

## Exercise Sheet 3

### Exercise 1

Consider the two iterative methods for solving a linear system:

1. Steepest Descent Method,
2. Conjugated Gradient Method.

Following the example code given in the Notes (code 3.4), implement the two algorithms mentioned above.

### Exercise 2

Verify on concrete examples, that on average the conjugated gradient method requires less steps than the steepest descent method for reaching the solution. You can verify the performances of the algorithms in one of the two following ways:

1. Fix the dimension of the problem and test the algorithms on an ensemble of random matrices. Present your results in the form of a percentage expressing the fraction of problem instances where the Conjugated gradient method required less steps.
2. Create a sequence of random matrices where the dimension  $D$  is growing ( $D=2, 3, 4, \dots$ ). Present your results in graphical form where on the X axis the dimension  $D$  is reported while on the Y axis the number of steps for the two algorithms are reported. The graph will contain two lines relative to each algorithm.