Lab lecture exercises – Week 10

- 1. Write a method public static int[] reverse(int[] a) that reverses a one dimensional array (e.g. $\{1,2,3,4\}$ goes to $\{4,3,2,1\}$).
- 2. Write a method pubic static double min(double[][] a) that computes the minimum of a two-dimensional array. For an empty array an exception should be thrown.
- 3. Write a method public static double[] copy(double[] a) that copies a one-dimensional array of double. Likewise write a method that copies a two-dimensional array: public static double[][] copy(double[][] a).
- 4. A magic square is an arrangement of the numbers $1, 2, ..., n^2$ in an $n \times n$ matrix so that each number occurs exactly once and the sum of the numbers in each row and column as well as the two diagonals is always the same value. For an example find a magic square to the right.

16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1

Write a program that first reads in the size n of a magic square and then reads in the n^2 numbers (all from the command line). Your program should then check that the numbers form actually a magic square:

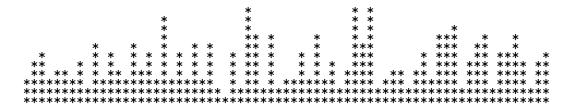
- Does each number in $1, 2, \ldots, n^2$ occur exactly once?
- Are the conditions on the sums met?

[taken from Horstmann, Big Java, 4th edition p. 299.]

- 5. Write a class Complex with the two fields private double realPart and private double complexPart. Furthermore write a constructor, getters, and a public String toString() method as well as a method public Complex add(Complex summand) and a method public Complex multiply(Complex factor) for addition and multiplication, respectively.
- 6. Write a class Name with two fields private String firstName and private String surname. Assume that you have arrays of equal lengths, one containing strings representing first names, the other surnames. Write a method public static Names[] makeNames(String[] firstNames, String[] surnames); to create a corresponding array of names.
- 7. Write a method public static double convert (double amount, String fromUnit, String toUnit) that can convert temperatures (degrees Fahrenheit to degrees Celsius and vice versa) and distances (miles, feet, inches, kilometres, metres, centimetres, millimetres into each other). Write code that is extensible so that you can easily add conversions between weights (e.g., pounds, ounces, kilograms, grams). The method should throw a suitable exception if called with incompatible units (i.e., if the fromUnit is incompatible with the toUnit).

8. Assume you have a one-dimensional array of strings. Write a method **public static** int[] lengths(String[] strings) that returns an array that stores the lengths of the strings.

Assume that all the lengths of the strings are between 1 and 20 and the array has a length of at most 50. Write a method that in such cases prints the lengths in the following form (Example shows the lengths corresponding to quoted text in the next exercise from the Universal Declaration of Human Rights):



9. Write a method public static void toHtml(String file) that reads in a text file file.txt which contains information such as

All human beings are born free and equal in dignity and rights. They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood.

Everyone is entitled to all the rights and freedoms set forth in this Declaration, without distinction of any kind, such as race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth or other status. ...

and produces a corresponding html version and writes it to file.html.

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- 10. Write a class Coin with the field variables String name and int value. Write a sub-class CollectableCoin with the additional field variables int year and String condition.
- 11. Write an interface Area that contains the method signature double area().

Write a class Rectangle that implements Area with field variables private double length and private double width. In particular, write a public String toString() method. Furthermore write a Square sub-class of Rectangle.

Write a class Ellipse that implements Area. It has two fields private double majorRadius and private double minorRadius. The area is given as Math.PI * majorRadius * minorRadius. Write a sub-class Circle of Ellipse. For Circle also write a method private double circumference(). (For a circle with radius r, the circumference is computed as $2 \cdot \pi \cdot r$.)