Advanced Programming in C++
Winter Semester 2023

HOMEWORK 1: ALGORITHMS IN C++

1. Implement in the C++ programming language the following algorithms:
   a. Matrix multiplication;
   b. Sieve of Eratosthenes for finding all prime numbers to a given limit: https://en.wikipedia.org/wiki/Sieve_of_Eratosthenes;
2. The following sorting algorithms:
   a. Bubble sort: http://en.wikipedia.org/wiki/Bubble_sort;
   b. Bucket sort: http://en.wikipedia.org/wiki/Bucket_sort;
3. Initialise the algorithms with uniformly distributed random numbers;
4. Choose for each algorithm one large problem size (i.e. array dimension) and execute it on your system;
5. Report and explain the results in a simple PDF file.
6. **Use classes and inheritance for the implementation of the algorithms in task 1 and 2.**

Important requirements:

1. **Create separate classes for assignment 1 and 2. Besides, define methods for each algorithm in the corresponding classes. Use friend functions where possible.**
2. Measure only the core execution time of each algorithm without random number generation, array/matrix initialisation, and any I/O operations.
3. Implement the algorithms as short (few lines) and as simple as possible, focused on the core functionality (e.g. without safety checks, small optimisations, or redundant tests).