Review of Concepts

1. Matrix (2D Array)

A matrix is a two-dimensional array that consists of rows and columns. For example, an n-by-n matrix has n rows and n columns.

2. Interface and Implementation

In Java, an interface is a reference type, similar to a class, that can contain only constants, method signatures, default methods, static methods, and nested types. An interface cannot contain instance fields and is defined using the interface keyword.

In this task, you will define an interface called Summable which will have two methods: sumRow and sumColumn.

3. SecureRandom

java.security.SecureRandom is a class that provides a cryptographically strong random number generator (RNG). You will use the nextInt(int bound) method to generate random numbers to fill the matrix.

4. ArrayList

ArrayList is a resizable array, which can be found in the java.util package. It is used to store dynamically sized collections of elements. In this task, ArrayList is used to store indices of rows and columns with the highest sum.

5. Formatted Output

Formatted output can be achieved using System.out.printf or String.format in Java. These methods allow you to format the output in a specific way, such as ensuring that numbers are displayed with two digits.

Test 1 (Java OOP) Reference Test1_Instructions.txt

This task involves creating a Java program that generates a matrix of random integers, prints the matrix in a formatted manner, and finds the row(s) and column(s) with the highest sums. The program consists of a class Test1 implementing an interface Summable. Below is a detailed explanation of the requirements and concepts:

1. Matrix Generation and Population:

- **Matrix Size**: Prompt the user to enter the size of the matrix, n, which will create an n x n matrix.
- **Random Number Generation**: Use java.security.SecureRandom to generate random numbers to fill the matrix.

- **Formatted Output**: Print each element of the matrix as it is set using System.out.printf to ensure two-digit formatting.

2. Interface and Implementation:

- **Summable Interface**: Define an interface Summable with two methods:
    - int sumRow(int[] row): Takes a row of integers and returns the sum.
    - int sumColumn(int[][] matrix, int colIndex): Takes the whole matrix and an integer column index, and returns the sum of the elements in that column.
- **Test1 Class**: Implement the Summable interface, providing concrete implementations of the sumRow and sumColumn methods.

3. Finding Rows and Columns with the Highest Sum:

- **Sum Calculation**: Calculate the sum of each row and each column.
- **Track Indices**: Use ArrayList<Integer> to store the indices of the rows and columns with the highest sums.
- **Comparison Logic**: Compare sums to find and update the highest sum, clear and add new indices if a higher sum is found, or add indices if the sum is equal to the current highest.

4. Output:

- **Matrix Display**: Print the randomly generated matrix in a formatted manner.
- **Largest Row and Column Indices**: Print the indices of the rows and columns with the highest sums.

Criteria	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Unsatisfactory (1)**
Interface Definition	Correctly defines Summable with required methods.	Correctly defines Summable but minor errors present.	Defines Summable with significant errors.	Incomplete or incorrect interface definition.	Missing interface definition.
Class Implementation	Correctly implements Summable in Test1.	Implements Summable with minor issues.	Implements Summable but significant issues present.	Incomplete or incorrect implementation.	Missing class implementation.

Matrix Generation	Correctly generates and populates matrix with random numbers.	Generates matrix but minor issues with population.	Generates matrix but major issues with population.	Incorrect or incomplete matrix generation.	Missing matrix generation.
Formatted Output	Correctly prints matrix with two-digit formatting.	Prints matrix but formatting issues present.	Prints matrix with significant formatting issues.	Incorrect or incomplete formatted output.	Missing formatted output.
Sum Calculation (Rows and Columns)	Correctly calculates sums and finds highest indices.	Calculates sums but minor issues with indices.	Calculates sums but significant issues with indices.	Incorrect or incomplete sum calculation.	Missing sum calculation.
Use of ArrayList	Correctly uses ArrayList to store indices.	Uses ArrayList but minor issues present.	Uses ArrayList but significant issues present.	Incorrect or incomplete use of ArrayList.	Missing use of ArrayList.
Output of Largest Indices	Correctly prints largest row and column indices.	Prints largest indices but minor issues present.	Prints largest indices but significant issues present.	Incorrect or incomplete output of largest indices.	Missing output of largest indices.