Experiment Number : 04 **Date:**

ARRAYS

Aim:

To understand and implement array operations in Java.

PRE LAB EXERCISE

QUESTIONS

- ✓ What is an array?

An **array** is a collection of elements of the **same data type** stored in **contiguous memory locations** and accessed using a **single name with an index**.

- ✓ Why are arrays used?

Arrays are used to:

- Store **multiple values** of the same type under one name
- Reduce **code repetition**
- Enable **easy access** to elements using index values
- Improve **memory management** and program efficiency

- ✓ What is the difference between array and variable?

Variable	**Array**
Stores only **one value**	Stores **multiple values**
Holds a **single memory location**	Uses **multiple contiguous memory locations**
Accessed directly by name	Accessed using **index**

Variable	Array
Suitable for single data	Suitable for **large data set**

IN LAB EXERCISE

Objective:

To perform array operations using simple programs.

PROGRAMS:

1. Program to Read and Print Array Elements

Code:

```
import java.util.Scanner;
public class ReadPrintArray {
   public static void main(String[] args) {
      Scanner sc = new Scanner(System.in);
      int[] arr = new int[5];
      System.out.println("Enter 5 elements:");
      for(int i = 0; i < 5; i++)
         arr[i] = sc.nextInt();
      System.out.println("Array elements are:");
      for(int i = 0; i < 5; i++)
         System.out.print(arr[i] + " ");
   }
}
```

OUTPUT:

Input:
10 20 30 40 50

Output:

Array elements are:

10 20 30 40 50

```
Enter 5 elements:
10 20 30 40 50
Array elements are:
10 20 30 40 50
```

2. Program to Find Sum of Array Elements

Code:

```
import java.util.Scanner;
public class SumArray {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        int[] arr = new int[5];
        int sum = 0;
        System.out.println("Enter 5 elements:");
        for(int i = 0; i < 5; i++)
            arr[i] = sc.nextInt();
        for(int i = 0; i < 5; i++)
            sum += arr[i];
        System.out.println("Sum = " + sum);
    }
}
```

OUTPUT:

Input:
5 10 15 20 25

Output:

Sum = 75

```
Enter 5 elements:
5 10 15 20 25
Sum = 75
```

3. Program to Find Largest Element in an Array

Code:

```
import java.util.Scanner;
public class LargestElement {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        int[] arr = new int[5];
        System.out.println("Enter 5 elements:");
        for(int i = 0; i < 5; i++)
            arr[i] = sc.nextInt();
        int max = arr[0];
        for(int i = 1; i < 5; i++)
            if(arr[i] > max)
                max = arr[i];
        System.out.println("Largest element = " + max);
    }
}
```

OUTPUT:

Input:

12 45 23 9 30

Output:

Largest element = 45

```
Enter 5 elements:
12 45 23 9 30
Largest element = 45
```

4. Program to Reverse an Array

Code:

```
import java.util.Scanner;


public class ReverseArray {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        int[] arr = new int[5];
        System.out.println("Enter 5 elements:");
        for(int i = 0; i < 5; i++)
            arr[i] = sc.nextInt();
        System.out.println("Reversed array:");
        for(int i = 4; i >= 0; i--)
            System.out.print(arr[i] + " ");
    }
}
```

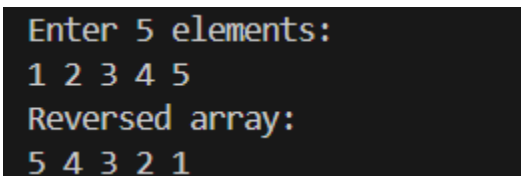
OUTPUT:

Input:
1 2 3 4 5

Output:

Reversed array:

5 4 3 2 1



5. Program to Count Even and Odd Numbers

Code:

```
import java.util.Scanner;
public class EvenOddCount {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        int[] arr = new int[5];
        int even = 0, odd = 0;
        System.out.println("Enter 5 elements:");
        for(int i = 0; i < 5; i++)
            arr[i] = sc.nextInt();
        for(int i = 0; i < 5; i++) {
            if(arr[i] % 2 == 0)
                even++;
            else
                odd++;
        }

        System.out.println("Even = " + even);
        System.out.println("Odd = " + odd);
    }
}
```

OUTPUT:

Input:
2 7 4 9 10

Output:

Even = 3

Odd = 2

```
Enter 5 elements:
2 7 4 9 10
Even = 3
Odd = 2
```

6. Program to Sort Array in Ascending Order

Code:

```
import java.util.Scanner;
public class SortArray {
   public static void main(String[] args) {
      Scanner sc = new Scanner(System.in);
      int[] arr = new int[5];
      int temp;
      System.out.println("Enter 5 elements:");
      for(int i = 0; i < 5; i++)
         arr[i] = sc.nextInt();
      for(int i = 0; i < 5; i++) {
         for(int j = i + 1; j < 5; j++) {
            if(arr[i] > arr[j]) {
               temp = arr[i];
               arr[i] = arr[j];
               arr[j] = temp;
            }
         }
      }
      System.out.println("Sorted array:");
      for(int i = 0; i < 5; i++)
         System.out.print(arr[i] + " ");
   }
```

}

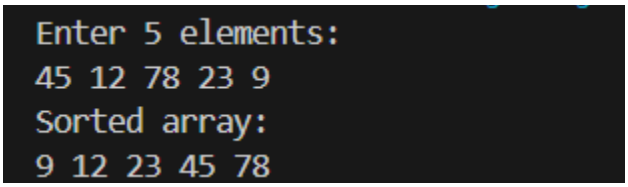
OUTPUT:

Input:
45 12 78 23 9

Output:

Sorted array:

9 12 23 45 78



7. Program to Find Second Largest Element

Code:

```
import java.util.Scanner;
public class SecondLargest {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        int[] arr = new int[5];

        System.out.println("Enter 5 elements:");
        for(int i = 0; i < 5; i++)
            arr[i] = sc.nextInt();
        int largest = arr[0];
        int second = arr[0];
        for(int i = 0; i < 5; i++) {
            if(arr[i] > largest) {
                second = largest;
                largest = arr[i];
```

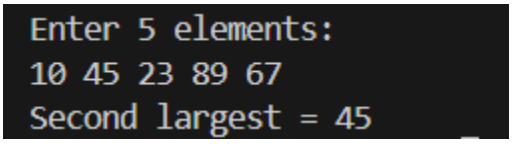
```
        }
      }
      System.out.println("Second largest = " + second);
   }
}
```

OUTPUT:

Input:
10 45 23 89 67

Output:

Second largest = 67



8. Program for Matrix Addition (2D Array)

Code:

```
import java.util.Scanner;
public class MatrixAddition {
   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[][] sum = new int[2][2];
      System.out.println("Enter elements of matrix A:");
      for(int i = 0; i < 2; i++)
         for(int j = 0; j < 2; j++)
            a[i][j] = sc.nextInt();
      System.out.println("Enter elements of matrix B:");
      for(int i = 0; i < 2; i++)
```

```
            for(int j = 0; j < 2; j++)
                b[i][j] = sc.nextInt();
        for(int i = 0; i < 2; i++)
            for(int j = 0; j < 2; j++)
                sum[i][j] = a[i][j] + b[i][j];
        System.out.println("Sum matrix:");
        for(int i = 0; i < 2; i++) {
            for(int j = 0; j < 2; j++)
                System.out.print(sum[i][j] + " ");
            System.out.println();
        }
    }
}
```

OUTPUT:

Matrix A:

1 2

3 4

Matrix B:

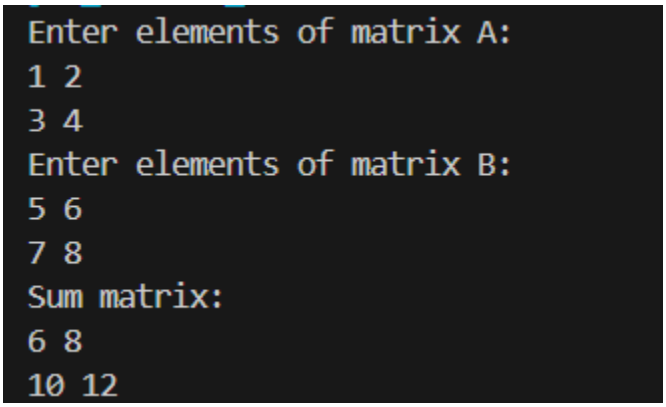
5 6

7 8

Sum matrix:

6 8

10 12



POST LAB EXERCISE

- ✓ Why is array indexing usually started from zero instead of one?

Array indexing starts from **zero** because the index represents the **offset from the base memory address**.

- The first element is at offset **0**, so it is accessed as index 0
- This makes address calculation faster and more efficient

- ✓ What happens if we try to access an array element outside its declared size?

Accessing an element outside the declared size leads to **undefined behavior**.

- It may cause **runtime errors**
- It can produce **garbage values**
- In some languages, it may cause **program crash**

- ✓ How does memory allocation differ for static arrays and dynamic arrays?

Static Array	**Dynamic Array**
Memory allocated at **compile time**	Memory allocated at **runtime**
Fixed size	Size can be **changed**
Stored in **stack memory**	Stored in **heap memory**
Faster access	Slightly slower due to runtime allocation

- ✓ Why is searching faster in arrays compared to linked lists?

Searching is faster in arrays because:

- Arrays support **direct access** using index
- Elements are stored in **contiguous memory**
- Binary search can be applied (if sorted)

In linked lists, traversal must start from the **first node**, making searching slower.

- ✓ What is the difference between contiguous and non-contiguous memory allocation?

Contiguous Memory Allocation	**Non-Contiguous Memory Allocation**
Memory locations are **adjacent**	Memory locations are **scattered**
Faster access	Slower access

Contiguous Memory Allocation	Non-Contiguous Memory Allocation
Used in **arrays**	Used in **linked lists**
Less flexible	More flexible

Result:

Thus the array operations were executed successfully.

ASSESSMENT

Description	Max Marks	Marks Awarded
Pre Lab Exercise	**5**	
In Lab Exercise	**10**	
Post Lab Exercise	**5**	
Viva	**10**	
Total	**30**	
Faculty Signature		