

Übungen zur Vorlesung
Einführung in das Programmieren für TM

Serie 3

Aufgabe 3.1. Write a function `scalarproduct` which computes and returns the scalar product $w = \mathbf{u} \cdot \mathbf{v} := ax + by + cz$ of two given vectors $\mathbf{u} = (a, b, c)^T$ and $\mathbf{v} = (x, y, z)^T$. Furthermore, write a main program which reads the parameters a, b, c, x, y, z from the keyboard and prints to the screen the value of the scalar product. Save your source code as `scalarproduct.c` into the directory `serie03`.

Aufgabe 3.2. Write a void function `vectorproduct`, which, given two vectors $\mathbf{u} = (a, b, c)^T$ and $\mathbf{v} = (x, y, z)^T$, computes and prints to the screen the vector product $\mathbf{w} = \mathbf{u} \times \mathbf{v}$ defined by

$$\begin{aligned}w_1 &= bz - cy \\w_2 &= cx - az \\w_3 &= ay - bx.\end{aligned}$$

Then, write a main program which reads the entries of the vectors \mathbf{u}, \mathbf{v} from the keyboard and calls the function. Save your source code as `vectorproduct.c` into the directory `serie03`.

Aufgabe 3.3. Write a void-function `divisor` which checks if a given number $x \in \mathbb{N} := \{1, 2, 3, \dots\}$ is divisible by 2, 3, or 6. Additionally, write a main program that reads in the number x , then calls the function `divisor`, and prints out the result. Save your source code as `teiler.c` into the directory `serie03`.

Aufgabe 3.4. Write a void-function `curve_sketching` which does a curve sketching for a quadratic function $p(x) = a + bx + cx^2$ with coefficients $a, b, c \in \mathbb{R}$. If existing, compute the extremum (and which kind of extremum it is). Additionally, if existing, compute the roots of the function. Otherwise, print on the screen, that the function does not have an extremum resp. roots. Moreover, write a main program which reads in the parameters a, b, c and which calls the function. Save your source code as `curve_sketching.c` into the directory `serie03`.

Aufgabe 3.5. Write a void-function `money` that calculates given an amount of money $n \in \mathbb{N}$ the minimal number of bank notes (500€, 100€, 50€, 20€, 10€, 5€) resp. coins (2€, 1€) such that the sum equals the value of n . This number shall be displayed on the screen. For example, for $n = 351$, one should get the following output

```
3 x 100 EUR
1 x 50 EUR
1 x 1 EUR
```

Write a main program which reads the value $n \in \mathbb{N}$ and which calls the function `money`. Save your source code as `money.c` into the directory `serie03`.

Aufgabe 3.6. Write a function `minabs` that, given two numbers $x, y \in \mathbb{R}$, returns the one with the smallest absolute value. The mathematical library must not be used. Then, write a main program, which reads x and y from the keyboard and prints a message with the result of the function. Save your source code as `minabs.c` into the directory `serie03`.

Aufgabe 3.7. Write a function `points` which, given three points (x, y) , (u, v) , and (a, b) in \mathbb{R}^2 , checks whether they lie on the same line. Moreover, write a main program which reads the six coordinates of the points from the keyboard and prints out the result on the screen. Save your source code as `points.c` into the directory `serie03`.

Aufgabe 3.8. Write a recursive function `division`, which computes and returns the result of the integer division m/n (division without remainder) of two given integers $m \geq 0$ und $n > 0$. Only the arithmetic operations `+` and `-` can be used by the function. Moreover, write a main program which reads m and n from the keyboard and print the result m/n to the screen. *Hint:* For any $y \neq 0$, it holds that $x/y = 1 + (x - y)/y$. Save your source code as `division.c` into the directory `serie03`.