

Lab 08 – Arrays and methods

Objectives

- Problem solving using arrays (single dimension and 2D arrays) and methods
- Design algorithms and write Java programs

Preparation

Chapter 7, 8

Background

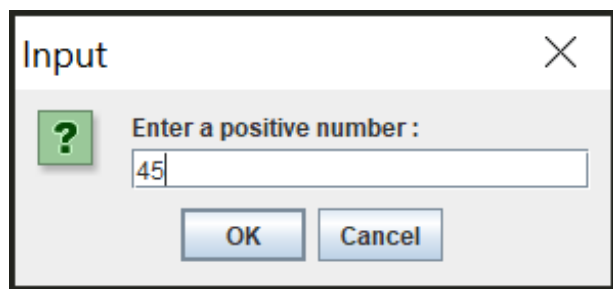
`Javax.swing` is a package that provides the classes and methods for having applications with graphical user interface (GUI). `JOptionPane` is a class in this package that has two methods for creating a dialog window and a information window for user. Using the method named `JOptionPane.showInputDialog(null, message)` shows a dialog window representing the message followed by a text box to get the user's input and returns it as a string. Another method can be used to show a message to the user i.e. `JOptionPane.showMessageDialog(null, message)`. The first parameter of both methods is the parent component, but we leave it as null at this point¹.

For example, the result of running the following statement is an Input window like below (a). After clicking OK button, "45" is stored to `userInput`.

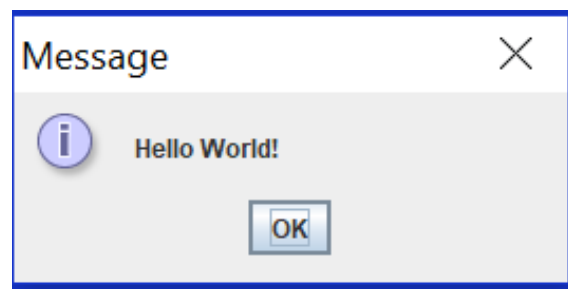
```
String userInput = JOptionPane.showInputDialog(null, "Enter a positive number: ");
```

If you run the following statement, a message box like blow (b) will be displayed.

```
JOptionPane.showMessageDialog(null, "Hello World!");
```



(a)



(b)

To use the above methods, you must import `javax.swing.JOptionPane` class.

Furthermore, `String.format(formatSpecifier, value)` can be used to format the output. The `formatSpecifier` is like `printf` method. The `format` method returns a string with the specified format.

¹ More information in <https://docs.oracle.com/javase/8/docs/api/>

Details

Exercise 1 [15 marks]: Write two overloaded methods that returns 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 (Arrays.java) that prompts the user to enter 5 double values, invoke this method and displays the average value.

Exercise 2 [39 marks]: Write a java program named **Matrix.java** including the following methods:

1. **[7 marks]** Write a method named **genMatrix** that given, m, the number of rows and columns initializes and returns a matrix with random positive double values less than 100.
2. **[7 marks]** Write a method named **printMatrix** that given a matrix of m rows and m columns of doubles, prints it in a tabular format with 2 digits after decimal point.
3. **[7 marks]** Write a method named **isSymmetric** that given a matrix checks whether it is symmetric.
A matrix, M, is symmetric if for every index of i and j the $M[i][j]$ is equal to $M[j][i]$.
4. **[7 marks]** Write a method named **Multiply** that given a double coefficient c and a matrices of m rows and m columns of doubles, calculates and returns $c \times M1$. The original matrix should not be changed.

$c \times M1 = M$ where $M[i][j] = c \times M1[i][j]$, For more information, [check this](#).

5. **[4 marks-bonus marks - optional]** Write a method named **Square** that given a matrices of n rows and n columns of doubles, calculates, and returns the square of the given matrix. The original matrix should not be changed.

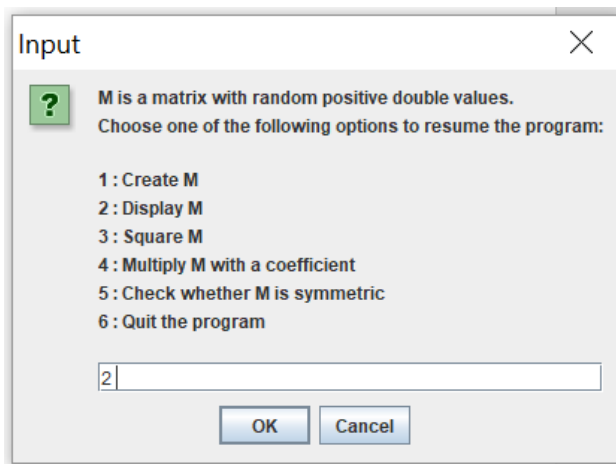
$M1 \times M2 = M$ where $M[i][j] = \sum_{k=1}^n M1[i][k] \times M2[k][j]$, For more info, [check this](#).

6. **[7 marks]** Write a main method that shows a menu like the following for choosing an operation and shows the result accordingly.

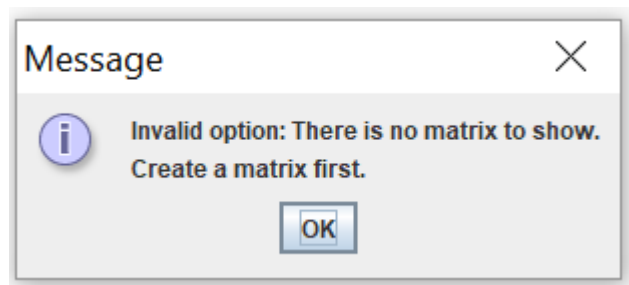
M is a matrix with random positive double values less than 100. Choose one of the following options to resume the program:

```
1 : Create M
2 : Display M
3 : Square M
4 : Multiply M with a coefficient
5 : Check whether M is symmetric
6 : Quit the program
```

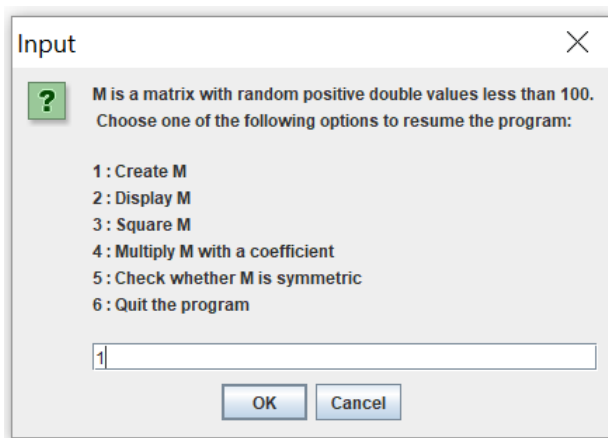
The following shows a partial run of the program using `JOptionPane` class:



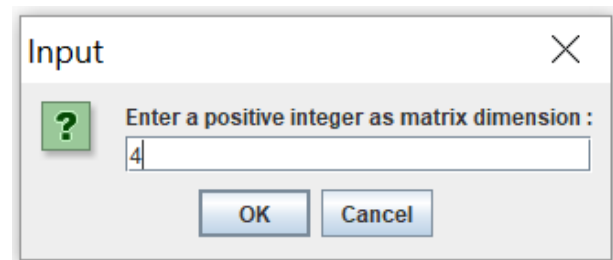
(a)



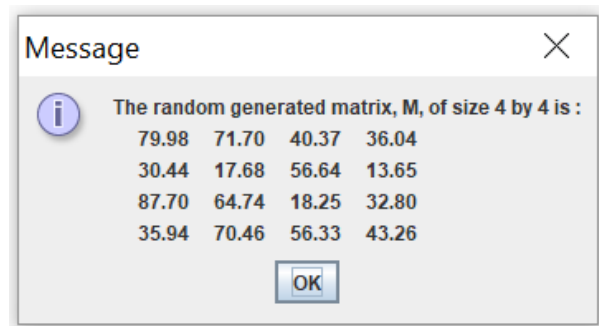
(b)



(c)



(d)



(e)

Submission

Make a folder containing your source codes (.java file) and external documentation, zip the folder and submit the zip file to D2L. Check Lab Guide (section 3) to find out more details about your submission and grading.