

## ADS practice questions: Sorting and heaps

### Question 1.

How many key comparisons does Mergesort do when the array is sorted at the start?

### Question 2.

(Dijkstra's 'Dutch Flag' Problem:) Each of the  $n$  elements of an array can have the value *red*, *white* or *blue*. Give an algorithm that sorts the array so that it lists all red, all white and then all blue elements (it is possible that a colour is not included). The only operations allowed are check colour and swap two colours (on the basis of their indices). What is the worst case complexity? There is a linear solution!

### Question 3.

Given an unsorted array of  $n$  integers.

1. Give an algorithm that checks whether the array contains two equal elements. What is the worst case complexity?
2. Suppose that it is known that the elements lie in the range 1 to  $2n$ . Give an algorithm with linear worst case complexity.

### Question 4.

Given an array 25, 19, 15, 5, 12, 4, 13, 3, 7, 10. Does this array represent a heap?

### Question 5.

Suppose that an array initially contains the following sequence of letters: C O M P L E X I T Y. Show the array that results after it has been built into a heap (using the *buildHeap* algorithm).

### Question 6.

Use the result from the above question as input for the *heapSort* algorithm.

### Question 7.

An array containing 10 different elements is sorted in decreasing order (so the first element is the largest).

1. How many comparisons need to be done when building a heap from this array?
2. How many comparisons need to be done when this array contains  $n$  elements?
3. Is an array of this nature a worst case, best case or average case, or none of these cases?