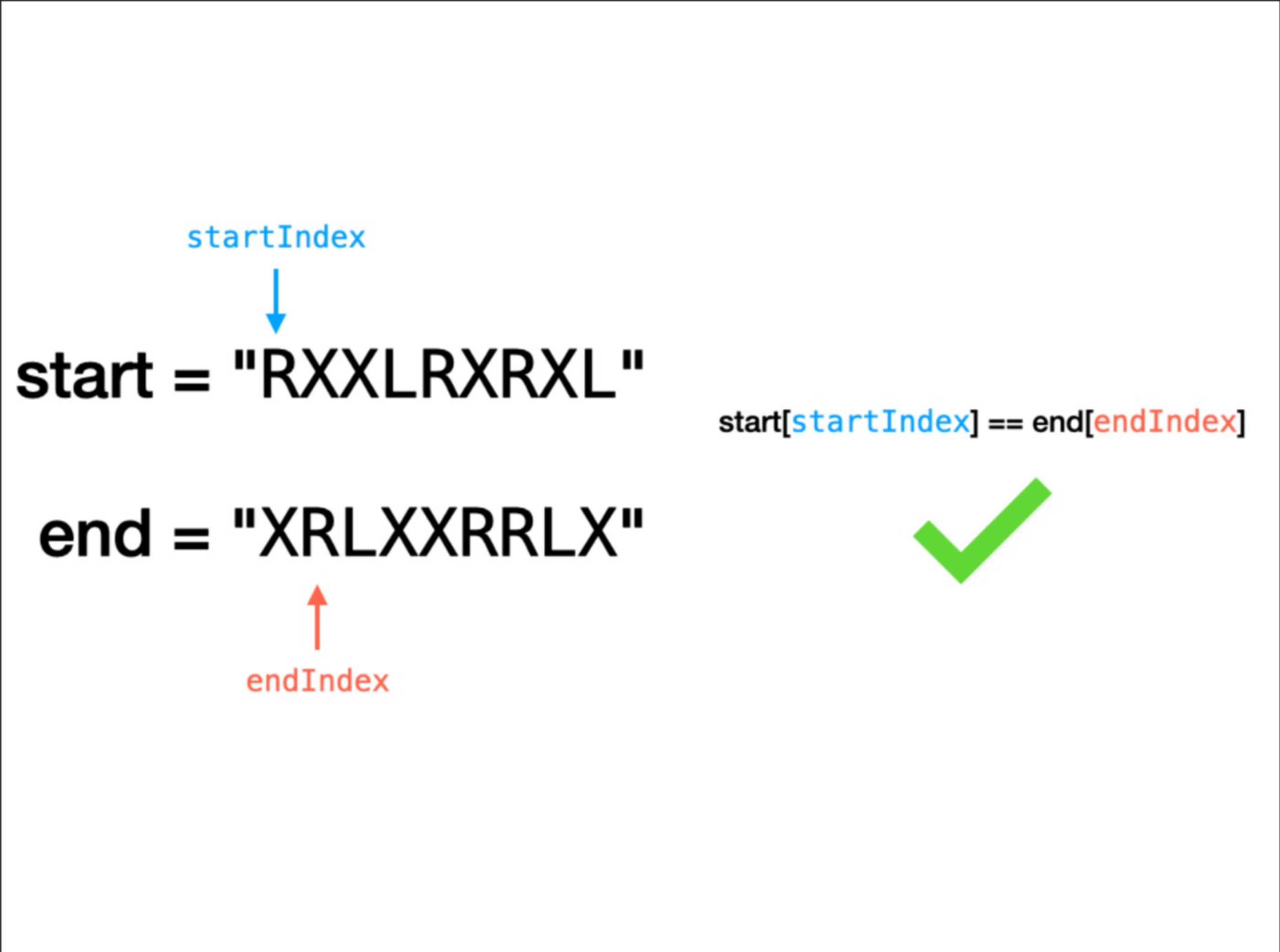
Let's label **L** and **R** as valid letters.

Our first condition for a transformation from `start` to `end` is that both `start` and `end` must have the same number of valid letters. In addition, the first valid letter in `start` must match the first valid letter in `end`, the second valid letter in `start` must match the second valid letter in `end`, and so on until the last.

We can also observe that for a transformation to exist, the i^{th} valid letter in `start` must be able to move to the position of the i^{th} valid letter in `end`. We'll denote `startIndex` as the index of the i^{th} valid letter in `start` and `endIndex` as the index of the i^{th} valid letter in `end`. There are two cases to consider:

- The valid letter is **L**. Since **L** can only move left, a transformation exists when `startIndex >= endIndex`.
- The valid letter is **R**. Since **R** can only move right, a transformation exists when `startIndex <= endIndex`.

We can implement this using the idea of [Two Pointers](#) to keep track of `startIndex` and `endIndex` for every valid letter.



Time Complexity

Let's denote N as the length of both strings `start` and `end`.

Since we use [Two Pointers](#) to iterate through both strings once, our time complexity is $O(N)$.

Time Complexity: $O(N)$

Space Complexity

Space Complexity: $O(1)$

C++ Solution

```
1 class Solution {
2     public:
3     bool canTransform(string start, string end) {
4         int n = start.size();
5         int startIndex = 0;
6         int endIndex = 0;
7         while (startIndex < n || endIndex < n) {
8             while (startIndex < n &&
9                 start[startIndex] == 'X') { // find next valid letter in start
10                startIndex++;
11            }
12            while (endIndex < n &&
13                end[endIndex] == 'X') { // find next valid letter in end
14                endIndex++;
15            }
16            if (startIndex == n && endIndex == n) { // both reached the end
17                return true;
18            }
19            if (startIndex == n || endIndex == n) { // different number of valid letters
20                return false;
21            }
22            if (start[startIndex] != end[endIndex]) { // different valid letter
23                return false;
24            }
25            if (start[startIndex] == 'R' && startIndex > endIndex) { // wrong direction
26                return false;
27            }
28            if (start[startIndex] == 'L' && startIndex < endIndex) { // wrong direction
29                return false;
30            }
31            startIndex++;
32            endIndex++;
33        }
34        return true;
35    }
36 };
```

Java Solution

```
1 class Solution {
2     public boolean canTransform(String start, String end) {
3         int n = start.length();
4         int startIndex = 0;
5         int endIndex = 0;
6         while (startIndex < n || endIndex < n) {
7             while (startIndex < n
8                 && start.charAt(startIndex) == 'X') { // find next valid letter in start
9                startIndex++;
10            }
11            while (endIndex < n
12                && end.charAt(endIndex) == 'X') { // find next valid letter in end
13                endIndex++;
14            }
15            if (startIndex == n && endIndex == n) { // both reached the end
16                return true;
17            }
18            if (startIndex == n || endIndex == n) { // different number of valid letters
19                return false;
20            }
21            if (start.charAt(startIndex)
22                != end.charAt(endIndex)) { // different valid letter
23                return false;
24            }
25            if (start.charAt(startIndex) == 'R'
26                && startIndex > endIndex) { // wrong direction
27                return false;
28            }
29            if (start.charAt(startIndex) == 'L'
30                && startIndex < endIndex) { // wrong direction
31                return false;
32            }
33            startIndex++;
34            endIndex++;
35        }
36        return true;
37    }
38 }
```

Python Solution

```
1 class Solution:
2     def canTransform(self, start: str, end: str) -> bool:
3         n = len(start)
4         startIndex = 0
5         endIndex = 0
6         while startIndex < n or endIndex < n:
7             while (
8                 startIndex < n and start[startIndex] == "X"
9             ): # find next valid letter in start
10                startIndex += 1
11            while (
12                endIndex < n and end[endIndex] == "X"
13            ): # find next valid letter in end
14                endIndex += 1
15            if startIndex == n and endIndex == n: # both reached the end
16                return True
17            if startIndex == n or endIndex == n: # different number of valid letters
18                return False
19            if start[startIndex] != end[endIndex]: # different valid letter
20                return False
21            if start[startIndex] == "R" and startIndex > endIndex: # wrong direction
22                return False
23            if start[startIndex] == "L" and startIndex < endIndex: # wrong direction
24                return False
25            startIndex += 1
26            endIndex += 1
27        return True
28
```

Got a question? [Ask the Teaching Assistant](#) anything you don't understand.