King Saud University
College of Computer & Information Science
CSC113 – Computer Programming II
Lab07: Recursion II

Submission rules:

- The project name must be: Lab07_ID_FirstName_LastName.zip. For example: Lab07_123456789_Marwan_Almaymoni.zip
- Use the default package.
- The due date is Wednesday 11/11/2020 11:59 PM via lms.ksu.edu.sa
- Email submissions will not be accepted.
- ***This is a recursion lab. All questions must be solved using recursion. Otherwise, you will receive 0 for answers without recursion.***
- ***Do not use loops in any method except main (for the menu).***
- ***Do not use global variables***
- ***Do not give the class Lab7 any attributes.***
- ***Do not use static variables in any method.***

Question 1:

Write the class **Lab7** which implements some recursive and static methods, as well as a main method to test them. Your program will maintain an integer array of size 10 and offer a menu of the following choices to the user until the user chooses to quit:

```
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
```

Make sure to print the array after performing the tasks in 1, 3, 4, and 7 using ***recPrint***.

You may use ***method overloading*** to provide a cleaner interface for each method. In this case, your recursive helper method should be private. For example:

```
public static int sum(int[] arr) { //Overloaded, interface method
      return sum(arr, 0);
}

private static int sum(int[] arr, int index) { //Helper-recursive method
      .
      .
      .
}
```

You can use the following code to print the menu:

```
System.out.println("*************************************************");
System.out.println("* 1) Fill.\t2) Sum.\t\t3) Shift right.\t*");
System.out.println("* 4) Shift left.5) Find max.\t6) Find min.\t*");
System.out.println("* 7) Reverse.\t8) Print.\t9) Quit.\t*");
System.out.println("*************************************************");
System.out.print("=> ");
```

Question 1.a:

Write a recursive method ***recFill*** that takes an array of `int`. This method will fill the array with numbers given by the user until here is no more room in the array. The method’s header should be:

```
public static void recFill(int[] arr)
```

Question 1.b:

Write a recursive method ***recSum*** that takes an array of `int`. This method will recursively calculate the sum of the array’s elements and return the result. The method’s header should be:

```
public static int recSum(int[] arr)
```

Question 1.c:

Write a recursive method ***recShiftRight*** that takes an array of `int`. This method will recursively shift the elements to the right and place the last element in the first index. The method’s header should be:

```
public static void recShiftRight(int[] arr)
```

Question 1.d:

Write a recursive method ***recShiftLeft*** that takes an array of `int`. This method will recursively shift the elements to the left and place the first element in the last index. The method’s header should be:

```
public static void recShiftLeft(int[] arr)
```

Question 1.e:

Write a recursive method ***recFindMax*** that takes an array of `int`. This method will recursively search the array for the maximum element and return it. The method's header should be:

```
public static int recFindMax(int[] arr)
```

Question 1.f:

Write a recursive method ***recFindMin*** that takes an array of `int`. This method will recursively search the array for the minimum element and return it. The method's header should be:

```
public static int recFindMin(int[] arr)
```

Question 1.g:

Write a recursive method ***recReverse*** that takes an array of `int`. This method will recursively reverse the elements of the array permanently (Do not just print them in reverse). The method's header should be:

```
public static void recReverse(int[] arr)
```

Sample run:

```
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 1 ↲
Enter the element 1/10: 1 ↲
Enter the element 2/10: 2 ↲
Enter the element 3/10: 3 ↲
Enter the element 4/10: 4 ↲
Enter the element 5/10: 5 ↲
Enter the element 6/10: 6 ↲
Enter the element 7/10: 7 ↲
Enter the element 8/10: 8 ↲
Enter the element 9/10: 9 ↲
Enter the element 10/10: 10 ↲
[ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
```

```
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 2 ↲
The sum of the array's elements is 55
```

```
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 3 ↲
[ 10, 1, 2, 3, 4, 5, 6, 7, 8, 9]
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 3 ↲
[ 9, 10, 1, 2, 3, 4, 5, 6, 7, 8]
```

```
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 4 ↲
[ 10, 1, 2, 3, 4, 5, 6, 7, 8, 9]
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 4 ↲
[ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
```

```
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 5 ↲
The maximum element in the array is 10
```

```
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 6 ↲
The minimum element in the array  is 1
```

```
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 7 ↲
[ 10, 9, 8, 7, 6, 5, 4, 3, 2, 1]
```

```
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 3 ↲
[ 1, 10, 9, 8, 7, 6, 5, 4, 3, 2]
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 3 ↲
[ 2, 1, 10, 9, 8, 7, 6, 5, 4, 3]
```

```
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 8 ↲
[ 2, 1, 10, 9, 8, 7, 6, 5, 4, 3]
```

```
*************************************************
* 1) Fill.      2) Sum.         3) Shift right. *
* 4) Shift left.5) Find max.    6) Find min.    *
* 7) Reverse.   8) Print.       9) Quit.        *
*************************************************
=> 9 ↲
Goodbye
```