Question 1: Quadratic Form

We want to compute the quadratic form

\[ Q = \vec{v}^T \cdot A \cdot \vec{w} = \sum_{ij} v_i A_{ij} w_j \]  

in parallel employing shared memory parallelism with OpenMP.

Given the \( n \times n \) matrix \( A \) and the vectors \( v, w \) prepared in the provided skeleton code QuadraticForm/skeleton.cpp compute the quadratic form of Equation 1 for a shared memory architecture. Put your solution in QuadraticForm/main_shared.cpp.

Question 2: GEMM

In this exercise you should familiarize yourself with general matrix multiplications (GEMM) using a BLAS library. We can start with the code of exercise 1, which you should parallelize using OpenMP. In the same code you should additionally perform the matrix multiplication with a call to GEMM. Install a BLAS library on your personal system.

a) Report on what version of BLAS you are using, how you can link to it, if it is single-threaded or multi-threaded, and how can you specify the number of threads in the multi-threaded version. Submit a Makefile along with your code.

b) How much faster is your code with BLAS compared to the trivial implementation of the matrix multiplication in the initial code?