

Applications of Algorithms

Assignment 1

Square Matrix Multiplication

Your assignment is to code up the three different algorithms for square matrix multiplication that are described in Chapter 4 of the textbook (3rd edition) and to run simulations of your algorithms to get empirical evidence for the asymptotic running time of each algorithm.

The three algorithms are:

- (1) SQUARE-MATRIX-MULTIPLY on page 75 (running time $\Theta(n^3)$).
- (2) SQUARE-MATRIX-MULTIPLY-RECURSIVE on page 77 (running time $\Theta(n^3)$).
- (3) STRASSENS-METHOD as described on pages 79 – 82 (running time $\Theta(n^{2.81})$).

The algorithms must be coded in either Java, C, or C++.

The algorithms must be coded from scratch and should not use any packages.

You must test your algorithms on square input matrices over a range of different dimensions.

The run-times of the algorithms on each of the inputs should be recorded.

The results must be plotted on graphs.

Choose a good range of values for the dimensions of the input matrices so that the graphs clearly illustrate the asymptotic growth of the algorithms' running times.

Don't use only matrices with dimension 2^k . (See Exercise 4.2-3 for how to deal with other dimensions).

For each matrix dimension that you use, you should run your algorithm on a number of randomly generated matrices of that dimension and then take the average running time over these matrices.

You must **submit the following**:

- (1) Your source code for the three algorithms (using Java, C or C++).
- (2) A document with the following:
 - (i) Graphs illustrating and comparing the running times of the three algorithms.
 - (ii) A description of how the graphs were obtained (e.g., range of dimensions, number of randomly generated matrices of each dimension, types of matrices, etc.).

You must submit your files to the AA Moodle page by **Friday 16 August at 23h00**.