**Longest Substring Without Repeating Characters**
Given a string s, find the length of the longest substring without repeating characters.

Example 1:

Input: s = "abcabcbb"
Output: 3
Explanation: The answer is "abc", with the length of 3.
Example 2:

Input: s = "bbbbb"
Output: 1
Explanation: The answer is "b", with the length of 1.
Example 3:

Input: s = "pwwkew"
Output: 3
Explanation: The answer is "wke", with the length of 3.
Notice that the answer must be a substring, "pwke" is a subsequence and not a substring.

**Zigzag Conversion**
The string "PAYPALISHIRING" is written in a zigzag pattern on a given number of rows like this: (you may want to display this pattern in a fixed font for better legibility)

P A H N
A P L S I I G
Y I R
And then read line by line: "PAHNAPLSIIGYIR"

Write the code that will take a string and make this conversion given a number of rows:

string convert(string s, int numRows);

Example 1:

Input: s = "PAYPALISHIRING", numRows = 3
Output: "PAHNAPLSIIGYIR"
Example 2:

Input: s = "PAYPALISHIRING", numRows = 4
Output: "PINALSIGYAHRPI"

Explanation:
P I N
A L S I G
Y A H R
P I
Example 3:

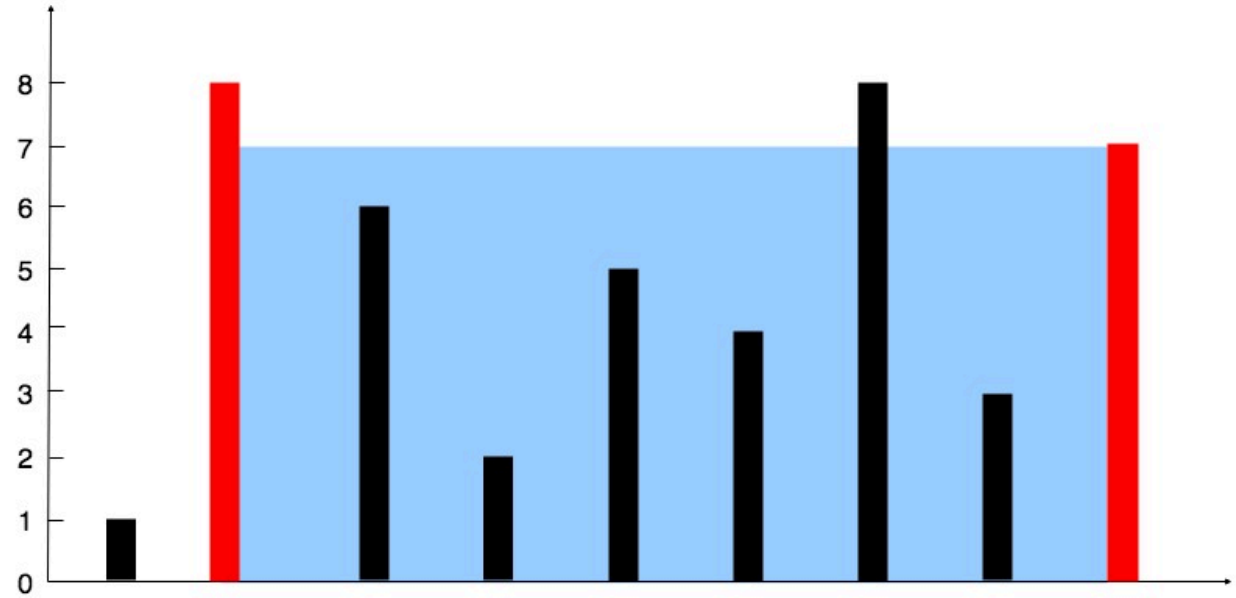
Input: s = "A", numRows = 1
Output: "A"

**Container With Most Water**
You are given an integer array height of length n. There are n vertical lines drawn such that the two endpoints of the ith line are (i, 0) and (i, height[i]).

Find two lines that together with the x-axis form a container, such that the container contains the most water.

Return the maximum amount of water a container can store.

Notice that you may not slant the container.




Example 1:

Input: height = [1,8,6,2,5,4,8,3,7]
Output: 49

Explanation: The above vertical lines are represented by array [1,8,6,2,5,4,8,3,7]. In this case, the max area of water (blue section) the container can contain is 49.
Example 2:

Input: height = [1,1]
Output: 1

**Integer to Roman**

Seven different symbols represent Roman numerals with the following values:

| Symbol | Value |
|---|---|
| I | 1 |
| V | 5 |
| X | 10 |
| L | 50 |
| C | 100 |
| D | 500 |
| M | 1000 |

Roman numerals are formed by appending the conversions of decimal place values from highest to lowest. Converting a decimal place value into a Roman numeral has the following rules:

If the value does not start with 4 or 9, select the symbol of the maximal value that can be subtracted from the input, append that symbol to the result, subtract its value, and convert the remainder to a Roman numeral.
If the value starts with 4 or 9 use the subtractive form representing one symbol subtracted from the following symbol, for example, 4 is 1 (I) less than 5 (V): IV and 9 is 1 (I) less than 10 (X): IX. Only the following subtractive forms are used: 4 (IV), 9 (IX), 40 (XL), 90 (XC), 400 (CD) and 900 (CM).
Only powers of 10 (I, X, C, M) can be appended consecutively at most 3 times to represent multiples of 10. You cannot append 5 (V), 50 (L), or 500 (D) multiple times. If you need to append a symbol 4 times use the subtractive form.
Given an integer, convert it to a Roman numeral.

Example 1:

Input: num = 3749

Output: "MMMDCCXLIX"

Explanation:

3000 = MMM as 1000 (M) + 1000 (M) + 1000 (M)
 700 = DCC as 500 (D) + 100 (C) + 100 (C)
  40 = XL as 10 (X) less of 50 (L)
   9 = IX as 1 (I) less of 10 (X)
Note: 49 is not 1 (I) less of 50 (L) because the conversion is based on decimal places
Example 2:

Input: num = 58

Output: "LVIII"

Explanation:

50 = L
 8 = VIII
Example 3:

Input: num = 1994

Output: "MCMXCIV"

Explanation:

1000 = M
 900 = CM
  90 = XC
   4 = IV

**3Sum**
Given an integer array nums, return all the triplets [nums[i], nums[j], nums[k]] such that i != j, i != k, and j != k, and nums[i] + nums[j] + nums[k] == 0.

Notice that the solution set must not contain duplicate triplets.

Example 1:

Input: nums = [-1,0,1,2,-1,-4]
Output: [[-1,-1,2],[-1,0,1]]
Explanation:
nums[0] + nums[1] + nums[2] = (-1) + 0 + 1 = 0.
nums[1] + nums[2] + nums[4] = 0 + 1 + (-1) = 0.
nums[0] + nums[3] + nums[4] = (-1) + 2 + (-1) = 0.
The distinct triplets are [-1,0,1] and [-1,-1,2].
Notice that the order of the output and the order of the triplets does not matter.
Example 2:

Input: nums = [0,1,1]
Output: []
Explanation: The only possible triplet does not sum up to 0.
Example 3:

Input: nums = [0,0,0]
Output: [[0,0,0]]
Explanation: The only possible triplet sums up to 0

**Next Permutation**
Medium
Topics
Companies
A permutation of an array of integers is an arrangement of its members into a sequence or linear order.

For example, for arr = [1,2,3], the following are all the permutations of arr: [1,2,3], [1,3,2], [2, 1, 3], [2, 3, 1], [3,1,2], [3,2,1].
The next permutation of an array of integers is the next lexicographically greater permutation of its integer. More formally, if all the permutations of the array are sorted in one container according to their lexicographical order, then the next permutation of that array is the permutation that follows it in the sorted container. If such arrangement is not possible, the array must be rearranged as the lowest possible order (i.e., sorted in ascending order).

For example, the next permutation of arr = [1,2,3] is [1,3,2].
Similarly, the next permutation of arr = [2,3,1] is [3,1,2].
While the next permutation of arr = [3,2,1] is [1,2,3] because [3,2,1] does not have a lexicographical larger rearrangement.
Given an array of integers nums, find the next permutation of nums.

The replacement must be in place and use only constant extra memory.

Example 1:

Input: nums = [1,2,3]
Output: [1,3,2]
Example 2:

Input: nums = [3,2,1]
Output: [1,2,3]
Example 3:

Input: nums = [1,1,5]
Output: [1,5,1]

**Sudoku Solver**
Write a program to solve a Sudoku puzzle by filling the empty cells.

A sudoku solution must satisfy all of the following rules:

Each of the digits 1-9 must occur exactly once in each row.
Each of the digits 1-9 must occur exactly once in each column.
Each of the digits 1-9 must occur exactly once in each of the 9 3x3 sub-boxes of the grid.
The '.' character indicates empty cells.

Example 1:

Input: board = [["5","3",".",".","7",".",".",".","."],
["6",".",".","1","9","5",".",".","."],
[".","9","8",".",".",".",".","6","."],
["8",".",".",".","6",".",".",".","3"],
["4",".",".","8",".","3",".",".","1"],
["7",".",".",".","2",".",".",".","6"],
[".","6",".",".",".",".","2","8","."],
[".",".",".","4","1","9",".",".","5"],
[".",".",".",".","8",".",".","7","9"]]
Output: [["5","3","4","6","7","8","9","1","2"],

["6","7","2","1","9","5","3","4","8"],
["1","9","8","3","4","2","5","6","7"],
["8","5","9","7","6","1","4","2","3"],
["4","2","6","8","5","3","7","9","1"],
["7","1","3","9","2","4","8","5","6"],
["9","6","1","5","3","7","2","8","4"],
["2","8","7","4","1","9","6","3","5"],
["3","4","5","2","8","6","1","7","9"]]

**Trapping Rain Water**
Hard
Topics
Companies
Given n non-negative integers representing an elevation map where the width of each bar is 1, compute how much water it can trap after raining.

Example 1:


Input: height = [0,1,0,2,1,0,1,3,2,1,2,1]
Output: 6
Explanation: The above elevation map (black section) is represented by array [0,1,0,2,1,0,1,3,2,1,2,1]. In this case, 6 units of rain water (blue section) are being trapped.
Example 2:

Input: height = [4,2,0,3,2,5]
Output: 9

**Wildcard Matching**
Given an input string (s) and a pattern (p), implement wildcard pattern matching with support for '?' and '*' where:

'?' Matches any single character.
'*' Matches any sequence of characters (including the empty sequence).
The matching should cover the entire input string (not partial).

Example 1:

Input: s = "aa", p = "a"
Output: false
Explanation: "a" does not match the entire string "aa".
Example 2:

Input: s = "aa", p = "*"
Output: true
Explanation: '*' matches any sequence.
Example 3:

Input: s = "cb", p = "?a"
Output: false
Explanation: '?' matches 'c', but the second letter is 'a', which does not match 'b'.

**Permutations**
Given an array nums of distinct integers, return all the possible permutations. You can return the answer in any order.

Example 1:

Input: nums = [1,2,3]
Output: [[1,2,3],[1,3,2],[2,1,3],[2,3,1],[3,1,2],[3,2,1]]
Example 2:

Input: nums = [0,1]
Output: [[0,1],[1,0]]
Example 3:

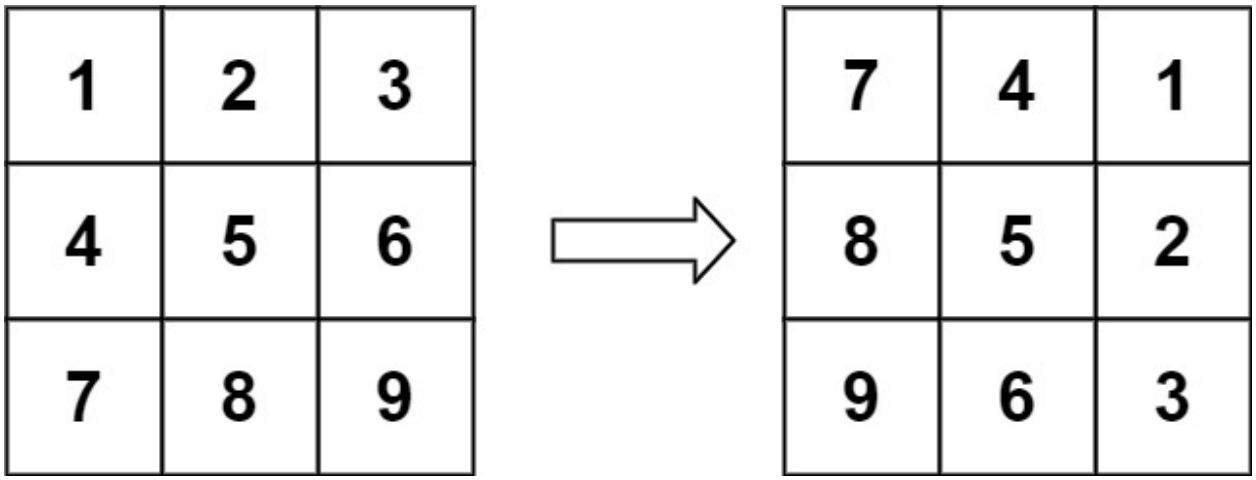
Input: nums = [1]

Output: [[1]]

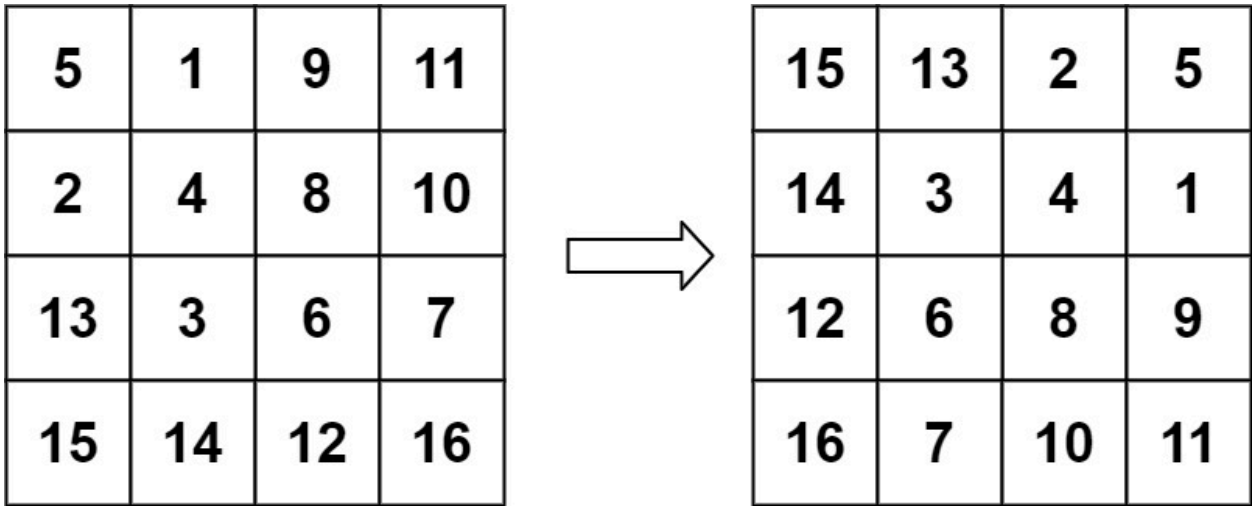
**Rotate Image**
Medium
Topics
Companies
You are given an n x n 2D matrix representing an image, rotate the image by 90 degrees (clockwise).

You have to rotate the image in-place, which means you have to modify the input 2D matrix directly. DO NOT allocate another 2D matrix and do the rotation.

Example 1:




Input: matrix = [[1,2,3],[4,5,6],[7,8,9]]
Output: [[7,4,1],[8,5,2],[9,6,3]]
Example 2:




Input: matrix = [[5,1,9,11],[2,4,8,10],[13,3,6,7],[15,14,12,16]]
Output: [[15,13,2,5],[14,3,4,1],[12,6,8,9],[16,7,10,11]]

**Gas Station**
There are n gas stations along a circular route, where the amount of gas at the ith station is gas[i].

You have a car with an unlimited gas tank and it costs cost[i] of gas to travel from the ith station to its next (i + 1)th station. You begin the journey with an empty tank at one of the gas stations.

Given two integer arrays gas and cost, return the starting gas station's index if you can travel around the circuit once in the clockwise direction, otherwise return -1. If there exists a solution, it is guaranteed to be unique

Example 1:

Input: gas = [1,2,3,4,5], cost = [3,4,5,1,2]
Output: 3
Explanation:
Start at station 3 (index 3) and fill up with 4 unit of gas. Your tank = 0 + 4 = 4
Travel to station 4. Your tank = 4 - 1 + 5 = 8
Travel to station 0. Your tank = 8 - 2 + 1 = 7
Travel to station 1. Your tank = 7 - 3 + 2 = 6
Travel to station 2. Your tank = 6 - 4 + 3 = 5
Travel to station 3. The cost is 5. Your gas is just enough to travel back to station 3.

Therefore, return 3 as the starting index.
Example 2:

Input: gas = [2,3,4], cost = [3,4,3]
Output: -1
Explanation:
You can't start at station 0 or 1, as there is not enough gas to travel to the next station.
Let's start at station 2 and fill up with 4 unit of gas. Your tank = 0 + 4 = 4
Travel to station 0. Your tank = 4 - 3 + 2 = 3
Travel to station 1. Your tank = 3 - 3 + 3 = 3
You cannot travel back to station 2, as it requires 4 unit of gas but you only have 3.
Therefore, you can't travel around the circuit once no matter where you start.

**Candy**
There are n children standing in a line. Each child is assigned a rating value given in the integer array ratings.

You are giving candies to these children subjected to the following requirements:

Each child must have at least one candy.
Children with a higher rating get more candies than their neighbors.
Return the minimum number of candies you need to have to distribute the candies to the children.

Example 1:

Input: ratings = [1,0,2]
Output: 5
Explanation: You can allocate to the first, second and third child with 2, 1, 2 candies respectively.
Example 2:

Input: ratings = [1,2,2]
Output: 4
Explanation: You can allocate to the first, second and third child with 1, 2, 1 candies respectively.
The third child gets 1 candy because it satisfies the above two conditions.

**Find Minimum in Rotated Sorted Array**

Suppose an array of length n sorted in ascending order is rotated between 1 and n times. For example, the array nums = [0,1,2,4,5,6,7] might become:

[4,5,6,7,0,1,2] if it was rotated 4 times.
[0,1,2,4,5,6,7] if it was rotated 7 times.
Notice that rotating an array [a[0], a[1], a[2], ..., a[n-1]] 1 time results in the array [a[n-1], a[0], a[1], a[2], ..., a[n-2]].

Given the sorted rotated array nums of unique elements, return the minimum element of this array.

Example 1:

Input: nums = [3,4,5,1,2]
Output: 1
Explanation: The original array was [1,2,3,4,5] rotated 3 times.
Example 2:

Input: nums = [4,5,6,7,0,1,2]
Output: 0
Explanation: The original array was [0,1,2,4,5,6,7] and it was rotated 4 times.
Example 3:

Input: nums = [11,13,15,17]
Output: 11
Explanation: The original array was [11,13,15,17] and it was rotated 4 times.

**Excel Sheet Column Title**
Given an integer columnNumber, return its corresponding column title as it appears in an Excel sheet.

For example:

A -> 1
B -> 2
C -> 3
...
Z -> 26
AA -> 27
AB -> 28
...

Example 1:

Input: columnNumber = 1
Output: "A"
Example 2:

Input: columnNumber = 28
Output: "AB"
Example 3:

Input: columnNumber = 701
Output: "ZY"

**Dungeon Game**
The demons had captured the princess and imprisoned her in the bottom-right corner of a dungeon. The dungeon consists of m x n rooms laid out in a 2D grid. Our valiant knight was initially positioned in the top-left room and must fight his way through dungeon to rescue the princess.

The knight has an initial health point represented by a positive integer. If at any point his health point drops to 0 or below, he dies immediately.

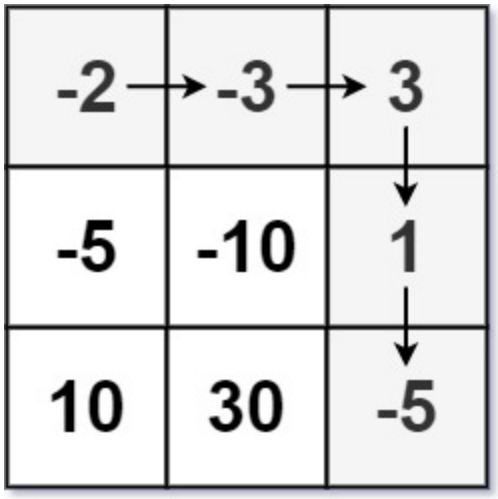
Some of the rooms are guarded by demons (represented by negative integers), so the knight loses health upon entering these rooms; other rooms are either empty (represented as 0) or contain magic orbs that increase the knight's health (represented by positive integers).

To reach the princess as quickly as possible, the knight decides to move only rightward or downward in each step.

Return the knight's minimum initial health so that he can rescue the princess.

Note that any room can contain threats or power-ups, even the first room the knight enters and the bottom-right room where the princess is imprisoned.

Example 1:




Input: dungeon = [[-2,-3,3],[-5,-10,1],[10,30,-5]]
Output: 7
Explanation: The initial health of the knight must be at least 7 if he follows the optimal path: RIGHT-> RIGHT -> DOWN -> DOWN.
Example 2:

Input: dungeon = [[0]]
Output: 1