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13. Oktober 2009

Informatik für Mathematiker und Physiker Serie 4 HS 09

URL: `http://www.ti.inf.ethz.ch/ew/courses/Info1_09/`

Skript-Aufgabe 13 (4 Punkte)

Parenthesize the following expressions according to operator precedence and associativity. 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 21 (4 Punkte)

Suppose that someone drives from A to B at an average speed of 50 km/h. On the way back from B to A, there is a traffic jam, and the average speed is only 30 km/h. What is the average speed over the whole roundtrip?

When confronted with this question, many people would answer "40 km/h," but this is wrong. Write a program `average_speed.cpp` that lets the user enter two average speeds in km/h ($A \to B$ and $B \to A$) and computes from this the average speed over the whole roundtrip ($A \to B \to A$). Both inputs should be positive integers, and the output should be rounded down to the next smaller integer.

Skript-Aufgabe 22 (4 Punkte)

Write a program `celsius.cpp` 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 30 (4 Punkte)

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

a) $\{\mathrm{AND}, \mathrm{NOT}\}$

b) $\{\mathrm{OR}, \mathrm{NOT}\}$

c) $\{\mathrm{NAND}\}$

d) $\{\mathrm{NOR}\}$, where $\mathrm{NOR} := \mathrm{NOT} \circ \mathrm{OR}$.

e) $\{\text{XOR}, \text{AND}\}$

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

Die **Aufgaben 25**, **26** und **36** aus den Vorlesungsunterlagen sind die **Challenge Aufgaben** und geben jeweils 8 Punkte, wenn sie vollständig gelöst werden.

Abgabe: Bis 20. Oktober 2009, 15.15 Uhr.