BM2043 - Algorithms and Data Structures

Exercise - 6

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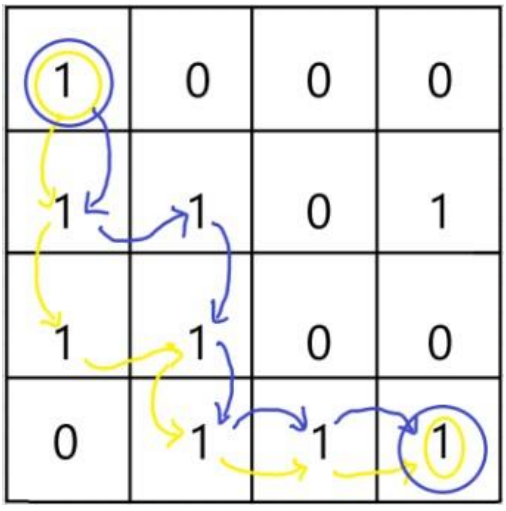
Write the most efficient algorithm for the following problems in C++ and mention the Time and Space Complexity of your algorithms in the comments (at the end).

Backtracking

1. **Consider a rat placed at (0, 0) in a square matrix of size mxn. It has to reach the destination at (m-1,n-1). Find all possible paths that the rat can take to reach from source to destination.The directions in which the rat can move are 'U'(up), 'D'(down), 'L' (left), 'R' (right). Value 0 at a cell in the matrix represents that it is blocked and the rat cannot move to it while value 1 at a cell in the matrix represents that rat can travel through it.**

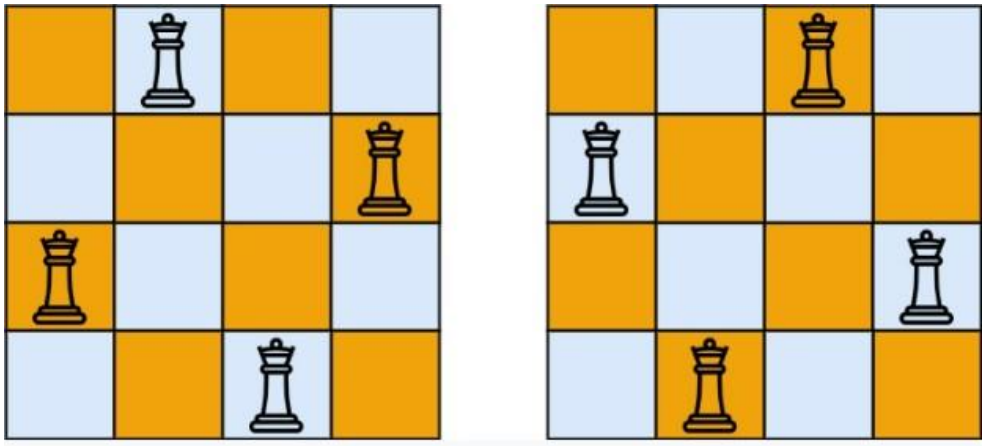
   Test Case:
   Input: m=4, n=4, Matrix = {{1, 0, 0, 0},{1, 1, 0, 1},{1, 1, 0, 0},{0, 1, 1, 1}}.

   Output: "DDRDRR", "DRDDRR".
   Explanation:



2. **The n-queens puzzle is the problem of placing `n` queens on an `n x n` chessboard such that no two queens attack each other. Given an integer `n`, return all distinct solutions to the n-queens puzzle. You may return the answer in any order. Each solution contains a distinct board configuration of the n-queens' placement, where 'Q' and '.' both indicate a queen and an empty space, respectively.**

Test Case:



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Input: n = 4
Output: [[".Q..","...Q","Q...","..Q."],
["..Q.","Q...","...Q",".Q.."]]
Explanation: There exist two distinct solutions to the 4-
queens puzzle as shown above
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3. **Given an integer array nums of unique elements, return all possible subsets (the power set). The solution set must not contain duplicate subsets. Return the** solution **in any order.**

   Test Case:

   Input: Nums = [1,2,3]

   Output: [[], [1], [2], [1,2], [3], [1,3], [2,3], [1,2,3]].

4. **You have been given a string s and asked to partition s such that all the substrings are palindromes. Return all possible palindrome partitions of s.**

   Test Case:

   Input: s = “aab”

   Output: [[“a”,”a”,”b”],[“aa”,”b”]