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 **similar data elements** stored in **contiguous (continuous) memory locations** under a **single name**.

✓ Why are arrays used?

Arrays are used because:

- They **store multiple values using one variable name**
- They **save memory and reduce complexity**
- They allow **easy access using index (position)**
- They are useful for **sorting, searching, and data processing**
- They help in **efficient program management**

✓ What is the difference between array and variable?

Variable	Array
Stores **only one value**	Stores **multiple values**
Uses **one memory location**	Uses **multiple contiguous memory locations**

Example: int x = 10;	Example: int a[5] = {1,2,3,4,5};
Simple to use	More powerful for handling data

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:

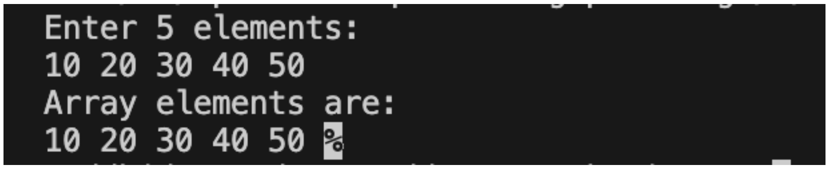
Input:

```
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:

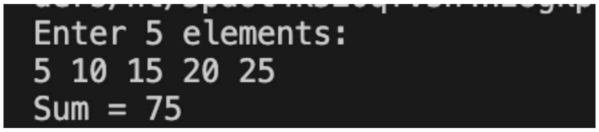
```
import java.util.Scanner;

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);
    }
}
```

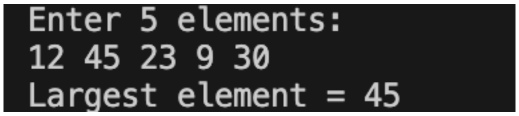
OUTPUT:

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] + " ");
    }
}
```

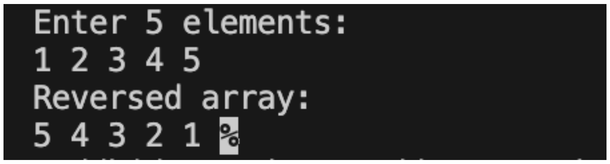
OUTPUT:

Input:
1 2 3 4 5

Output:

Reversed array:

5 4 3 2 1



```
Enter 5 elements:
1 2 3 4 5
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);
    }
}
```

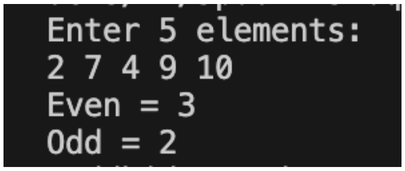
OUTPUT:

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] + " ");
    }
}
```

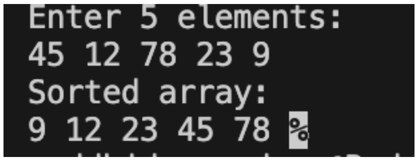
OUTPUT:

Input:
45 12 78 23 9

Output:

Sorted array:

9 12 23 45 78



```
Enter 5 elements:
45 12 78 23 9
Sorted array:
9 12 23 45 78 %
```

7. Program to Find Second Largest Element

Code:

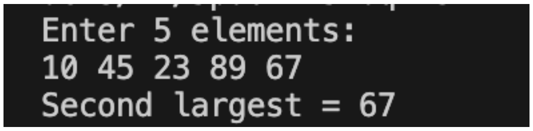
```
import java.util.Scanner;
public class SecondLargest {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        int[] arr = new int[5];

        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



```
Enter 5 elements:
10 45 23 89 67
Second largest = 67
```

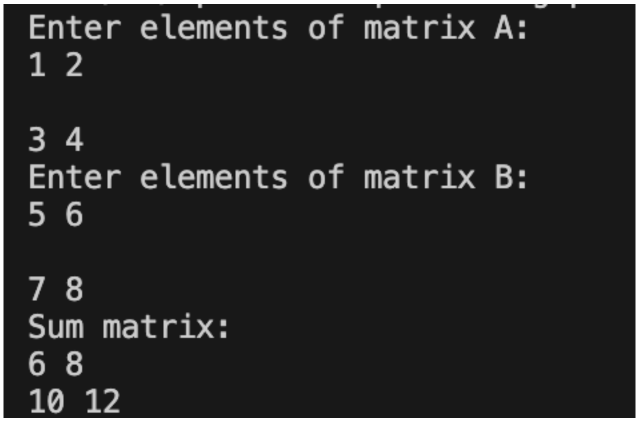
8. Program for Matrix Addition (2D Array)

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
```



```
Enter elements of matrix A:
1 2

3 4
Enter elements of 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 **0** because:

- The index represents the **offset (distance) from the first memory location**.
- The first element is at **0 distance** from the base address, so its index is 0.
- This makes **address calculation faster and simpler** for the computer.

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

It causes **Array Out of Bounds error** (or Undefined Behavior).

This may lead to:

- Program crash
- Garbage values
- Unexpected results
- Security issues

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

Static Array	Dynamic Array

Memory is allocated at **compile time**	Memory is allocated at **run time**
Size is **fixed**	Size can be **changed (flexible)**
Uses stack memory	Uses heap memory
Faster allocation	Slightly slower due to runtime management

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

Searching is faster in arrays because:

- Arrays store elements in **contiguous memory locations**
- We can access any element **directly using index (random access)**
- Linked lists require **sequential traversal from the first node**

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

Contiguous Memory	**Non-Contiguous Memory**
Memory locations are **continuous**	Memory locations are **scattered**
Used in **Arrays**	Used in **Linked Lists**
Faster access	Slower access

Fixed size Flexible size

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		