

# Programming I

## Lab 9

### Exercise 1 (5 points)

For each of the following code segments, what will be the contents of the array after the loop terminates? Assume the array declaration on the next line:

```
int array[] = new int[5];
```

#### Segment 1

```
int i = 0;
while (i < array.length)
{
    array[i] = i;
    i++;
}
```

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#### Segment 2

```
int i = 0;
while (i < array.length)
{
    array[i] = array.length - i;
    i++;
}
```

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#### Segment 3

```
int i = 0;
array[0] = 10;
while (i < array.length)
{
    i++;
    array[i] = array[i-1] % 2 + 1;
}
```

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#### Segment 4

```
for (int i = array.length - 1; i >= 0; i--)
    array[i] = i * i;
```

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## Segment 5

```
for (int i = 0; i < 5; i = i+2)
{
    for (int j = 0; j < array.length; j++)
        array[j] = i;
}
```

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## Programming exercise 1 (3 points)

Write a program that determines, among a sequence of double values entered by the user, how many exceed the average value. Your program should first prompt the user to specify how many numbers will be input, and then store the values entered in an array. The program will then compute the average value and count how many array elements exceed the average value. Here's a sample run of the program:

```
How many values would you like to enter? 7
Enter a number: 1
Enter a number: 2
Enter a number: 3
Enter a number: 4
Enter a number: 5
Enter a number: 6
Enter a number: 40
Among the values entered, 1 exceeded the average value 8.714285714285714.
```

Can you think of a way of writing this program without using arrays?

## Programming exercise 2

For this exercise, you are to create 5 methods that perform operations on an array of integers and incorporate them as part of a program that demonstrates that the methods work properly. Your program must use the method headers and the main method provided. The array operations you will implement are as follows:

- 1) Display the contents of the array (1 point):

Method header: `public static void printArray(int[] array)`

This method prints the array elements on the same line, separated by a space.

- 2) Put random integers in the array (1 point):

Method header: `public static void putRandomValues(int[] array, int max)`

This method creates random integers in the range 0 to `max` and places them in the array.

- 3) Count even numbers (2 points):

Method header: `public static int countEven(int[] array)`

This method counts how many values in the array are even. The method takes the array as a parameter and returns the count of even numbers.

4) Reverse array elements (2 points):

Method header: `public static void reverseArray(int[] array)`

This method reverses the order of the elements in the array. The method takes as an argument the array and returns void. As an example, if the array {2, 3, 4, 5} is passed to it, the method should change it to {5, 4, 3, 2}.

5) Shuffle array elements (2 points):

This method shuffles the contents of the array. Shuffling an array can be done by repeatedly swapping 2 values in the array. To make the shuffling realistic, the indices of the 2 values must be chosen randomly. For an array of 10 elements, you can obtain a random index with value between 0 and 9 by invoking the following:

```
int index = (int) (Math.random() * 10);
```

Once both indices are obtained, swapping the two values requires the use of a temporary value (similar to reversing an array). The only question left is how many times should values be swapped for the array to be shuffled? Let's say that the number of swaps needed is three times the size of the array (in this case it would be 30). You will use that number in the condition of the for loop.

Finally, the main method in your program should look like:

```
public static void main(String[] args)
{
    int max = 100;

    Scanner input = new Scanner(System.in);
    System.out.print("How many numbers should the list have? ");
    int arraySize = input.nextInt();

    // create an array with arraySize number of elements in it
    int [] list = new int[arraySize];

    putRandomValues(list, max);

    System.out.println("Here are some random values in the list: ");
    printArray(list);

    System.out.println("The list contains " + countEven(list) +
        " even numbers.");
    reverseArray(list);
    System.out.println("The list in reverse order: ");
    printArray(list);

    shuffleArray(list);
    System.out.println("The list, after some shuffling: ");
    printArray(list);
}
```