

Informatik für Mathematiker und Physiker**Serie 9****HS11**URL: http://www.ti.inf.ethz.ch/ew/courses/Info1_11/**Skript-Aufgabe 93 (4 Punkte)**

What are the problems (if any) with the following functions? Fix them and find appropriate pre- and postconditions.

```
a) bool is_even (const int i)
   {
     if (i % 2 == 0) return true;
   }

b) double inverse (const double x)
   {
     double result;
     if (x != 0.0)
       result = 1.0 / x;
     return result;
   }
```

Skript-Aufgabe 98 (4 Punkte)

a) Write a function

```
// POST: return value is true if and only if n is prime
bool is_prime (unsigned int n);
```

and use this function in a program to count the number of *twin primes* in the range $\{2, \dots, 10000000\}$ (two up to ten millions). A twin prime is a pair of numbers $(i, i + 2)$ both of which are prime.

b) Is the approach of a) the best (most efficient) one to this problem? If you can think of a better approach, you are free to implement it instead of the one outlined in a).

Skript-Aufgabe 101 (4 Punkte)

Write a program `unique.cpp` that implements and tests the following function.

```
// PRE: [first, last) is a valid range and describes a sequence
//       of elements that are sorted in nondecreasing order
// POST: the return value is true if and only if no element
//       occurs twice in the sequence
bool unique (const int* first, const int* last);
```

Skript-Aufgabe 105 (4 Punkte)

A *perpetual calendar* can be used to determine the weekday (Monday, ..., Sunday) of any given date. You may for example know that the Berlin wall came down on November 9, 1989, but what was the weekday? (It was a Thursday.) Or what is the weekday of the 1000th anniversary of the Swiss confederation, to be celebrated on August 1, 2291? (Quite adequately, it will be a Saturday.)

- a) The task is to write a program that outputs the weekday (Monday, ..., Sunday) of a given input date.

Identify a set of subtasks to which you can reduce this task. Such a set is not unique, of course, but all individual subtasks should be small (so small that they could be realized with few lines of code). It is of course possible for a subtask in your set to reduce to other subtasks. (One subtask that you certainly need is to determine whether a given year is a leap year).

- b) Write a program `perpetual_calendar.cpp` that reads a date from the input and outputs the corresponding weekday. The range of dates that the program can process should start no later than January 1, 1900 (Monday). The program should check whether the input is a legal date, and if not, reject it. An example run of the program might look like this.

```
day =? 13
month =? 11
year =? 2007
Tuesday
```

To structure your program, implement the subtasks from a) as functions, and put the program together from these functions.

Die **Aufgaben 110** und **111** aus den Vorlesungsunterlagen sind die **Challenge Aufgaben** und geben jeweils 8 Punkte, wenn sie vollständig gelöst werden.

Abgabe: Bis 29. November 2011, 15.15 Uhr.