

Fast Iterative Solvers

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Suggested Work on Project 1 - Part 1

1. You should familiarize yourself with the Matrix Market online repository, which can be found at

<http://math.nist.gov/MatrixMarket/>

Matrix Market is a library of matrices, which can be used to benchmark numerical algorithms. We shall frequently use matrices from this repository to test our computer programs.

2. Write a function that reads in a matrix in the Matrix Market exchange format (see <http://math.nist.gov/MatrixMarket/formats.html>), and converts to compressed sparse row format (CSR).

Hints:

- The matrix market format is basically a COO format, as discussed in class, with some additional annotation.
- Code samples are provided on the matrix market web site for reading this format. You may use these examples, and incorporate them into your code.
- You should use no other external code, except that for reading in matrices.
- Note that for symmetric matrices only the lower triangle (including the diagonal) is stored.

3. Write a function that implements a matrix-vector product for the CSR format.

Hints:

- This should work for both non-symmetric and symmetric matrices.
- You need to account for symmetry by modifying the matrix-vector product appropriately
- This can be done by combining CSR and CSC matrix-vector products in an appropriate manner. (Convince yourself that for a matrix stored in CSR format, carrying out the matrix-vector product using the CSC algorithm computes $A^T \mathbf{x}$.)
- In the CSR format that you create, it is highly recommended to make sure that column-dependent entries are ordered in ascending fashion by column.
- You probably want to test your implementation. You may use the matrices `ORSIRR 1` and `s3rmt3m3` from Matrix Market (non-symmetric and symmetric, respectively)