PS Algorithms and Data Structures 2025

Task sheet 1

Task 1

It is given an array A of natural numbers. Design an algorithm in pseudo-code that calculates the mean value of all numbers contained in A. What is the asymptotic running time of your algorithm?

Task 2

Sort the following expressions according to their asymptotic growth. A sorting $f_1, f_2, f_3, \ldots$ is to be created so that $f_i = O(f_{i-1})$. Show the correctness of your sorting using Theorems 2.10 and 2.11 from the slides. Find three Θ equivalences!

- $2^{\log n}$
- $4^{\log n}$
- $n \log\log 2^n$
- $n \log\log n$
- 2^{n+1}
- $\log n$
- n^2
- $2^{\log\log n}$
- $n^{0{,}001}$
- $n \log n$
- $\log_{10} n$
- $\log^{2024} n$

We use the convention of writing the logarithm to the base 2 as ‘log’, i.e., without a base.

Task 3

Prove or disprove:

- $f(n) = \Omega(f(n))$
- $f(n) = \Omega(g(n)) \Rightarrow g(n) = \Omega(f(n))$
- $f(n) = \Omega(g(n)) \wedge g(n) = \Omega(h(n)) \Rightarrow f(n) = \Omega(h(n))$