

Algorithms and Data Structures 1 (AD1)

SML Assignment 1 of Spring 2007

Solutions should be written in English in a *.txt, or *.pdf, or *.html file (no other format is allowed). In a *.txt or *.html file, write `Omega` for Ω , `O` for O , `Theta` for Θ , `n^a` for n^a , and `sqrt(n)` for \sqrt{n} .

A Master Theorem

Solve the following recurrences with help of *Master Theorem* (MT). Explain which case is used, why it applies, and how you used it. If MT does not apply: specify why MT does not work, and use another method for solving recurrences.

1. $T(n) = 4T(\frac{n}{2}) + n^2$
2. $T(n) = T(n - 1) + n$
3. $T(n) = 8T(\frac{n}{3}) + 2^n$
4. $T(n) = 4T(\frac{n}{2}) + \lg n$
5. $T(n) = 3T(\frac{n}{4}) + n \lg n$

B Analysis of list functions

Every recursive algorithm consists of next steps: divide, conquer, and combine. Give efficient recursive SML functions, recurrences for the running time of the functions, and Θ for the recurrences for next primitive SML list functions:

1. last N
2. rev N
3. M @ N

where M and N are lists with m and n elements respectively. Explain which case of *Master Theorem* (MT) is used, why it applies, and how you used it. If MT does not apply: specify why MT does not work, and use another method for solving recurrences.