

METAMODELING, FB 20, TU DARMSTADT

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Exercise 1

for **Introduction to Computer Science I** - WS 02/03

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On the following Web site you can find further information about the lecture and the exercises: <http://www.cdc.informatik.tu-darmstadt.de/~mal/mcs>.

Task 1.1 Representation of numbers

Put the following numbers into their decimal, binary, octal and hexadecimal representation:

$$\begin{array}{ccc} 45_{10} & 202_8 & 202_{10} \\ 10001_2 & ABC_{16} & 1984_{10} \end{array}$$

Task 1.2 Algorithms

Which qualities must an algorithm possess? Decide for each of the following bullets (letters) if the instructions form an algorithm? Explain, why or why not!

a. **List of numbers**

1. Make a list of all odd natural numbers.
2. Remove all entries of the list, which are divisible by 3 without remainder.

b. **Drawing a circle**

1. Divide the distance \overline{AB} in the middle and draw a straight line perpendicular to it.
2. Divide the distance \overline{BC} in the middle and draw a straight line perpendicular to it.
3. Determine the intersection U of the straight lines from step a and b.
4. Determine the distance r between U and one of the vertices. Draw a circle with central point U and radius r .

c. **Sum**

1. At the beginning the sum of the numbers is initialized to zero ($S \leftarrow 0$).
2. Read a new natural number n .
3. Add n to s .
4. If n is equal to 0, then proceed with step 4, else with step 3.
5. Return sum as the sum of the numbers

Home Assignment 1.1 Java

The goal of this homework is to install the Java programming environment (the version that will be used in this course). This task is meant for those who want (are able) to solve the programming tasks at home also. In any event, it is not necessary to install Java at the pool computers in the RBG pool rooms! The second part of this task helps you to check whether the installed Java compiler is set up correctly. You may also do this on the pool computers.

Installing Java

Install Java by executing the Java binary from the CD available to this exercise course. You can get the CD from the Department "Telekooperation" which organizes the German version of this course. A more detailed description of the installation can also be found on this CD.

Testing the installation

Type `java -version` at the command line. The output of this command should be similar to the following:

```
H:\>java -version
java version "1.4.0_02"
Java(TM) 2 Runtime Environment, Standard Edition (build 1.4.0_02-b02)
Java HotSpot(TM) Client VM (build 1.4.0_02-b02, mixed mode)
```

Home Assignment 1.2 Algorithm for calculating the arithmetic mean value (8 Points)

Prepare an algorithm, which calculates the arithmetic mean value of an arbitrary sequence of non negative numbers. The end of the sequence is marked by a negative number. Assume the following operations as given: addition, subtraction, multiplication and division. (E.g. 1, 4, 6, 8, -1, 2; $\bar{n} = 4.75$).

Home Assignment 1.3 Algorithms (8 Points)

Prepare an algorithm which factorizes arbitrary natural numbers into their prime divisors. Describe the algorithm as precisely as you can! Presume the following operations as given: addition, subtraction, multiplication and integer division (DIV) of natural numbers as well as the calculation of the remainder (MOD) of an integer division. All operations have natural numbers as their result. (E.g. $51\text{DIV}5 = 10$ and $51\text{MOD}5 = 1$).

Home Assignment 1.4 Representation of numbers (8 Points)

Put the following numbers into their decimal, binary, octal and hexadecimal representation. Make sure that it is comprehensible *how* you solved it, the plain result is not enough!

42_{10}	76_8	1984_{10}
471_{10}	100101_2	$5C6_{16}$