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 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 from pages 79 – 82 (running time $\Theta(n^{2.81})$)

You must test your algorithms on input matrices over a range of different dimensions and record the times taken by the algorithms. You must plot graphs illustrating your results.

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

Don't use only matrices with dimensions that are powers of 2 - 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 size and then take the average running time over these matrices.

You must submit the following:

(1) Your source code for the three algorithms (using C, C++, Java or python).
(2) A document with the following:
    (i) pseudocode for STRASSENS-METHOD,
    (ii) a solution to Exercise 4.2-3,
    (iii) graphs illustrating and comparing the running time of the three algorithms,
    (iv) a description of how the graphs were obtained (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 **Monday 30 August** at **23h00**.