Universität Siegen
Lehrstuhl Theoretische Informatik
Markus Lohrey

Exercise 4

Task 1

(a) Show that the leaves of a heap of size n are at positions

$$\lfloor n/2 \rfloor + 1, \lfloor n/2 \rfloor + 2, \ldots, n$$

of the array representation.

(b) How many comparisons does build-heap need on a sorted list?

(c) How many comparisons does build-heap need on a reversed sorted list?

Task 2
Sort the following list via Radixsort.

$$[224, 421, 319, 121, 914, 314]$$

Task 3
Show that the median of five numbers can be computed using six comparisons.

Task 4
Does the algorithm "Median of the Medians" run in linear time, if one uses blocks of three or blocks of seven?

Task 5
Which of the following pairs is a subset system, respectively matroid?

(a) $(\{1,2,3\}, \{\emptyset, \{1\}, \{3\}, \{1,2\}\})$

(b) $(\{1,2,3\}, \{\emptyset, \{1\}, \{2\}, \{3\}, \{2,3\}\})$

(c) (E, U), where E is a finite set and $U = \{A \subseteq E \mid |A| \leq k\}$ for a $k \in \mathbb{N}$.

(d) (E, U), where E is a finite set, $\{E_i \mid 1 \leq i \leq k\}$ is a partition of E and

$$U = \{A \subseteq E \mid |A \cap E_i| \leq 1 \text{ for all } 1 \leq i \leq k\}.$$