

**1. Merge sort**

- a) Can be implemented in such way that it becomes unstable
- b) is stable because its complexity is  $\Theta(n \cdot \log(n))$
- c) is not stable because its complexity is  $\Theta(n \cdot \log(n))$
- d) is fast ( $\Theta(n \cdot \log(n))$ ) because it is stable
- e) is more stable than any of the slower  $O(n^2)$  sorts

**2** A certain problem is being solved by the algorithm A. The input data size is  $n$ . In the process of solution the algorithm creates an array which contains  $2n^3$  values and sorts it using Merge sort. What is the asymptotic complexity of the sort in terms of  $n$ ? Write the answer in the most simple form.

**3.** The array contains  $n^{1.5} + \log(n^2)$  values and is being sorted by Merge sort. What is the asymptotic complexity of the sort in terms of  $n$ ?

**4.** Merge sort is sorting the array  $\{8, 1, 7, 6, 4, 2\}$ . In the last iteration of the sort, just before the last Merge operation which merges two halves of the original array the values in the array will be in the order:

- a) 1 7 8 2 4 6
- b) 1 2 4 6 7 8
- c) 8 7 6 4 2 1
- d) 1 2 4 7 8 6
- e) 2 4 6 1 7 8

**5.** The input array of length  $n$  is (by accident) sorted in ascending order. The asymptotic complexity of Heap sort which sorts this particular array is

- a)  $\Theta(n)$ , because Heap sort creates a heap in time  $\Theta(n)$
- b)  $\Theta(n^2)$ , because Heap sort creates a heap in time  $\Theta(n^2)$
- c)  $\Theta(n \cdot \log_2(n))$ , because Heap sort creates a heap in time  $\Theta(n \cdot \log_2(n))$
- d)  $\Theta(n \cdot \log_2(n))$ , because Heap sort processes the heap in time  $\Theta(n \cdot \log_2(n))$
- e)  $\Theta(n)$ , because Heap sort creates and also processes the heap in time  $\Theta(n)$

**6.** Which of the following sequences represents a heap stored in an array?

- a) 1 3 4 2
- b) 1 4 2 3
- c) 1 2 4 3
- d) 2 3 4 1

**7.** The following sequence represents a heap stored in an array. Perform the first step of the sorting phase of the Heap sort, namely

- a) remove the heap top
- b) repair the heap

1 5 2 17 13 24 9 19 23 22

**8.** Sort the given sequence using Heap sort. What is the number of value comparisons during the whole process?

23 29 27 4 28 17 1 24 6 30 19

**9.** Both sorts in the given pair of sorts can be implemented as stable sorts

- a) Heap sort and Insertion sort
- b) Selection sort and Quick sort
- c) Insertion sort and Merge sort
- d) Heap sort and Merge sort
- e) Radix sort and Quick sort

**10.** We have many different data arrays to sort. We sort each data array by Quick Sort (QS) and also by Merge sort (MS). Decide which of the statements is true

- a) QS is always asymptotically faster than MS
- b) MS is always asymptotically faster than QS
- c) sometimes, QS might be asymptotically faster than MS
- d) sometimes, MS might be asymptotically faster than QS
- e) both algorithm have always the same asymptotical complexity