Excercise 2

Task 1

Give the decision tree of Mergesort for an input array of length 3.

Task 2

Sort the array

$$[7, 3, 8, 1, 5, 2, 4, 6]$$

with Mergesort and Quicksort (median-out-of-three). How many comparisons do both algorithms need?

Task 3

Is there a sorting algorithm and a number $c > 0$ such that the proportion of all inputs of length n, for which the algorithm needs at most $c \cdot n$ comparisons, is at least $\frac{1}{2^n}$?

Task 4

Use the algorithm of Strassen to calculate the following matrix product:

$$\begin{pmatrix} 3 & -2 \\ 1 & 0 \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 \\ -1 & 1 \end{pmatrix}$$