



Institut of Numerical Mathematics

Dr. Andreas F. Borchert and Dr. Michael C. Lehn
Constantin Greif

8 November 2019
Quiz 2

High Performance Computing I (WS 2019/2020)

Deadline: 15 November 2019, 2pm

Notice:

Please register yourself in SLC for HPC I, if you haven't done this before. The registration will allow you to submit your answers to the following questions.

Please download the skeletons either as ZIP or as TAR archive:

- *quiz02.tar*:
<http://www.mathematik.uni-ulm.de/numerik/hpc/ws19/quizzes/quiz02.tar>
- *quiz02.zip*:
<http://www.mathematik.uni-ulm.de/numerik/hpc/ws19/quizzes/quiz02.zip>

You need to edit *vector.hpp*, *dot.cpp*, and *gemv.cpp*. Just look for the "FIXME" comments. Once you are finished you can submit your updated files to our server *theon* using the following command:

```
theon$ submit hpc quiz02 vector.hpp dot.cpp gemv.cpp
```

Please note that neither *matrix.hpp*, *dot.hpp* nor *gemv.hpp* are to be submitted.

Question 1

Develop a vector class **struct** *Vector* in the header file *vector.hpp* in the style of the downloaded *matrix.hpp* which is similar to the *Matrix* class of the 7th session. However, both classes are now stored in header files with suffixes ".hpp" instead of ".cpp".

The access methods shall perform range checks for the parameter *i* using *assert*.

Question 2

Develop a function for the scalar product of two vectors in *dot.cpp* with following signature:

```
double dot(const Vector& x, const Vector& y) {  
    // ...  
}
```

Assert that the operation can be performed using the *assert* function.

Question 3

Develop a *gemv* function in *gemv.cpp* for the matrix-vector multiplication $y \leftarrow \beta y + \alpha Ax$ with following signature:

```
void gemv(double alpha, const Matrix& A, const Vector& x,  
          double beta, Vector& y) {  
    // ...  
}
```

Make sure that the operation can be performed using the *assert* function.