

Guidelines for the assessment

The programming

In Practical 4 you wrote a class of matrices that had similar functionality to the class of vectors that was presented in lectures. For the assessment you should do the following.

1. Finish the exercises in Practical 4.
2. Extend the class of matrices further to include more of the basic functions that are available in MATLAB.
3. Implement at least one linear solver (either a direct solver such as Gaussian elimination or an iterative solver such as `cgs` or `gmres`).
4. Your main task is to show that you can use your matrix class to solve some “useful” problem. Example topics for your assessment are given below.
 - Use the classes of vectors and matrices to write MATLAB style code in C++. For example, code to compute the numerical solution of Laplace’s equation or the heat equation. You may, if appropriate, chose to use your linear algebra classes to solve a problem which is related to your main research topic.
 - Implement some more linear solvers and compare speed and convergence properties over a range of suitable data. In MATLAB solvers such as `cgs` and `gmres` can accept many additional arguments that are assigned default options—use the help function in MATLAB for ideas when developing these functions in C++.
 - Develop the classes of vectors and matrices to improve the speed of the executables that are generated. Demonstrate on reasonably large linear systems that your improvements have made a significant difference.

Whatever you decide to do, the code written should be well documented.

Alternative project

If you think that you would like to tackle a different scientific problem and not linear algebra then *please talk to me about your ideas in advance*. It is essential that whatever you do should demonstrate that you can write C++ objects for some scientific purpose.

The report

Your report should follow the conventions as to the recommended length. It should be labelled with your candidate number rather than name so that your identity can be anonymous during the marking of the report.

Your special topic report should contain the following:

- an explanation of what you have done, and how it is different from the class of matrices that you wrote in Practical 4;
- a description of the mathematics that underpins your assessment;
- any unexpected problems you encountered, and how they were dealt with;
- a summary of what your implementation does (advertise what is in the code)
- sample code from classes that you use and from the code that tests the classes; and
- some results that demonstrate a mathematical feature of the problem you have chosen, for example convergence plots.