**Assignment – 2**

**Q1. Write a java program that will create a one-dimensional array of integer and display the elements of the array.**

import java.util.Scanner;  
class Main {  
 public static void main(String[] args) {  
 Scanner sc = new Scanner(System.*in*);  
 System.*out*.print("Enter the size of the array: ");  
 int n = sc.nextInt();  
 int[] array = new int[n];  
 System.*out*.print("Enter the array elements: ");  
  
 for (int i = 0; i < n; i++) {  
 array[i] = sc.nextInt();  
 }  
 System.*out*.print("The array elements are: ");  
  
 for (int element : array) {  
 System.*out*.print(element + " ");  
 }  
 System.*out*.println();  
 }  
}

**Output:**

Enter the size of the array: 5  
Enter the array elements: 1 2 3 4 5  
The array elements are: 1 2 3 4 5

**Q2. Write a java program that to perform linear search.**

import java.util.Scanner;  
class Main {  
 public static void main(String[] args) {  
 Scanner sc = new Scanner(System.*in*);  
 System.*out*.print("Enter the size of the array: ");  
 int n = sc.nextInt();  
 int[] array = new int[n];  
 System.*out*.print("Enter the array elements: ");

for (int i = 0; i < n; i++) {  
 array[i] = sc.nextInt();  
 }  
 System.*out*.print("Enter the element to search: ");  
 int key = sc.nextInt();  
  
 for (int i = 0; i < n; i++) {  
 if (array[i] == key) {  
 System.*out*.println(key + " was found at index " + i);  
 return;  
 }  
 }  
 System.*out*.println(key + " was not found in the array");  
 }  
}

**Output:**

Enter the size of the array: 5  
Enter the array elements: 1 2 3 4 5  
Enter the element to search: 3  
3 was found at index 2

**Q3.** **Write a java program that to perform binary search.**

import java.util.Scanner;  
class Main {  
 public static void main(String[] args) {  
 Scanner sc = new Scanner(System.*in*);  
 System.*out*.print("Enter the size of the array: ");  
 int n = sc.nextInt();  
 int[] array = new int[n];  
 System.*out*.print("Enter the array elements: ");  
  
 for (int i = 0; i < n; i++) {  
 array[i] = sc.nextInt();  
 }  
 System.*out*.print("Enter the element to search in the array: ");  
 int key = sc.nextInt();  
 int low = 0, high = n - 1;  
  
 while (low <= high) {  
 int mid = (low + high) / 2;  
  
 if (array[mid] > key) {  
 high = mid - 1;  
 } else if (array[mid] < key) {  
 low = mid + 1;  
 } else {  
 System.*out*.println(key + " was found at index " + mid);  
 return;  
 }  
 }  
 System.*out*.println(key + " was not found in the array");  
 }  
}

**Output:**

Enter the size of the array: 5  
Enter the array elements: 1 2 3 4 5  
Enter the element to search: 3  
3 was found at index 2

**Q4** **Write a java program that will perform scalar product of two vectors.**

import java.util.Scanner;  
class Main {  
 public static void main(String[] args) {  
 int[] vec1 = *createArray*("first vector");  
 int[] vec2 = *createArray*("second vector");  
 int res = *scalarProduct*(vec1, vec2);  
 System.*out*.println("The scalar product of the two vectors is " + res);  
 }  
  
 private static int scalarProduct(int[] vec1, int[] vec2) {  
 if (vec1.length != vec2.length) {  
 System.*out*.println("Cannot determine the scalar product of different dimension of vectors");  
 System.*exit*(0);  
 }  
 int res = 0;  
  
 for (int i = 0; i < vec1.length; i++) {  
 res += vec1[i] \* vec2[i];  
 }  
 return res;  
 }  
  
 private static int[] createArray(String name) {  
 Scanner sc = new Scanner(System.*in*);  
 System.*out*.print("Enter the size of the " + name + ": ");  
 int n = sc.nextInt();  
 int[] array = new int[n];  
 System.*out*.print("Enter the " + name + " elements: ");  
  
 for (int i = 0; i < n; i++) {  
 array[i] = sc.nextInt();  
 }  
 return array;  
 }  
}

**Output:**

Enter the size of the first vector: 3  
Enter the first vector elements: 1 5 9  
Enter the size of the second vector: 3  
Enter the second vector elements: 7 5 3  
The scalar product of the two vectors is 59

**Q5. Write a java program that to perform multiplication of two matrix.**

import java.util.Scanner;  
class Main {  
 public static void main(String[] args) {  
 int[][] matrix1 = *createMatrix*("first matrix");  
 int[][] matrix2 = *createMatrix*("second matrix");  
  
 if (matrix1[0].length != matrix2.length) {  
 System.*out*.println("Invalid matrix dimensions for multiplication");  
 System.*exit*(0);  
 }  
 int[][] res = new int[matrix1.length][matrix2[0].length];  
  
 for (int k = 0; k < matrix1.length; k++) {  
 for (int i = 0; i < matrix2[0].length; i++) {  
 for (int j = 0; j < matrix1[0].length; j++) {  
 res[k][i] += matrix1[k][i] \* matrix2[j][i];  
 }  
 }  
 }  
 System.*out*.println("The resultant matrix elements are:");  
  
 for (int[] array : res) {  
 for (int element : array) {  
 System.*out*.print(element + " ");  
 }  
 System.*out*.println();  
 }  
 }  
  
 private static int[][] createMatrix(String name) {  
 Scanner sc = new Scanner(System.*in*);  
 System.*out*.print("Enter the dimensions of the " + name + ": ");  
 int row = sc.nextInt();  
 int col = sc.nextInt();  
 int[][] matrix = new int[row][col];  
 System.*out*.println("Enter the " + name + " elements:");  
  
 for (int i = 0; i < row; i++) {  
 for (int j = 0; j < col; j++) {  
 matrix[i][j] = sc.nextInt();  
 }  
 }  
 return matrix;  
 }  
}

**Output:**

Enter the dimensions of the first matrix: 3 3  
Enter the first matrix elements:  
1 2 3  
4 5 6  
7 8 9  
Enter the dimensions of the second matrix: 3 3  
Enter the second matrix elements:  
10 11 12  
13 14 15  
16 17 18  
The resultant matrix elements are:  
39 84 135  
156 210 270  
273 336 405

**Q6. Write a java program, that will read a matrix, identify if the matrix is symmetric or not.**

import java.util.Scanner;  
class Main {  
 public static void main(String[] args) {  
 Scanner sc = new Scanner(System.*in*);  
 System.*out*.print("Enter the dimensions of the matrix: ");  
 int row = sc.nextInt();  
 int col = sc.nextInt();  
 int[][] matrix = new int[row][col];  
 System.*out*.println("Enter the matrix elements:");  
  
 for (int i = 0; i < matrix.length; i++) {  
 for (int j = 0; j < matrix[0].length; j++) {  
 matrix[i][j] = sc.nextInt();  
 }  
 }  
 if (row == col) {  
 for (int i = 1; i < matrix.length; i++) {  
 for (int j = 0; j < i; j++) {  
 if (matrix[i][j] != matrix[j][i]) {  
 System.*out*.println("The matrix is not a symmetric matrix");  
 return;  
 }  
 }  
 }  
 }  
 System.*out*.println("The matrix is a symmetric matrix");  
 }  
}

**Output:**

Enter the dimensions of the matrix: 3 3  
Enter the matrix elements:  
1 2 4  
2 3 5  
4 5 6  
The matrix is a symmetric matrix

**Q7. Given a sorted array, remove the duplicate elements from the array.
Input: size of the array(n) and n numbers (the elements of the array).
You are supposed to output the size of the new array followed by the elements of the new array after removing duplicates.**

import java.util.Scanner;  
class Main {  
 public static void main(String[] args) {  
 Scanner sc = new Scanner(System.*in*);  
 System.*out*.print("Enter the size of the array: ");  
 int n = sc.nextInt();  
 int[] array = new int[n];  
 System.*out*.print("Enter the array elements: ");  
  
 for (int i = 0; i < n; i++) {  
 array[i] = sc.nextInt();  
 }  
 int i = 0;  
 for (int j = 0; j < n; j++) {  
 if (array[i] != array[j]) {  
 array[++i] = array[j];  
 }  
 }  
 int newSize = i + 1;  
 System.*out*.print("The array elements after removing duplicates are: ");  
  
 for (int j = 0; j < newSize; j++) {  
 System.*out*.print(array[j] + " ");  
 }  
 System.*out*.println();  
 }  
}

**Output:**

Enter the size of the array: 10  
Enter the array elements: 1 1 2 2 3 4 5 6 6 7  
The array elements after removing duplicates are: 1 2 3 4 5 6 7

**Q8. Given an array which contains both positive and negative numbers, find if there is a subarray (of size at-least one) with 0 sum. What is a subarray? Well, a subarray is a contiguous part of array. An array that is inside another array. For example, consider the array [1, 2, 3, 4], There are 10 non-empty sub-arrays. The sub-arrays are (1), (2), (3), (4), (1,2), (2,3), (3,4), (1,2,3), (2,3,4) and (1,2,3,4). In the first line, you are given an integer n (size of the array) as input. In the second line you are given n numbers (the elements of the array). You are supposed to output true in case there is a subarray (of size at-least one) with 0 sum else output false.**

import java.util.Scanner;  
class Main {  
 public static void main(String[] args) {  
 Scanner sc = new Scanner(System.*in*);  
 System.*out*.print("Enter the size of the array: ");  
 int n = sc.nextInt();  
 int[] array = new int[n];  
 System.*out*.print("Enter the array elements: ");  
  
 for (int i = 0; i < n; i++) {  
 array[i] = sc.nextInt();  
 }  
 int sum;  
  
 for (int i = 0; i < n; i++) {  
 sum = 0;  
  
 for (int j = i; j < n; j++) {  
 sum += array[j];  
  
 if (sum == 0) {  
 System.*out*.println(true);  
 return;  
 }  
 }  
 }  
 System.*out*.println(false);  
 }

**Output:**

Enter the size of the array: 5  
Enter the array elements: 1 2 -3 2 1  
true