

Zigzag Conversion

For solving the Zigzag Conversion problem, the goal is to simulate writing characters in a zigzag pattern and then reading them row by row.

Core Idea: Simulate the zigzag by filling characters into rows going down and then up diagonally repeatedly.

Use: A vector <string> to store characters for each row.

A row index and a direction flag to determine movement between rows.

Algorithm:

1. If $\text{numRows} = 1$ → return s directly (zigzag isn't needed)
2. Initialize a vector of empty strings: $\text{vector<string> rows(numRows)}$
3. $\text{row} = 0$, and $\text{direction} = -1$
4. Loop through characters in s :
 - Append to $\text{rows}[\text{row}]$
 - If a top or bottom row, reverse direction
 - Move $\text{row} += \text{direction}$
5. After loop, concatenate all strings in rows

Time Complexity: $O(n)$ where $n = s.length()$ — each character is processed once.
• $O(n)$ space for storing rows.

Example: "PAYPALISHIRING", $\text{numRows} = 4$

Row 0: P I N

Row 1: A L S I G

Row 2: Y A H R

Row 3: P I

Concatenate: "PINALSIGYAHRIPI"