Code : 1

```
package Topic_05_2D_Arrays;

import java.util.Scanner;

public class A_2d_Arrays_Demo {

	public static void main(String[] args) {
		Scanner s = new Scanner(System.in);
		int n1 = s.nextInt();
		int n2 = s.nextInt();
		int[][] a = new int[n1][n2];
		for (int i = 0; i < a.length; i++) {
			for (int j = 0; j < a[0].length; j++) {
				a[i][j] = s.nextInt();
			}
		}
		display2dArray(a);
	}

	private static void display2dArray(int[][] a) {
		for (int i = 0; i < a.length; i++) {
			for (int j = 0; j < a[0].length; j++) {
				System.out.print(a[i][j] + " ");
			}
			System.out.println();
		}

	}

}
```

Code : 2

```
package Topic_05_2D_Arrays;

import java.util.*;

public class B_Matrix_Multiplication {
	public static void main(String[] args) {
		Scanner scn = new Scanner(System.in);
		/* Matrix 1 Input */
		int r1 = scn.nextInt();
		int c1 = scn.nextInt();
		int[][] a = new int[r1][c1];
		for (int i = 0; i < a.length; i++) {
			for (int j = 0; j < a[0].length; j++) {
				a[i][j] = scn.nextInt();
			}
		}
		/* Matrix 2 Input */
		int r2 = scn.nextInt();
		int c2 = scn.nextInt();
		int[][] b = new int[r2][c2];
		for (int i = 0; i < b.length; i++) {
			for (int j = 0; j < b[0].length; j++) {
				b[i][j] = scn.nextInt();
			}
		}

		if (c1 != r2) {
			System.out.println("Invalid input");
			return;
		}

		int[][] prd = new int[r1][c2];
		for (int i = 0; i < prd.length; i++) {
			for (int j = 0; j < prd[0].length; j++) {
				for (int k = 0; k < c1; k++) {
					prd[i][j] += a[i][k] * b[k][j];
				}
			}
		}
		display2dArray(prd);
	}

	private static void display2dArray(int[][] a) {
		for (int i = 0; i < a.length; i++) {
			for (int j = 0; j < a[0].length; j++) {
				System.out.print(a[i][j] + " ");
			}
			System.out.println();
		}

	}

}
```

Code : 3

```
package Topic_05_2D_Arrays;

import java.util.Scanner;

public class C_StateOfWakanda_1 {

	public static void main(String[] args) {
		/* Matrix 1 Input */
		int a[][] = takeInput();
		for (int i = 0; i < a[0].length; i++) {
			if (i % 2 == 0) {
				for (int j = 0; j < a.length; j++) {
					System.out.println(a[j][i]);
				}
			} else {
				for (int j = a.length - 1; j >= 0; j--) {
					System.out.println(a[j][i]);
				}
			}
		}
	}

	private static int[][] takeInput() {
		Scanner scn = new Scanner(System.in);
		int r1 = scn.nextInt();
		int c1 = scn.nextInt();
		int[][] a = new int[r1][c1];
		for (int i = 0; i < a.length; i++) {
			for (int j = 0; j < a[0].length; j++) {
				a[i][j] = scn.nextInt();
			}
		}
		return a;
	}

}
```

Code : 4

```
package Topic_05_2D_Arrays;

import java.util.Scanner;

public class D_Spiral_Matrix {

	public static void main(String[] args) {
		// TODO Auto-generated method stub
		int[][] a = takeInput();
		int minr = 0, minc = 0, maxr = a.length - 1, maxc = a[0].length - 1;
		int totalCount = a.length * a[0].length;
		int count = 0;
		while (count != totalCount) {
			for (int i = minr, j = minc; i <= maxr && count != totalCount; i++) {
				print(a[i][j]);
				count++;
			}
			minc++;
			for (int i = maxr, j = minc; j <= maxc && count != totalCount; j++) {
				print(a[i][j]);
				count++;
			}
			maxr--;
			for (int i = maxr, j = maxc; i >= minr && count != totalCount; i--) {
				print(a[i][j]);
				count++;
			}
			maxc--;
			for (int i = minr, j = maxc; j >= minc && count != totalCount; j--) {
				print(a[i][j]);
				count++;
			}
			minr++;
		}
	}

	private static void print(int i) {
		// TODO Auto-generated method stub
		System.out.println(i);
	}

	private static int[][] takeInput() {
		Scanner scn = new Scanner(System.in);
		int r1 = scn.nextInt();
		int c1 = scn.nextInt();
		int[][] a = new int[r1][c1];
		for (int i = 0; i < a.length; i++) {
			for (int j = 0; j < a[0].length; j++) {
				a[i][j] = scn.nextInt();
			}
		}
		return a;
	}

}
```

Code : 5

```
package Topic_05_2D_Arrays;

import java.util.Scanner;

public class E_ExitPointOfMatrix {
	public static void main(String[] args) {
		int[][] a = takeInput();
		int dir = 0;
		int i = 0, j = 0;
		while (true) {
			dir = (dir + a[i][j]) % 4;
			if (dir == 0) {
				j++;
			} else if (dir == 1) {
				i++;
			} else if (dir == 2) {
				j--;
			} else if (dir == 3) {
				i--;
			}
			if (i < 0) {
				i++;
				break;
			} else if (j < 0) {
				j++;
				break;
			} else if (i == a.length) {
				i--;
				break;
			} else if (j == a[0].length) {
				j--;
				break;
			}
		}
		System.out.println(i);
		System.out.println(j);
	}

	private static int[][] takeInput() {
		Scanner scn = new Scanner(System.in);
		int r1 = scn.nextInt();
		int c1 = scn.nextInt();
		int[][] a = new int[r1][c1];
		for (int i = 0; i < a.length; i++) {
			for (int j = 0; j < a[0].length; j++) {
				a[i][j] = scn.nextInt();
			}
		}
		return a;
	}
}
```

Code : 6

```
package Topic_05_2D_Arrays;

import java.util.Scanner;

public class F_RotateBy90Degree {

	public static void main(String[] args) throws Exception {
		// write your code here
		int[][] a = takeInput();
		for (int i = 0; i < a.length; i++) {
			for (int j = i; j < a[0].length; j++) {
				int temp = a[i][j];
				a[i][j] = a[j][i];
				a[j][i] = temp;
			}
		}
		for (int i = 0; i < a.length; i++) {
			int li = 0;
			int ri = a[0].length - 1;
			while (li < ri) {
				int temp = a[i][li];
				a[i][li] = a[i][ri];
				a[i][ri] = temp;
				li++;
				ri--;
			}
		}
		display(a);
	}

	public static void display(int[][] arr) {
		for (int i = 0; i < arr.length; i++) {
			for (int j = 0; j < arr[0].length; j++) {
				System.out.print(arr[i][j] + " ");
			}
			System.out.println();
		}
	}

	private static int[][] takeInput() {
		Scanner scn = new Scanner(System.in);
		int r1 = scn.nextInt();
//		int c1 = scn.nextInt();
		int[][] a = new int[r1][r1];
		for (int i = 0; i < a.length; i++) {
			for (int j = 0; j < a[0].length; j++) {
				a[i][j] = scn.nextInt();
			}
		}
		return a;
	}
}
```

Code : 7

```
package Topic_05_2D_Arrays;

import java.util.Scanner;

public class G_RingRotate {

	public static void main(String[] args) throws Exception {
		Scanner sc = new Scanner(System.in);
		int n = sc.nextInt();
		int m = sc.nextInt();

		int[][] arr = new int[n][m];
		for (int i = 0; i < arr.length; i++) {
			for (int j = 0; j < arr[0].length; j++) {
				arr[i][j] = sc.nextInt();
			}
		}
		// Which shell to rotate?
		int s = sc.nextInt();
		// How many time?
		int r = sc.nextInt();
		rotateShell(arr, s, r);
		display(arr);
		sc.close();
	}

	public static void rotateShell(int[][] arr, int s, int r) {
		// Extract OneD Array
		int[] oned = fillOnedFromShell(arr, s);
		rotate(oned, r);
		fillShellFromOned(arr, s, oned);
	}

	public static int[] fillOnedFromShell(int[][] arr, int s) {
		// if Shell = 3, then Box TopLeft = S-1, S-1, Box BottomDown = arr.length-S
		int minRow = s - 1;
		int minCol = s - 1;
		int maxRow = arr.length - s;
		int maxCol = arr[0].length - s;
		// corners are getting repetitive so -4
		// leftWall + bottomWall + rightWall + topWall
		// int size = (2 * (maxRow - minRow + 1)) + (2 * (maxCol - minCol + 1)) - 4;
		int size = 2 * (maxRow - minRow + maxCol - minCol);
		int[] oned = new int[size];

		// leftWall
		int idx = 0;
		for (int i = minRow, j = minCol; i <= maxRow; i++) {
			oned[idx] = arr[i][j];
			idx++;
		}
		// bottomWall
		for (int i = maxRow, j = minCol + 1; j <= maxCol; j++) {
			oned[idx] = arr[i][j];
			idx++;
```

```
        }
        // rightWall
        for (int i = maxRow - 1, j = maxCol; i >= minRow; i--) {
                oned[idx] = arr[i][j];
                idx++;
        }
        // topWall
        for (int i = minRow, j = maxCol - 1; j >= minCol + 1; j--) {
                oned[idx] = arr[i][j];
                idx++;
        }
        return oned;
}

public static void rotate(int[] oned, int r) {
        r = r % oned.length;
        if (r < 0)
                r += oned.length;
        reverse(oned, 0, oned.length - r - 1);
        reverse(oned, oned.length - r, oned.length - 1);
        reverse(oned, 0, oned.length - 1);
}

public static void reverse(int[] oned, int li, int ri) {
        while (li < ri) {
                int temp = oned[li];
                oned[li] = oned[ri];
                oned[ri] = temp;
                li++;
                ri--;
        }
}

public static void fillShellFromOned(int[][] arr, int s, int[] oned) {
        // if Shell = 3, then Box TopLeft = S-1, S-1, Box BottomDown = arr.length-S
        int minRow = s - 1;
        int minCol = s - 1;
        int maxRow = arr.length - s;
        int maxCol = arr[0].length - s;

        // leftWall
        int idx = 0;
        for (int i = minRow, j = minCol; i <= maxRow; i++) {
                arr[i][j] = oned[idx];
                idx++;
        }
        // bottomWall
        for (int i = maxRow, j = minCol + 1; j <= maxCol; j++) {
                arr[i][j] = oned[idx];
                idx++;
        }
        // rightWall
        for (int i = maxRow - 1, j = maxCol; i >= minRow; i--) {
                arr[i][j] = oned[idx];
                idx++;
        }
```

```
		// topWall
		for (int i = minRow, j = maxCol - 1; j >= minCol + 1; j--) {
			arr[i][j] = oned[idx];
			idx++;
		}
	}

	public static void display(int[][] arr) {
		for (int i = 0; i < arr.length; i++) {
			for (int j = 0; j < arr[0].length; j++) {
				System.out.print(arr[i][j] + " ");
			}
			System.out.println();
		}
	}
}
```

Code : 8

```
package Topic_05_2D_Arrays;

import java.util.Scanner;

public class H_StateOfWakanda_2 {

	public static void main(String[] args) {
		/* Matrix 1 Input */
		int a[][] = takeInput();
		for (int g = 0; g < a.length; g++) {
			for (int i = 0, j = g; j < a.length; i++, j++) {
				System.out.println(a[i][j]);
			}
		}
	}

	private static int[][] takeInput() {
		Scanner scn = new Scanner(System.in);
		int r1 = scn.nextInt();
		//			int c1 = scn.nextInt();
		int[][] a = new int[r1][r1];
		for (int i = 0; i < a.length; i++) {
			for (int j = 0; j < a[0].length; j++) {
				a[i][j] = scn.nextInt();
			}
		}
		return a;
	}

}
```

Code : 9

```
package Topic_05_2D_Arrays;

import java.util.Scanner;

public class I_SaddlePrice {
	public static void main(String[] args) throws Exception {
		// write your code here

		Scanner sc = new Scanner(System.in);
		int n = sc.nextInt();
		int ar[][] = new int[n][n];
		for (int i = 0; i < ar.length; i++) {
			for (int j = 0; j < ar[0].length; j++) {
				ar[i][j] = sc.nextInt();
			}
		}

		//traversing row by row and finding the least element column index and then checking in that
		//column if there is any element greater than this or not.

		for (int i = 0; i < ar.length; i++) {

			int lci = 0;
			for (int j = 1; j < ar[0].length; j++) {
				if (ar[i][j] < ar[i][lci]) {
					lci = j;
				}
			}

			boolean flag = true;
			for (int k = 0; k < ar.length; k++) {

				if (ar[k][lci] > ar[i][lci]) {
					flag = false;
					break;
				}

			}
			if (flag == true) {
				System.out.println(ar[i][lci]);
				return;
			}

		}

		System.out.println("Invalid input");

	}

}
```

Code : 10

```
package Topic_05_2D_Arrays;

import java.util.Scanner;

public class J_SearchInASorted2dArray {
   public static void main(String[] args) throws Exception {
      // write your code here
      Scanner sc = new Scanner(System.in);
      int n = sc.nextInt();
      int ar[][] = new int[n][n];
      for (int i = 0; i < ar.length; i++) {
         for (int j = 0; j < ar[0].length; j++) {
            ar[i][j] = sc.nextInt();
         }
      }

      int x = sc.nextInt();

      int a = 0;
      int b = ar[0].length - 1;

      while (a < ar.length && b >= 0) {

         if (ar[a][b] == x) {
            System.out.println(a);
            System.out.println(b);
            return;

         } else if (ar[a][b] > x) {
            b--;
         } else {
            a++;
         }

      }
      System.out.println("Not Found");
   }
}
```

Code : 11

```
package Topic_05_2D_Arrays;

import java.util.Scanner;

public class L_Fibonacci_DP {

	public static void main(String[] args) throws Exception {
		// write your code here
		Scanner sc = new Scanner(System.in);
		int n = sc.nextInt();

		// System.out.println(fib(n));
		System.out.println(fiboMemorize(n, new int[n + 1]));
	}

	public static int fib(int n) {
		if (n <= 1) {
			return n;
		}
		return fib(n - 1) + fib(n - 2);
	}

	public static int fiboMemorize(int n, int dp[]) {

		if (n == 0 || n == 1) {
			return n;
		}
		if (dp[n] != 0) {
			return dp[n];
		}

		int ans = fiboMemorize(n - 1, dp) + fiboMemorize(n - 2, dp);
		dp[n] = ans;
		return ans;

	}

}
```