

Informatik für Mathematiker und Physiker

Serie 3

HS 07

URL: http://www.ti.inf.ethz.ch/ew/courses/Info1_07/

Skript-Aufgabe 8 (4 Punkte)

Parenthesize the following expressions and then evaluate them step by step. This means that types and values of all intermediate results that are computed during the evaluation should be provided.

- a) $-2-4*3$ b) $10\%6*8\%3$ c) $6-3+4*5$
d) $5u+5*3u$ e) $31/4/2$ f) $-1-1u+1-(-1)$

Skript-Aufgabe 15 (4 Punkte)

Write a program `celsius.C` that converts temperatures from degrees Fahrenheit into degrees Celsius.

The initial output that prompts the user to enter the temperature in degrees Fahrenheit should also contain *lower* and *upper* bounds for the allowed inputs. These bounds should be chosen such that no over- and underflows can occur in the subsequent computations, given that the user respects the bounds. You may for this exercise assume that the integer division rounds towards zero for all operands: for example, $-5 / 2$ then rounds the exact result -2.5 to -2 .

The program should output the *correct* result in degrees Celsius as a mixed rational number of the form $x\frac{y}{9}$ (meaning $x + y/9$), where $x, y \in \mathbb{Z}$ and $|y| \leq 8$. For example, $13\frac{4}{9}$ could be output simply as $13\ 4/9$. We also allow, for example, the output $-1\ -1/9$ (meaning $-1 - 1/9 = -10/9$).

Skript-Aufgabe 21 (4 Punkte)

Show that the following sets of functions are complete for the set of binary Boolean functions.

- a) {AND, NOT}
b) {OR, NOT}
c) {NAND}
d) {NOR}, where $\text{NOR} := \text{NOT} \circ \text{OR}$.
e) {XOR, AND}

You may use the fact that {AND, OR, NOT} is a complete set of binary Boolean functions.

Skript-Aufgabe 26 (4 Punkte)

Find the logical parentheses in lines 9 and 12 of the following program. What can you say about the output of the following program? Characterize it depending on the input and explain your reasoning.

```
1  #include <iostream>
2
3  int main ()
4  {
5      unsigned int a;
6      std::cin >> a;
7
8      unsigned int b = a;
9      b /= 2 + b / 2;
10     std::cout << b << "\n";
11
12     bool c = a < 1 || b != 0 && 2 * a / (a - 1) > 2;
13     std::cout << c << "\n";
14
15     return 0;
16 }
```

Challenge

Students who are interested in more advanced exercises can replace two of the ordinary exercises by one challenge exercises. Candidates for this week are exercises 17 and 27 from the lecture notes. Each of those accounts for 8 points. Note that, it is not possible to achieve more points than the sum of points of the normal exercises. It should be made clear which exercises have been replaced.

Programm: fahrenheit.C

```
// Program: fahrenheit.C
// Convert temperatures from Celsius to Fahrenheit.

#include <iostream>

int main()
{
    // Input
    std::cout << "Temperature in degrees Celsius =? ";
    int celsius;
    std::cin >> celsius;

    // Computation and output
    std::cout << celsius << " degrees Celsius are "
              << 9 * celsius / 5 + 32 << " degrees Fahrenheit.\n";
    return 0;
}
```

Abgabe: Bis 16. Oktober 2007, 15.15 Uhr.