

ADS Tutorial 2

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Problem 1

Use Strassen's algorithm to compute the matrix product

$$\begin{pmatrix} 1 & 3 \\ 5 & 7 \end{pmatrix} \begin{pmatrix} 8 & 4 \\ 6 & 2 \end{pmatrix}.$$

(Taken from Cormen, Leiserson, Rivest, and Stein (CLRS), exercise 28.2-1).

Problem 2

Describe an algorithm for efficiently multiplying a $(p \times q)$ matrix with a $(q \times r)$ matrix, where p, q, r are arbitrary positive integers. The running time should be $\Theta(n^{\lg(7)})$, where $n = \max\{p, q, r\}$.

Problem 3

Consider the Selection algorithm that we saw in the lectures, but with one of the following two modifications:

- (a) Instead of splitting into groups of size 5, we split into groups of size 3.
- (b) Instead of splitting into groups of size 5, we split into groups of size 7.

For each of the cases (a) and (b), prove an asymptotic bound on the running time of the algorithm using the analysis that was presented in the lectures. What do you observe?