Exercise sheet 9

February 18, 2020

Exercise 1 *(5 points)*
a) The accession of data structures is often directed by the following recursion:

$$T(n) = \begin{cases} a & \text{for } n = 1 \\ c + T(n/2) & \text{else} \end{cases} \tag{1}$$

Proof that $T(n) = \mathcal{O}(\log n)$.
b) The following recursion is given:

$$T(n) = \begin{cases} a & \text{for } n = 1 \\ 2T(n/2) + n^3 & \text{else} \end{cases} \tag{2}$$

Provide an expression for the runtime $T(n)$ if the recurrence can be solved with the Master Theorem.

Exercise 2 *(10 points)*
A recursive algorithm has the cost of:

$$T(n) = \begin{cases} 1 & \text{for } n = 1 \\ 4T(n/2) + n^2 & \text{else} \end{cases} \tag{3}$$

Provide an expression for the runtime $T(n)$ if the recurrence can be solved with the Master Theorem. Write a program that proves experimentally that this algorithm satisfies the calculated time complexity.

Exercise 3 *(5 points)*
Given is the following recurrence relation:

$$T(n) = \begin{cases} a & \text{for } n \leq 2 \\ T(\sqrt{n}) + a & \text{else} \end{cases} \tag{4}$$

Provide an expression for the runtime $T(n)$ if the recurrence can be solved with the Master Theorem. Hint: Find a suitable substitution for $\sqrt{n}$, such that the Master Theorem can be used.

Commit

Commit your code into the SVN in a new subdirectory **uebungsblatt_09** and a PDF with the solutions of the theoretical tasks in the same folder. Commit your feedback in a text file *erfahrungen.txt* as usual. Please specify: The length of time needed for the exercise. Which tasks have been difficult for you and where did you have problems? How much time did you spend to solve the problems?