Software and Programming 1

Lab 7:
Exercises on Arrays
Array Exercises

Lab objectives:

- Understand how to pass and return an array as a parameter variable for a method.
- Use an array to solve problems in a program.

One Class (ArrayExercises) will be created with several methods that will be tested with calls from a main method.

- For some tasks you will need to make use of the Java Array Utility class by importing it into your class.

```java
import java.util.Arrays;
```

This utility class contains various methods for manipulating arrays (such as sorting and searching). This class also allows arrays to be viewed as lists and as strings.
Exercise 1

Class ArrayExercises

1. Implement a method (reverseArray) that returns the reverse of its array argument:
   For example, if you call it with 1 4 9 16 9, the method returns a new array with 9 16 9 4 1.
Class ArrayExercises (2)

• Method for first exercise

```
public static int[] reverseArray(int[] data)
```

Method `reverseArray` returns the reverse of the array `data`.

Type of return value
Name and type of parameter variable
Algorithm for the method `reverseArray` (in pseudo code)

1. Create an array variable, `reversedData`, using `new int[data.length]`.
2. Use a `for` loop to copy the values from `data` into `reversedData` in reverse order.
3. Return `reversedData`.

**Hint:** use `data.length` in the test condition to terminate the `for` loop such that the loop iterates from 0 up to `(data.length - 1)`. 
Class ArrayExercises (4)

• Testing the method:

To do this we need to create a main method that includes a call to the reverseArray method

- Make the following statement as the first line of your program

  ```java
  import java.util.Arrays;
  ```

- Read numeric inputs at the keyboard for the array elements.
- Use the method `Arrays.toString` to print out the array.

For example,

```java
int[] data = {1, 4, 9, 16, 9};
System.out.println(Arrays.toString(data)); // prints 1 4 9 16 9
```
Class ArrayExercises (5)

Input
Parameter variable, data →
{ 1  4  9  16  9 }

Example (in method main):
```java
int[] data = { 1, 4, 9, 16, 9 };
int[] dataR = reverseArray(data);
System.out.println("Reversed data: " + Arrays.toString(dataR));
```

Computation
Inside the method reverseArray:
for loop to reverse the data;
return the reversedData array.

Output
Reversed data:
[  9  16  9  4  1 ]
import java.util.Arrays;
import java.util.Scanner;

public class ArrayExercises {
    public static void main(String[] args) {
        final int SIZE = 5;
        int[] data = new int[SIZE];
        Scanner in = new Scanner(System.in);
        for (int i=0; i < data.length; i++) {
            System.out.print("Enter a number: ");
            data[i] = in.nextInt();
        }
        int[] dataR = reverseArray(data);  // call method reverseArray()
        System.out.println("Original array: " + Arrays.toString(data));
        /* Write a similar statement to print the reversed data from the array dataR */
    }
}

private static int[] reverseArray(int[] array) {
    int[] reversedArray = new int[array.length];
    for (int i = 0; i < array.length; i++) {
        reversedArray[i] = array[array.length - 1 - i];
    }
    return reversedArray;
}
Anatomy of method reverseArray

```java
public static int[] reverseArray(int[] data) {
    /* 1. Create an array variable, reversedData, using
        new int[data.length]. */
    /* 2. Use a for loop to copy the values from data into
        reversedData in reverse order.
        Hint:
        (i) use data.length in the test condition to
            terminate the for loop such that the loop iterates
            from 0 up to (data.length-1) using the index i.
        (ii) use reversedData[(data.length-1) - i] = data[i];
            to copy the data inside the for loop. */
    return reversedData;
}
} // end of class ArrayExercises
```
Exercises 2 and 3

2. Implement a method that reverses the sequence of elements in an array:

For example, if you call it with \[1 \ 4 \ 9 \ 16 \ 9\],
the array is changed to \[9 \ 16 \ 9 \ 4 \ 1\].

Note: this time you are storing the reversed values back into the array.

3. Implement a method that returns the sum of all elements in an array:

For example, if you call it with \[1 \ 4 \ 9 \ 16 \ 9\]
then it returns \[1 + 4 + 9 + 16 + 9 = 39\].
Exercise 4

4. Implement a method that returns the alternating sum of all elements in an array (that is, the sum of all elements with odd indexes minus the sum of all elements with even indexes).

For example, if you call it with 1 4 9 16 9 then it returns 1 - 4 + 9 - 16 + 9 = -1.