COMP 6481

Programming and Problem Solving

ATDC

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Problem Solving Approach

- **Analyze:** The most important aspect of problem solving approach is to spend time understanding the problem before writing any code
- **Test Cases:** Pen down all the test cases you can think of. Difficult to note down all scenarios that can create trouble (will always miss something)
- **Data Structure & Algorithms:** Choose which data structure and algorithm to use
- **Code:** Write code for all of the test cases. Might have to loop between T and C.

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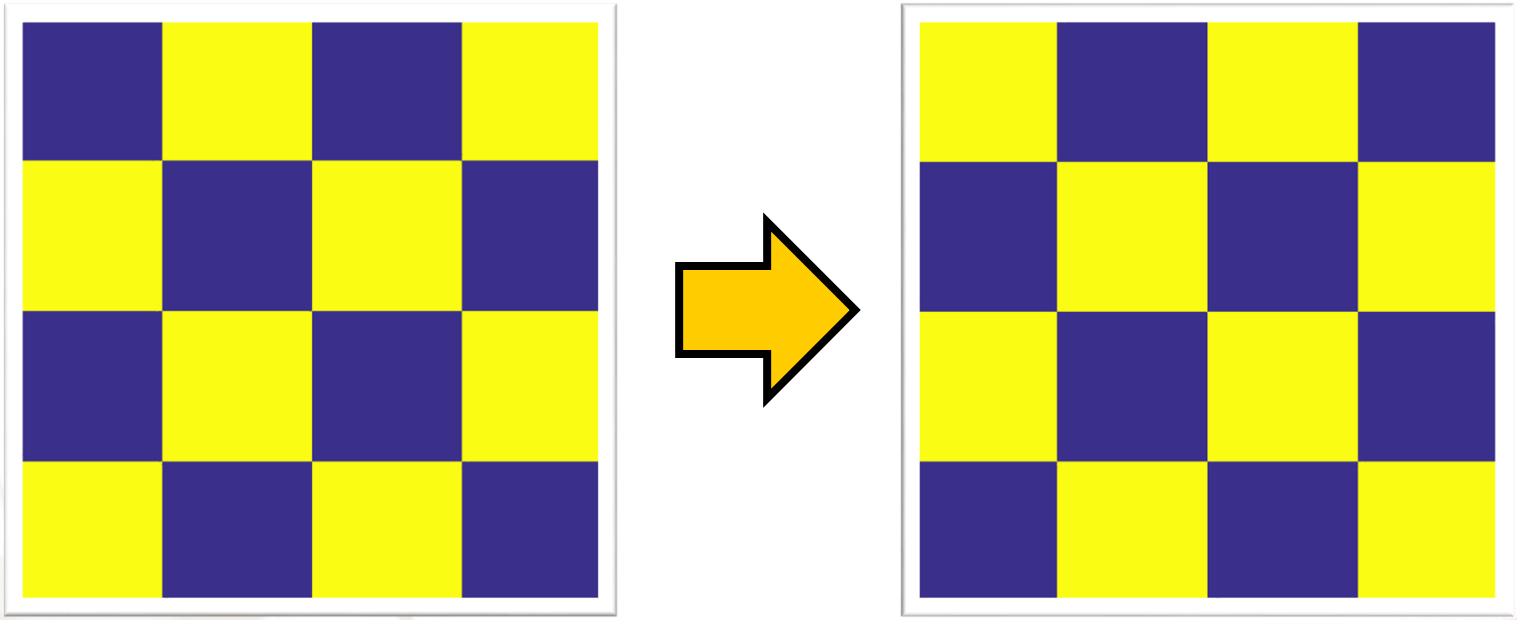
Problem Solving Approach

- **Problem Statement: Rotating a 2D image matrix by 90 degrees in clockwise direction.**



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Problem Solving Approach

- **Analyze: The most important aspect of problem solving approach is to spend time understanding the problem before writing any code**
- **The first thing to do is defining what is an input and what is an output**
  - **Input: 2D matrix or Array of arrays**
  - **Output: Rotated 2D matrix or array of arrays**
- **But what it actually means?**
- **How can we formulate it?**

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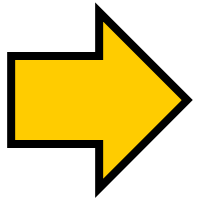
Problem Solving Approach

- **Analyze: Let's consider the matrix form of the image and rotate it by 90 degrees clockwise**

240	-120	240	-140
-120	1200	-2700	1680
240	-2700	6480	-4200
-140	1680	-4200	2800



-140	240	-120	240
1680	-2700	1200	-120
-4200	6480	-2700	240
2800	-4200	1680	-140

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Problem Solving Approach

- **Analyze: First formulate the rules/requirements**
  - **Matrix is an array of nested arrays (rows)**
  - **First row in input → Last column in output**
  - **Nested arrays have same lengths**
  - **Number of rows in Input = Number of columns in Output; Number of rows in Output equal to length of matrix array**
  - **Elements from last nested arrays becomes first elements of each nested output array**

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Problem Solving Approach

- **Data Structure & Algorithm: Data structure in this problem is an array of arrays**
  - **Create a result array with length equal to length of nested array length and fill it with empty arrays**
  - **Loop on input array to take nested arrays**
    - **take column elements of the current array and push it to row elements of the result**
    - **Process column-wise and output row-wise**
    - **…**

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Problem Solving Approach

- **Code: Write code for the algorithm**

```
function rotateImage(matrix)
{
      Declare result;
      for (int row = 0; row < matrix[0].length; row++) {
            result.push([]);
      }
     for (int i = matrix.length-1; i >= 0; i--)
    {
        for (int j = 0; j < matrix[i].length; j++)
        {
              result[j].push(matrix[i][j]);}}

    return result;
}
```

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Problem Solving Approach

- **Problem Statement: A bank of switches which are numbered 1 to n. Each switch controls exactly one light and all the lights are initially off. The lights are toggled iteratively as mentioned below.**
  - **In the first pass, toggle every light**
  - **In the second pass, toggle lights 2, 4, 6, …**
  - **In the third pass, toggle lights 3, 6, 9, …**
  - **Repeat the process until n passes**
  - **Output the lights which are ON at the end**