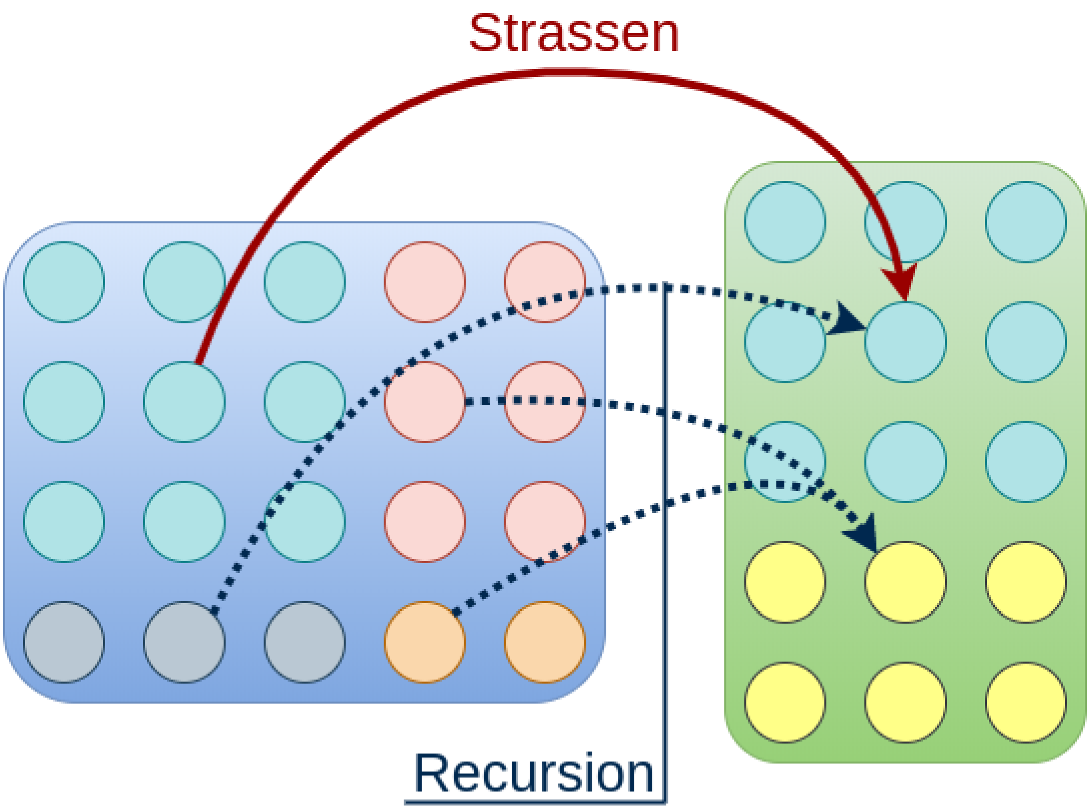
02_homework

Here it can be found a brief explanation about the solution of the exercises. Implementations can be found on the source files of [`AD_strassen_template`]: `strassen.c` and `strassen_optimized.c`. `test.c` has been modified in order to include a version of the code with the improvement suggested on exercise 2. In the current implementation, it has been taken a threshold of `n=100` in order to use the naive algorithm or Strassen's algorithm.

Exercise 1

Generalize the implementation to deal with non-square matrices.

The Strassen's algorithm can not be generalized itself: it can be generalized the recursion structure in order to multiply non-square matrices exploiting Strassen's algorithm. In this case the strategy followed is to identify in both matrices a square maximal block of the same dimensions and then apply Strassen's algorithm to multiply them. The rest of non-square products are multiplied by using recursion, repeating the same process. The next image shows this strategy:



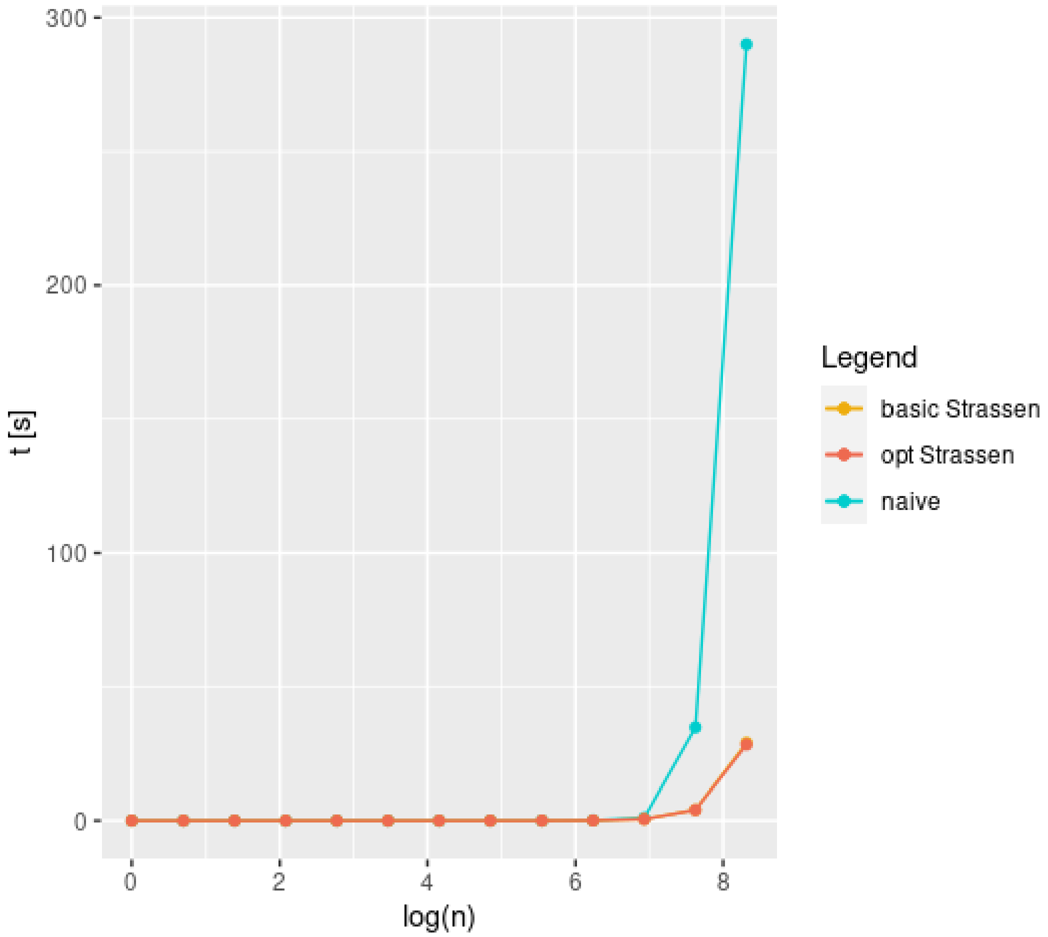
Exercise 2

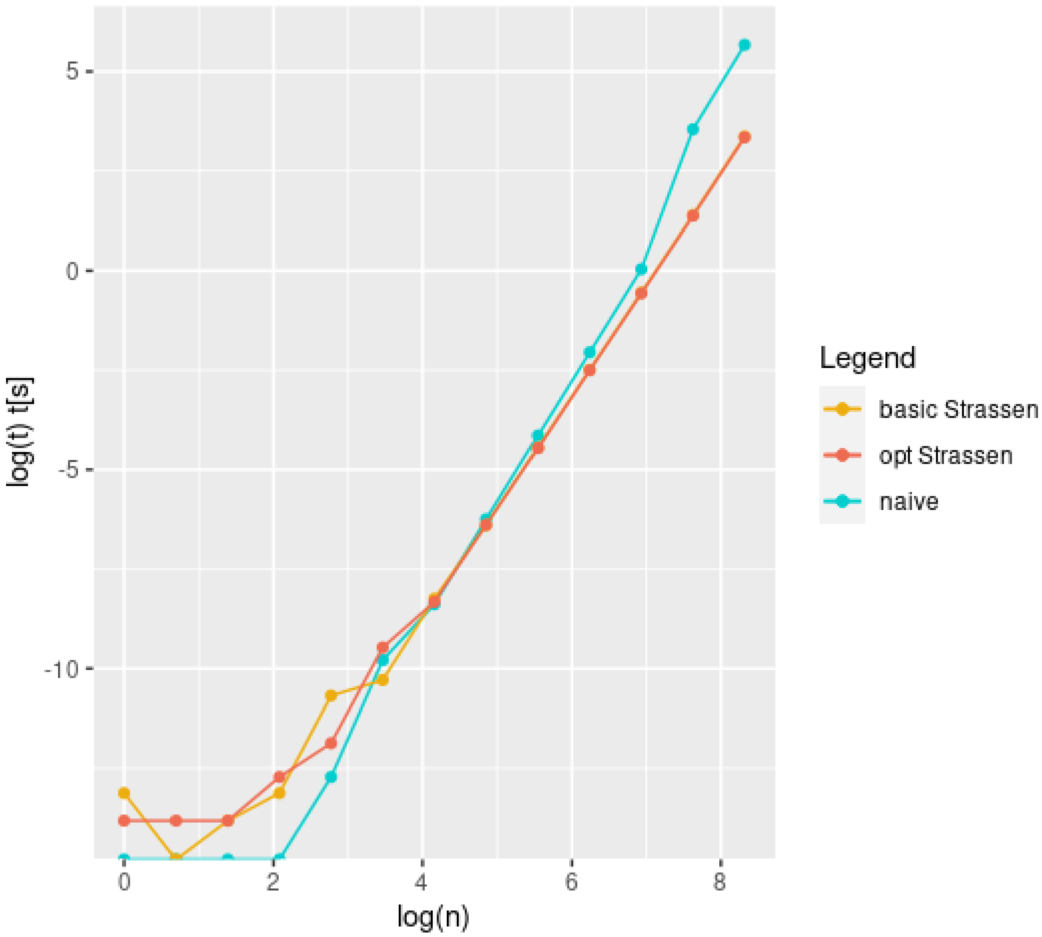
Improve the implementation of the Strassen's algorithm by reducing the memory allocations and test the effects on the execution time.

In the algorithm, there are two arrays of matrices that are used: **S** and **P** (with slides notation). Each one of these matrices are allocated every recursion call. A possibility could be to use the same **P** for all recursion calls. Each call of the algorithm contains 7 further recursion calls which allocates 7 new **P** matrices. The improvement in this case is to use the same **P** matrices for all the 7 calls with one single call to `malloc()`, avoiding the rest of calls.

Performance test

Here there are both semilog and log-log representations:





As it can be seen, it is a notable difference between the naive and Strassen algorithms. However, the difference with the optimized version of the algorithm is such little. Moreover, with a such big value of n, it possibly could be observed some difference.