

Informatik für Mathematiker und Physiker HS14

Exercise Sheet 4

Submission deadline: 15:15 - Tuesday 14th October, 2014

Course URL: <http://lec.inf.ethz.ch/ifmp/2014/>

Assignment 1 (4 points)

Write a program `kdivisors.cpp` that inputs a natural number `k` and outputs a list of all numbers `n` between 1 and 1000 with exactly `k` divisors (including 1 and `n`).

Assignment 2 (3 points)

This is a theory exercise.

In the lecture you have seen three loop types: `for`, `while` and `do`. Decide which type is most appropriate for each of the following tasks and argue why you chose that particular loop type. Then provide loops that solve this task. (Possible overflows and underflows can be ignored for this exercise.)

- You are given an `unsigned int` variable `n`. Read `n` floating-point numbers from the terminal and compute their average in a variable `avg`.
- You are given two `unsigned int` variables `a` (where `a >= 2`) and `upper_bound`. Count how many times you can execute `a *= 2` without growing larger than `upper_bound`. Then output this number.
- The production line of XMPLMotor Inc. has a sensor device which checks each fully manufactured motor for broken parts. It then writes the number of broken parts for that motor to a file. After all motors have been checked, the sensor writes `-1` to the file. For example: if we have 4 undamaged motors, then one damaged motor with 2 broken parts, and then again 3 undamaged motors the sensor would write the following sequence to the file.

0 0 0 0 2 0 0 0 -1

Your task is to write a code snippet that determines the index of the first damaged motor, and then outputs this index (or outputs 0 if there is no broken motor at all). For the example above your code should output 5. Assume that the sequence can be read from `std::cin`.

Assignment 3 – Skript-Aufgabe 69 (4 points)

The number π can be defined through various infinite sums. Here are two of them.

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$$
$$\frac{\pi}{2} = 1 + \frac{1}{3} + \frac{1 \cdot 2}{3 \cdot 5} + \frac{1 \cdot 2 \cdot 3}{3 \cdot 5 \cdot 7} + \dots$$

Write a program for computing an approximation of π , based on these formulas. Which formula is better for that purpose?

Assignment 4 - Skript Aufgabe 73 (4 points)

Mr. Plestudent studies Mathematics at ETH. Last year he developed a little smartphone app that got quite successful. He expects to make m CHF net profit every year and decides to save all this money for holidays. He puts his earnings into a savings account that promises $p\%$ interest every year. How much will he have at the end of his studies in n years?

Write a program `interest.cpp` that reads m, n and p from the standard input and outputs the amount of money that is in Mr. Plestudent's account after he deposits m CHF for n years on the account with $p\%$ interest rate. Please note, that both m and p do *not* have to be integers (however, they are non-negative), n is a positive integer.

The output of the program should look like this:

```
Yearly amount m =? 300
Yearly interest (in %) p =? 0.75
Number of years n =? 5
The total amount after 5 years is 1534.09 CHF.
```

Challenge - Skript-Aufgabe 56 (8 points)