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Effiziente Algorithmen und Datenstrukturen I

Aufgabe 1

Theorem 5.1: *Merge Sort takes $O(n \log n)$ time to sort n elements.*

Prove this theorem given the following information. Be aware that the first two terms in the function $T(n)$ consider floor and ceiling on $n/2$.

$$T(1) = \Theta(1)$$

$$T(n) = T(\lfloor n/2 \rfloor) + T(\lceil n/2 \rceil) + \Theta(n)$$

Aufgabe 2

Carry out a Radix Sort on the following set and show the set after each round (i.e. after sorting each place value):

$$\{104, 2, 8, 38, 92, 917, 42, 200, 3, 15, 66, 932, 50\}$$

Aufgabe 3

Consider the Patricia Sort and build the Patricia Tree using lists corresponding to the following set:

$$\{738, 917, 173, 62, 71, 82, 911, 5, 3, 99, 423, 423, 666, 90, 1, 34\}$$

Aufgabe 4

In the BFPRT-algorithm assuming that $m = 5$,

$$T(n) \leq T(\lfloor (3/4)n \rfloor) + T(\lceil n/5 \rceil) + cn$$

for a constant c.

Theorem 5.8: *$T(n) \leq dn$ for a constant d.*

Please prove this theorem.