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Sommersemester 2014
26.05.2014

Übungen zur Vorlesung
Einführung in das Programmieren für TM

Serie 11

***Note:** For this series you need the matrix class from the last exercise sheet.*

Aufgabe 11.1. Overload the operator + for the class Matrix from the last exercise sheet. Moreover, test your implementation.

Aufgabe 11.2. Overload the operator * (matrix-matrix multiplication) for the class Matrix from the last exercise sheet. Moreover, test your implementation.

Aufgabe 11.3. Overload the operator + for the class MyVector from the lecture notes. Moreover, test your implementation.

Aufgabe 11.4. Overload the operator * for the class MyVector from the lecture notes. We define the multiplication of two vectors $x, y \in \mathbb{R}^n$ component-wise, i.e. the j-th entry of the product $z = x * y$ is given by $z_j = x_j y_j$. Moreover, test your implementation.

Aufgabe 11.5. Write a class Alcohol for the storage of different alcoholic drinks. The class should contain the following members: name, alcoholic strength percent, price in €. Moreover, implement an appropriate constructor and overload operator<, that compares two objects of the class with respect to the ratio $\frac{\text{Vol.\%}}{\text{€}}$. Additionally, implement the methods getName(), getPrice(), and getVolPercent().
Hint: In general, the operator < is overloaded by the syntax

```
    bool operator<(const type& lhs, const type& rhs);
```

Here, type is an arbitrary datatype. In our case it is Alcohol.

Aufgabe 11.6. Overload the function print such that

```
  void print(vector<double> &d);
  void print(vector<Complex> &c);
```

either prints out a vector with double entries or a vector with Complex entries. Test your implementations.

Aufgabe 11.7. Overload the function norm, such that

```
  double norm(Matrix& A);
  double norm(vector<double>& v);
```

either computes and returns the Frobenius norm $\sqrt{\sum_{j=1}^m \sum_{k=1}^m A_{jk}^2}$ of a $m \times n$-matrix A or the ℓ_2-norm $\sqrt{\sum_{j=1}^n v_j^2}$ of a vector $v \in \mathbb{R}^n$. Test your implementations. Why is it a good idea to use *Call by Reference* for the input parameters?

Aufgabe 11.8. Write two functions

```
  double prod(vector<double> &a, double c);
  double prod(vector<double> &a, vector<double> &b, double c);
```

which compute and return either $c \prod_{j=1}^n a_j^2$ or $c \prod_{j=1}^n a_j b_j$. Test your implementations.