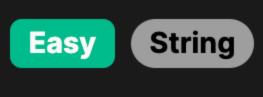
1309. Decrypt String from Alphabet to Integer Mapping



Problem Description

The given problem defines a unique mapping system where digits are used to represent English lowercase letters, with some digits followed by a '#' symbol to represent letters beyond 'i'. Specifically, the digits '1' to '9' correspond to the letters 'a' to 'i', and the representation for letters 'j' to 'z' is given as two digits followed by a '#', starting with '10#' for 'j' and ending with '26#' for 'z'.

Given a string s that is formed by these digits and '#' characters, the objective is to convert or map the string back to its English lowercase letter representation. For example, if the string s is "10#11#12", the output should be "jk".

This mapping is bijective, meaning there will always be a unique solution to the mapping. One key detail stated in the problem is that test cases are generated in a way that ensures a unique mapping is always possible.

Intuition

To achieve the conversion from the given string s to the lowercase English letters, we need to traverse the string and determine if we are dealing with a one-digit number (which maps to 'a' to 'i') or a two-digit number followed by a '#' (which maps to 'j' to 'z').

Our approach is as follows: 1. We iterate over the string s starting from the beginning. 2. At each step, we check if there's a '#' character two positions ahead. If there is, it means the current and the next character form a two-digit

number that corresponds to a letter from 'j' to 'z'. We then convert these two digits (and skip the '#' symbol) into the respective letter.

3. If there's no '#' two positions ahead, we treat the current character as a one-digit number and convert it to the respective letter from 'a' to 'i'.

the implementation based on the provided Python code:

by: chr(ord('a') + int(s) - 1).

- 4. We continue this until the end of the string, appending each translated letter to a result list. 5. Once the traversal is done, we join all elements of the result list to form the final string.
- Solution Approach
- The solution's approach is rather straightforward and employs a simple while loop to iterate over the string. Let's walk through

Define a helper function named get, which takes a string s representing a number and converts it into a character. The

function does this by first converting the string to an integer, then adding it to the ASCII value of 'a', and subtracting 1. This result is then converted back to a char using the chr function, aligning '1' with 'a', '2' with 'b', etc. The logic can be expressed

Initialize two variables, i and n, where i will be used to iterate over the string s and n holds the length of the string. Start a while loop that continues as long as i is smaller than n. This loop will process each character or pair of characters followed by a '#' one at a time.

Inside the loop, there's an if statement that checks if the current position i plus 2 is within bounds of the string and if there is

If the condition is false, it suggests we are currently handling a single digit. Append the result of the helper function get with

- a '#' character at this position. This condition confirms that we have a two-digit number that needs to be mapped to a character from 'j' to 'z'.
- If the condition is true, append the letter obtained from the helper function get by passing the substring from i to i + 2. Then increment i by 3 to account for the two digits and the '#' we just processed.
- After the loop exits, use the join method on an empty string to concatenate all the elements in the result list res. This provides us with the final decoded string.
- followed by '#' without the need for separate parsing steps. The use of array slicing and the helper function makes the code more readable and maintainable.

Notice how the solution ensures we correctly interpret characters that are either single-digit numbers or two-digit numbers

• Check the i+2 position for a '#', which is true at i = 0. Use get('12') to map to 'l' and increment i by 3.

1st iteration (i = 0):

Initialize i to 0 and n to the length of the string (which is 8).

Return the decoded string.

• Now i is 3, and i+2 is '11#', so get('11') maps to 'k' and i becomes 6. • Finally, i is 6, and i+2 hits '10#', so get('10') maps to 'j' and i becomes 9, which breaks the loop. The result list res has ['l', 'k', 'j'], which joins to ljk.

∘ We check if there is a '#' at position i+2. However, i+2 is 2 and s[2] is not '#', it's '5'. Therefore, we process a single-digit number.

∘ Now i is 1. Again, we check if there is a '#' at position i+2. This time, i+2 is 3 and s[3] is '#', indicating a two-digit number followed by '#'.

Example Walkthrough Let's apply the solution approach step-by-step on a smaller example input: "2#5".

• We call get(s[1:1+2]), which means get('25'), translating to 'y' using our custom function.

Helper function to convert a string number to its corresponding alphabet

result.append(decode to char(string[index: index + 2]))

Move the index by 3 positions forward, skipping over the two digits and the '#'

If false, it's a single-digit number which is directly appended after decoding

The alphabet starts from 'a', hence the offset is 'a' + int(s) - 1

By following this process, the solution efficiently decodes the entire string into the format we need.

the single character at position i. Increment i by 1 to move to the next character.

Here's a step-by-step explanation of how the algorithm works on the input "12#11#10":

2nd iteration (i = 1):

Increment i by 3 to move past the two-digit number and the '#'.

Increment i by 1 to move to the next character.

def freqAlphabets(self, string: str) -> str:

return chr(ord('a') + int(s) - 1)

index, length_of_string = 0, len(string)

Initialize index and the length of the input string

Initialize an empty list to store the resulting characters

result.append(decode_to_char(string[index]))

Move the index by 1 position forward

def decode_to_char(s: str) -> str:

Iterate over the input string

index += 3

index += 1

We call get('2'), which translates to 'b' using our custom function.

We initialize i to 0 and n to 4, which is the length of the string.

- The while loop exits as i (now 4) is not smaller than n. We finally join ['b', 'y'] to form the output string, resulting in "by".
- Solution Implementation

In this example, our first step was to convert the single digit '2' into 'b'. Then, we correctly identified '25#' as a representation of

'y' and completed our decoding process. The final result, for the input string "2#5", using the provided solution approach, is "by".

while index < length_of_string:</pre> # Check if a '#' follows two characters to detect if it's a two-digit number if index + 2 < length_of_string and string[index + 2] == '#':</pre> # If true, append the decoded character from the two-digit number to the result

else:

result = []

Python

class Solution:

```
# Join the list of characters into a string and return it
        return ''.join(result)
Java
class Solution {
    // Function to decode the string s as per the given pattern
    public String freqAlphabets(String s) {
        int index = 0; // Initialize index to keep track of the current position in the string
        int strLength = s.length(); // Store the length of the input string for boundary checking
        StringBuilder decodedString = new StringBuilder(); // StringBuilder to append the decoded characters
        // Iterate through the string until all characters are processed
       while (index < strLength) {</pre>
           // Check if the current character is part of a two-digit number followed by a '#'
            if (index + 2 < strLength && s.charAt(index + 2) == '#') {</pre>
                // Decode the two-digit number and append the corresponding character
                decodedString.append(decode(s.substring(index, index + 2)));
                index += 3; // Skip the next two characters and the '#'
            } else {
                // Decode a single-digit number and append the corresponding character
                decodedString.append(decode(s.substring(index, index + 1)));
                index += 1; // Move to the next character
       // Convert the StringBuilder to a String and return it
        return decodedString.toString();
    // Helper function to convert a numeric string to its respective alphabet character
    private char decode(String numericString) {
       // Subtract '1' because 'a' corresponds to '1', 'b' to '2', and so on.
```

// Parse the numeric string to an integer, subtract 1, and then add it to the char 'a'

// If so, take the two characters before '#' and push them onto the vector.

// Skip the next two characters and the '#' by incrementing the index by 3.

return (char) ('a' + Integer.parseInt(numericString) - 1);

std::string freqAlphabets(const std::string& encoded_str) {

// Initialize a vector to build the decoded characters.

// Initialize an index to iterate over the input string.

// Check if there is a '#' two characters ahead.

if (index + 2 < length && encoded_str[index + 2] == '#') {</pre>

decoded_chars.push_back(encoded_str.substr(index, 2));

// Otherwise, push the current character onto the vector.

// Move to the next character by incrementing the index by 1.

decoded_chars.push_back(encoded_str.substr(index, 1));

// Get the length of the input string.

std::vector<std::string> decoded_chars;

size_t length = encoded_str.length();

// Iterate over the input string.

while (index < length) {</pre>

index += 3;

index++;

C++

#include <iostream>

size_t index = 0;

} else {

#include <string>

#include <vector>

```
// Initialize the decoded string.
      std::string decoded_str;
      // Convert each encoded character or pair in the vector to the corresponding letter.
      for (const auto& encoded_char : decoded_chars) {
          // 'a' - 1 provides the offset necessary because 'a' starts at 97. Adding encoded_value gives us the ASCII value.
          char decoded_char = static_cast<char>('a' + std::stoi(encoded_char) - 1);
          // Add the decoded character to the decoded string.
          decoded_str += decoded_char;
      // Return the final decoded string.
      return decoded_str;
  // Example of using the function.
  int main() {
      std::string encoded_string = "12#14#3#";
      std::string decoded = freqAlphabets(encoded_string);
      std::cout << "Decoded string: " << decoded << std::endl;</pre>
      return 0;
  TypeScript
  function freqAlphabets(encodedStr: string): string {
      // Get the length of the input string.
      const length = encodedStr.length;
      // Initialize an array to build the decoded characters.
      const decodedChars: string[] = [];
      // Initialize an index to iterate over the input string.
      let index = 0;
      // Iterate over the input string.
      while (index < length) {</pre>
          // Check if there is a '#' two characters ahead.
          if (encodedStr[index + 2] === '#') {
              // If so, slice the two characters before '#' and add them to the array.
              decodedChars.push(encodedStr.slice(index, index + 2));
              // Skip the next two characters and the '#' by incrementing the index by 3.
              index += 3;
          } else {
              // Otherwise, add the current character to the array as is.
              decodedChars.push(encodedStr[index]);
              // Move to the next character by incrementing the index by 1.
              index += 1;
      // Map each character or pair in the array to its corresponding decoded character.
      // Convert each encoded character to its respective letter in the alphabet.
      return decodedChars.map(encodedChar =>
          String.fromCharCode('a'.charCodeAt(0) + Number(encodedChar) - 1)
      ).join(''); // Join the array of characters to form the final decoded string.
class Solution:
```

Join the list of characters into a string and return it return ''.join(result)

Time and Space Complexity

result = []

else:

def freqAlphabets(self, string: str) -> str:

return chr(ord('a') + int(s) - 1)

index, length_of_string = 0, len(string)

Initialize index and the length of the input string

Initialize an empty list to store the resulting characters

result.append(decode_to_char(string[index]))

Move the index by 1 position forward

if index + 2 < length_of_string and string[index + 2] == '#':</pre>

result.append(decode_to_char(string[index: index + 2]))

def decode_to_char(s: str) -> str:

Iterate over the input string

while index < length_of_string:</pre>

index += 3

index += 1

Helper function to convert a string number to its corresponding alphabet

The alphabet starts from 'a', hence the offset is 'a' + int(s) - 1

Check if a '#' follows two characters to detect if it's a two-digit number

If true, append the decoded character from the two-digit number to the result

Move the index by 3 positions forward, skipping over the two digits and the '#'

If false, it's a single-digit number which is directly appended after decoding

Time Complexity

The time complexity of the provided code can be analyzed by looking at the number of iterations it makes over the string s. The code uses a while loop to iterate over each character of the string. The key operation within the loop is checking whether the next character is a special '#' and then either taking one or two characters to convert them into a letter. These operations are all constant time, and since the loop runs for each character or pair of characters marked with a '#', the time complexity is O(n), where n is the length of the string s.

Space Complexity

The code uses additional memory for the res list to store the result. In the worst case, where there are no '#' characters, the res list would have as many characters as the original string s. Therefore, the space complexity is also 0(n), where n is the length of the string s. In the case of the given code, the space complexity does not grow more than O(n) as we are only creating a result list that, at most, will have the same length as the input.