CS203 Java Programming and Applciations
Winter 2019

Assignment 1 (6 Questions, 100 marks)

Assigned Date: January 16, 2019
Due Date: January 31, 2019 @ 00:00

QUESTION 1 (10 Marks) Formatting Console Output

Show the output of the following statements.

(a) `System.out.printf("amount is %f %e\n", 32.32, 32.32);`

(b) `System.out.printf("amount is %5.2%% %5.4e\n", 32.327, 32.32);`

(c) `System.out.printf("%6b\n", (1 > 2));`

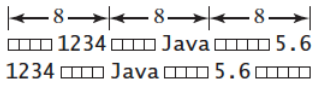
(d) `System.out.printf("%6s\n", "Java");`

(e) `System.out.printf("%-6b%s\n", (1 > 2), "Java");`

Write your answers as the two examples given below:

```
System.out.printf("%8d%8s%8.1f\n", 1234, "Java", 5.63);
System.out.printf("%-8d%-8s%-8.1f \n", 1234, "Java", 5.63);
```

display



where the square box (□) denotes a blank space.

Note: There is a missing "f" after "5.2" in (b).

QUESTION 2 (15 Marks) Methods

A pentagonal number is defined as $n(3n-1)/2$ for $n = 1, 2, \cdots$, and so on. Therefore, the first few numbers are 1, 5, 12, 22, $\cdots$. Write a method with the following header that returns a pentagonal number:

```
public static int getPentagonalNumber(int n)
```

Write a test program with class name **TestPentagonalNumber** that uses this method to display the first 100 pentagonal numbers with 10 numbers on each line. The method **getPentagonalNumber** is to be invoked in your **main** method. Each pentagonal number occupies 6 spaces and is left justified. Use CamelCase Notation for all identifiers in your program.

QUESTION 3 (20 Marks) Basics of One-Dimensional Arrays

(1) Once an array is created, its size cannot be changed. Does the following code resize the array? Explain your answer.

```
int[] myList;
myList = new int[10];
// Sometime later you want to assign a new array to myList
myList = new int[20];
```

(2) Suppose the following code is written to reverse the contents in an array, explain why it is wrong. How do you fix it?

```
int[] list = {1, 2, 3, 5, 4};

for (int i = 0, j = list.length - 1; i < list.length; i++, j--) {
  // Swap list[i] with list[j]
  int temp = list[i];
  list[i] = list[j];
  list[j] = temp;
}
```

(3) Show the output of the following code:

```
int[] list1 = {2, 4, 7, 10};
java.util.Arrays.fill(list1, 7);
System.out.println(java.util.Arrays.toString(list1));

int[] list2 = {2, 4, 7, 10};
System.out.println(java.util.Arrays.toString(list2));
System.out.print(java.util.Arrays.equals(list1, list2));
```

(4) Compile and run the following program in command-line environment and make screenshots to show your results.

```
public class Test {
  public static void main(String[] args) {
    System.out.println("Number of strings is " + args.length);
    for (int i = 0; i < args.length; i++)
      System.out.println(args[i]);
  }
}
```

Use the following commands one by one:

a) ls command: The listed files and directories should include "Test.java" and no "Test.class".

b) javac command: Use it to compile your "Test.java", which produces "Test.class".

c) ls command: The listed files and directories should now include both "Test.java" and "Test.class".

d) java command: Use it three times to invoke the program as follows:

java Test I have a dream
java Test "1 2 3"
java Test

Your screenshots should include all the above commands, and the outputs of the three invocations. (Hint: You may need to import java.lang.String in the program.)

QUESTION 4 (20 Marks) Programming with One-Dimensional Arrays

Write two overloaded methods that return the average of an array with the following headers:

```
public static int average(int[] array)
public static double average(double[] array)
```

Write a test program that prompts the user to enter ten double values, invokes this method, and displays the average value. Use CamelCase Notation for all identifiers in your program.

QUESTION 5 (15 Marks) Basics of Multidimensional Arrays

Show the output of the following codes:

(1)

```
int[][] array = {{1, 2}, {3, 4}, {5, 6}};
int sum = 0;
for (int i = 0; i < array.length; i++)
  sum += array[i][0];
System.out.println(sum);
```

(2)

```java
public class Test {
  public static void main(String[] args) {
    int[][] array = {{1, 2, 3, 4}, {5, 6, 7, 8}};
    System.out.println(m1(array)[0]);
    System.out.println(m1(array)[1]);
  }

  public static int[] m1(int[][] m) {
    int[] result = new int[2];
    result[0] = m.length;
    result[1] = m[0].length;
    return result;
  }
}
```

(3)

```java
int[][][] array = {{{1, 2}, {3, 4}}, {{5, 6},{7, 8}}};
System.out.println(array[0][0][0]);
System.out.println(array[1][1][1]);
```

QUESTION 6 (20 Marks) Programming with Multidimensional Arrays

An $n \times n$ matrix is called a positive Markov matrix if each element is positive and the sum of the elements in each column is 1. Write the following method to check whether a matrix is a (positive) Markov matrix.

```java
public static boolean isMarkovMatrix(double[][] m)
```

Write a test program that prompts the user to enter a 3×3 matrix of double values and tests whether it is a Markov matrix. Here are sample runs:

```
Enter a 3-by-3 matrix row by row:
0.15 0.875 0.375 Enter
0.55 0.005 0.225 Enter
0.30 0.12 0.4 Enter
It is a Markov matrix
```

```
Enter a 3-by-3 matrix row by row:
0.95 -0.875 0.375 Enter
0.65 0.005 0.225 Enter
0.30 0.22 -0.4 Enter
It is not a Markov matrix
```