Informatik für Mathematiker und Physiker   HS13

Exercise Sheet 4

Submission deadline: 15:15 - Tuesday 15th October, 2013

Course URL: http://www.ti.inf.ethz.ch/ew/courses/Info1_13/

Assignment 1 (4 points)

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

Assignment 2 – Skript-Aufgabe 50 (4 points)

Write a program `dec2bin2.cpp` that inputs a natural number `n` and outputs the binary digits of `n` in the *correct* order. For example, for n==2 the output is 10 and for n==11 the output is 1011.

Hint: Find a way to "invert" the output of `dec2bin.cpp`.

Assignment 3 – Skript-Aufgabe 68 (4 points)

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

$$
\begin{aligned}
\frac{\pi}{4} &= 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots \\
\frac{\pi}{2} &= 1 + \frac{1}{3} + \frac{1 \cdot 2}{3 \cdot 5} + \frac{1 \cdot 2 \cdot 3}{3 \cdot 5 \cdot 7} + \cdots
\end{aligned}
$$

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

Assignment 4 - (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 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 amout 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 55

The largest Mersenne prime known as of October 2013 is

$$2^{57,885,161} - 1$$

Write a program `famous_last_digits.cpp` that computes and outputs the last 10 decimal digits of the above Mersenne prime!