```java
// Basics of Two Dimensional Arrays
// Arrays Initialization and Declaration Methods

import java.util.Scanner;

class TwoDAP_1 {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        // 2D Array Construction, Declaration and Initialization
        //First Method
        int a[][] = {{1,2,3},{4,5}};

        //Second Method
        // int b[][] = new int [row_size][column_size]

        // First Bracket used for row, second for Column
        int b[][] = new int[2][2];

        System.out.println("Array Printed Using For Loop: ");
        // For Loop for Printing Array Elements

        for (int i=0; i<a.length;i++){
            for (int j=0;j<a[i].length;j++){
                System.out.print(a[i][j]+" ");
            }
        }

        System.out.println("Array A Printed Using For Each Loop: ");
        // For each Loop for Printing Array Elements
        for (int[] x: a){
            for (int y: x){
                System.out.print(y + " ");
            }
            System.out.println();
        }

        // Loop to take User input of each element for Array b

        for (int i=0; i<b.length;i++){
            for (int j=0;j<b[i].length;j++){
                System.out.print("Enter element a[" + i+"]"+"[" + j+"]: ");
                b[i][j] = sc.nextInt();
            }
            System.out.println();
        }

        System.out.println("Array B Printed Using For Each Loop: ");
        // For each Loop for Printing Array Elements of b
        for (int[] x: b){
            for (int y: x){
                System.out.print(y + " ");
            }
            System.out.println();
        }
    }
}
```

```java
/*Write a program to read two 5*5 matrices from the user and store the addition of two
matrices in the resultant Matrix.
i.e C=A+B , where A,B,C each one is 5*5 matrix.*/

import java.util.Scanner;
public class TwoDAP_2 {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);

        int a[][] = new int[2][2];
        int b[][] = new int[2][2];
        int c[][] = new int[2][2];

        System.out.println("Enter Elements of Array a: ");
        // For loop for user input of each element of array 'a'

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                a[i][j] = sc.nextInt();
            }
        }

        System.out.println("Enter Elements of Array b: ");
        // For loop for user input of each element of array 'b'

        for (int i = 0; i < b.length; i++) {
            for (int j = 0; j < b[i].length; j++) {
                b[i][j] = sc.nextInt();
            }
        }

        System.out.print("Array a is: \n");
        // For loop for printing array elements of 'a'

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                System.out.print(a[i][j]+" ");
            }
            System.out.println();
        }

        System.out.print("Array b is: \n");
        // For loop for printing array elements of 'b'

        for (int i = 0; i < b.length; i++) {
            for (int j = 0; j < b[i].length; j++) {
                System.out.print(b[i][j]+" ");
            }
            System.out.println();
        }

        // For loop for Summation Process C = A + B;

        for (int i = 0; i<a.length;i++){
            for (int j=0;j<a[i].length;j++){
                c[i][j] = a[i][j] + b[i][j];
            }
        }
```

```java
        System.out.print("Array c = a+b is: \n");

        // For Loop for Printing final array C,

        for (int i = 0; i < c.length; i++) {
            for (int j = 0; j < c[i].length; j++) {
                System.out.print(c[i][j]+" ");
            }
            System.out.println();
        }
    }
}
```

```java
/* Write a program to read two matrix from the user and
store the multiplication of two matrix in the resultant matrix.
i.e. C = A * B
*/

import java.util.Scanner;

public class TwoDAP_3 {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter rows required for matrix a: ");
        int a_row = sc.nextInt();
        System.out.println("Enter columns required for matrix a: ");
        int a_col = sc.nextInt();
        System.out.println("Enter rows required for matrix b: ");
        int b_row = sc.nextInt();
        System.out.println("Enter columns required for matrix b: ");
        int b_col = sc.nextInt();


        // Construction and Declaration of Array a,b and c
        int a[][] = new int[a_row][a_col];
        int b[][] = new int[b_row][b_col];
        int c[][] = new int[a_row][b_col];

        if (a_row == b_col) {

            System.out.println("Enter Elements of Array a: ");
            // For loop for user input of each element of array 'a'

            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    a[i][j] = sc.nextInt();
                }
            }

            System.out.println("Enter Elements of Array b: ");
            // For loop for user input of each element of array 'b'

            for (int i = 0; i < b.length; i++) {
                for (int j = 0; j < b[i].length; j++) {
                    b[i][j] = sc.nextInt();
                }
            }

            System.out.print("Array a is: \n");
            // For loop for printing array elements of 'a'

            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    System.out.print(a[i][j] + " ");
                }
                System.out.println();
            }

            System.out.print("Array b is: \n");
            // For loop for printing array elements of 'b'

            for (int i = 0; i < b.length; i++) {
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```java
            for (int j = 0; j < b[i].length; j++) {
                System.out.print(b[i][j] + " ");
            }
            System.out.println();
        }

        // For Loop for Multiplication Process

        // Use condition of row_size of first array 'a'
        for (int i = 0; i < a_row; i++) {
            // Use condition of column_size of second array 'b'
            for (int j = 0; j < b_col; j++) {
                c[i][j] =0;
                // Use additional for loop for multiplication purpose
                for (int k = 0; k <a_col; k++)
                    // Multiplication Logic
                    c[i][j] = c[i][j] + a[i][k] * b[k][j];
            }
        }

        System.out.print("Array c = a*b is: \n");
        // For loop to print Final Array 'C'

            for (int i = 0; i < c.length; i++) {
                for (int j = 0; j < c[i].length; j++) {
                    System.out.print(c[i][j] + " ");
                }
                System.out.println();
            }
    }
    else{
        System.out.print("Multiplication Not Possible");
    }
  }
}
```

```java
/* Write a Program to find maximum element from 3*3 Matrices */

import java.util.Scanner;
public class TwoDAP_4 {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);

        // Construction and Declaration of Array a (3 x 3 Matrix)
        int a[][] = new int[3][3];

        System.out.println("Enter Elements of Array a: ");
        // For loop for user input of each element of array 'a'

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                a[i][j] = sc.nextInt();
            }
        }

        System.out.print("Array a is: \n");
        // For loop for printing array elements of 'a'

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                System.out.print(a[i][j] + " ");
            }
            System.out.println();
        }
        // Initialization of max using first element of array for comparison purpose
        int max = a[0][0];

        // For loop to get maximum element using conditional statements

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                if (a[i][j]>max){
                    max = a[i][j];
                }
            }
        }
        System.out.print("\nMax Element is: "+max);
    }
}
```

```java
/* Write a Program to find minimum element from 3*3 Matrices */

import java.util.Scanner;
public class TwoDAP_5 {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);

        // Construction and Declaration of Array a (3 x 3 Matrix)
        int a[][] = new int[3][3];

        System.out.println("Enter Elements of Array a: ");
        // For loop for user input of each element of array 'a'

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                a[i][j] = sc.nextInt();
            }
        }

        System.out.print("Array a is: \n");
        // For loop for printing array elements of 'a'

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                System.out.print(a[i][j] + " ");
            }
            System.out.println();
        }
        // Initialization of min using first element of array for comparison purpose
        int min = a[0][0];

        // For loop to get minimum element using conditional statements

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                if (a[i][j]<min){
                    min = a[i][j];
                }
            }
        }
        System.out.print("\nMin Element is: "+min);
    }
}
```

```java
/* Write a program to display transpose of given 3*3 matrix. */

import java.util.Scanner;
public class TwoDAP_6 {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);

        // Construction and Declaration of Array a and b (3 x 3 Matrix)
        int a[][] = new int[3][3];
        int b[][] = new int[3][3];

        System.out.println("Enter Elements of Array a: ");
        // For loop for user input of each element of array 'a'

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                a[i][j] = sc.nextInt();
            }
        }

        System.out.print("Array a is: \n");
        // For loop for printing array elements of 'a'

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                System.out.print(a[i][j] + " ");
            }
            System.out.println();
        }

        // Logic of Transpose using For Loop Written here

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                b[j][i] = a[i][j];
            }
        }

        System.out.print("Transpose of a is: \n");
        // For Loop to Print Transpose of Matrix

        for (int i = 0; i < b.length; i++) {
            for (int j = 0; j < b[i].length; j++) {
                System.out.print(b[i][j] + " ");
            }
            System.out.println();
        }
    }
}
```

```java
/*Write a program to count number of positive, negative and zero elements from 3 x 3 matrix
.*/

import java.util.Scanner;
public class TwoDAP_7 {
    public static void main(String args[]) {
        Scanner sc = new Scanner(System.in);

        int a[][] = new int[3][3];

        System.out.println("Enter Elements of Array a: ");

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                a[i][j] = sc.nextInt();
            }
        }

        System.out.print("Array a is: \n");

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                System.out.print(a[i][j] + " ");
            }
            System.out.println();
        }

        int count_p = 0;
        int count_n = 0;
        int count_z = 0;

        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                if (a[i][j] > 0)
                    count_p++;
                else if (a[i][j] == 0)
                    count_z++;
                else
                    count_n++;
            }
        }

        System.out.println("Total Positive Elements are: " + count_p);
        System.out.println("Total Negative Elements are: " + count_n);
        System.out.println("Total Zero Elements are: " + count_z);
    }
}
```

```java
/* WAP to check if entered matrix is Symmetric matrix or not. */

import java.util.Scanner;
public class TwoDAP_8 {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter No. of Rows: ");
        int row = sc.nextInt();
        System.out.println("Enter No. of Columns: ");
        int col = sc.nextInt();

        if (row == col) {

            int a[][] = new int[row][col];
            int b[][] = new int[col][row];

            // Loop to take elements as user input
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    System.out.println("Enter element a[" + i + "][" + j + "]: ");
                    a[i][j] = sc.nextInt();
                }
            }

            // Loop to print Array 'a'
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    System.out.print(a[i][j]);
                }
                System.out.println();
            }

            // Loop to find transpose of matrix
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    b[j][i] = a[i][j];
                }
            }

            // Loop to print Array 'b'
            for (int i = 0; i < b.length; i++) {
                for (int j = 0; j < b[i].length; j++) {
                    System.out.print(b[i][j]);
                }
                System.out.println();
            }

            // Loop to check Symmetric Matrix
            boolean check = true;
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    if (a[i][j]!=b[i][j]){
                        check = false;
                        break;
                    }
                }
            }
            if (check){
                System.out.println("Symmetric matrix");
```

```java
            }
            else{
                System.out.println("Not Symmetric matrix");
            }
        }
        else{
            System.out.println("Entered matrix is not Square matrix");
        }
    }
}
```

```java
import java.util.Scanner;

// WAP to check if entered matrix is Identity Matrix or not.
public class TwoDAP_9 {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter No. of Rows: ");
        int row = sc.nextInt();
        System.out.println("Enter No. of Columns: ");
        int col = sc.nextInt();

        if (row == col) {

            int a[][] = new int[row][col];

            // Loop to take elements as user input
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    System.out.println("Enter element a[" + i + "][" + j + "]: ");
                    a[i][j] = sc.nextInt();
                }
            }

            // Loop to print Array 'a'
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    System.out.print(a[i][j]);
                }
                System.out.println();
            }

            // Loop to check Identity matrix
            // Check if diagonal elements are equal to '1' and rest elements are '0'
            boolean check = true;
            for(int i=0;i<a.length;i++){
                for(int j=0;j<a[i].length;j++){
                    if (i==j && a[i][j]!=1){
                        check = false;
                        break;
                    }
                    if (i!=j && a[i][j]!=0){
                        check = false;
                        break;
                    }
                }
            }
            if (check){
                System.out.println("Given matrix is Identity Matrix");
            }
            else{
                System.out.println("Given matrix is not an Identity Matrix");
            }


        }
        else{
            System.out.println("Entered matrix is not square matrix");
        }
    }
}
```

```
}
```

```
}
```

```java
// WAP to create Upper Triangular Matrix from given matrix.
import java.util.Scanner;

public class TwoDAP_10 {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter No. of Rows: ");
        int row = sc.nextInt();
        System.out.println("Enter No. of Columns: ");
        int col = sc.nextInt();

        if (row == col) {

            int a[][] = new int[row][col];

            // Loop to take elements as user input
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    System.out.println("Enter element a[" + i + "][" + j + "]: ");
                    a[i][j] = sc.nextInt();
                }
            }

            System.out.println("Matrix A is: ");
            // Loop to print Array 'a'
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    System.out.print(a[i][j]);
                }
                System.out.println();
            }

            System.out.println("Upper Triangular Matrix is: ");
            // Loop to create Upper Triangular Matrix
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    if (i>j){
                        System.out.print("0 ");
                    }
                    else{
                        System.out.print(a[i][j]+" ");
                    }
                }
                System.out.println();
            }
        }
        else{
            System.out.println("Entered matrix is not Square Matrix");
        }
    }
}
```

```java
// WAP to create Lower Triangular Matrix from given matrix.
import java.util.Scanner;

public class TwoDAP_11 {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter No. of Rows: ");
        int row = sc.nextInt();
        System.out.println("Enter No. of Columns: ");
        int col = sc.nextInt();

        if (row == col) {

            int a[][] = new int[row][col];

            // Loop to take elements as user input
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    System.out.println("Enter element a[" + i + "][" + j + "]: ");
                    a[i][j] = sc.nextInt();
                }
            }

            System.out.println("Matrix A is: ");
            // Loop to print Array 'a'
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    System.out.print(a[i][j]);
                }
                System.out.println();
            }

            System.out.println("Lower Triangular Matrix is: ");
            // Loop to create Lower Triangular Matrix
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    if (i<j){
                        System.out.print("0 ");
                    }
                    else{
                        System.out.print(a[i][j]+" ");
                    }
                }
                System.out.println();
            }
        }
        else{
            System.out.println("Entered matrix is not Square Matrix");
        }
    }
}
```

```java
// WAP to find Row Sum and Column Sum from given matrix.
import java.util.Scanner;

public class TwoDAP_12 {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter No. of Rows: ");
        int row = sc.nextInt();
        System.out.println("Enter No. of Columns: ");
        int col = sc.nextInt();

            int a[][] = new int[row][col];

            // Loop to take elements as user input
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    System.out.println("Enter element a[" + i + "][" + j + "]: ");
                    a[i][j] = sc.nextInt();
                }
            }

            System.out.println("Matrix A is: ");
            // Loop to print Array 'a'
            for (int i = 0; i < a.length; i++) {
                for (int j = 0; j < a[i].length; j++) {
                    System.out.print(a[i][j]);
                }
                System.out.println();
            }

            // Loop to find sum of each row of given matrix
            for (int i = 0; i < row; i++) {
                int rowsum = 0;
                for (int j = 0; j < col; j++) {
                    rowsum += a[i][j];
                }
                System.out.println("Sum of row "+(i+1) + ": "+rowsum);
            }

        // Loop to find sum of each column of given matrix
        for (int i = 0; i < col; i++) {
            int colsum = 0;
            for (int j = 0; j < row; j++) {
                colsum += a[j][i];
            }
            System.out.println("Sum of column "+(i+1) +": "+colsum);
        }
    }
}
```

```java
// WAP to find and display sum of upper and lower triangular matrix.

import java.util.Scanner;

public class TwoDAP_13 {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.println("Enter No. of Rows: ");
        int row = sc.nextInt();
        System.out.println("Enter No. of Columns: ");
        int col = sc.nextInt();

        int a[][] = new int[row][col];

        // Loop to take elements as user input
        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                System.out.println("Enter element a[" + i + "][" + j + "]: ");
                a[i][j] = sc.nextInt();
            }
        }

        System.out.println("Matrix A is: ");
        // Loop to print Array 'a'
        for (int i = 0; i < a.length; i++) {
            for (int j = 0; j < a[i].length; j++) {
                System.out.print(a[i][j]);
            }
            System.out.println();
        }

        int upper_sum = 0;
        int lower_sum = 0;

        // Calculate sum of upper triangular matrix
        for (int i=0;i<row;i++){
            for (int j=0;j<col;j++){
                if (i<=j){
                    upper_sum += a[i][j];
                }
            }
        }
        System.out.println("Upper triagle sum is: "+upper_sum);

        // Calculate sum of lower triangular matrix
        for (int i=0;i<row;i++){
            for (int j=0;j<col;j++){
                if (i>=j){
                    lower_sum += a[i][j];
                }
            }
        }
        System.out.println("Lower triagle sum is: "+lower_sum);
    }
}
```