

Searchs / Sorts I

Exam Questions

/ 2 P

e) *Sorting algorithms:*

Below you see four sequences of snapshots, each obtained during the execution of one of the following five algorithms: InsertionSort, SelectionSort, ~~QuickSort~~, MergeSort, and BubbleSort. For each sequence, write down the corresponding algorithm.

8	6	4	2	5	1	3	7
<hr/>							
6	4	2	5	1	3	7	8
<hr/>							
4	2	5	1	3	6	7	8

Algorithm:

8	6	4	2	5	1	3	7
<hr/>							
1	6	4	2	5	8	3	7
<hr/>							
1	2	4	6	5	8	3	7

Algorithm:

8	6	4	2	5	1	3	7
<hr/>							
6	8	2	4	1	5	3	7
<hr/>							
2	4	6	8	1	3	5	7

Algorithm:

8	6	4	2	5	1	3	7
<hr/>							
6	8	4	2	5	1	3	7
<hr/>							
4	6	8	2	5	1	3	7

Algorithm:

/ 4 P

g) *Sorting algorithms quiz*: For each of the following claims, state whether it is true or false. You get 1P for a correct answer, -1P for a wrong answer, 0P for a missing answer. You get at least 0 points in total.

Claim	true	false
There exist arrays of length n which can be sorted with BubbleSort after $\Theta(n)$ swaps.	<input type="checkbox"/>	<input type="checkbox"/>

There exist arrays of length n for which the runtime of InsertionSort is $\Theta(n)$.	<input type="checkbox"/>	<input type="checkbox"/>
--	--------------------------	--------------------------

Consider a sequence of n numbers $\{x_1, \dots, x_n\}$, where $0 \leq x_i \leq 1000, \forall i = 1, \dots, n$, is given as input. There exists an algorithm with runtime $O(n)$ which sorts any such sequence.	<input type="checkbox"/>	<input type="checkbox"/>
--	--------------------------	--------------------------

There exist a comparison-based sorting algorithm that can sort any array of length n in runtime $O(n)$.	<input type="checkbox"/>	<input type="checkbox"/>
--	--------------------------	--------------------------

/ 3 P

g) *Sorting algorithms:*

i) Consider the sequence 6, 5, 4, 1, 2, 3. How many swaps does Bubble Sort perform to sort this sequence? *Give the exact number of swaps required.*

ii) Consider the sequence 6, 5, 4, 1, 2, 3. How many swaps does Selection Sort perform to sort this sequence? *Give the exact number of swaps required.*

iii) Let $n \in \mathbb{N}$ be an even number and consider the sequence with the following structure:

$$2, 1, 4, 3, 6, 5, \dots, n, n - 1.$$

How many swaps does Insertion Sort perform to sort this sequence? *Give the exact number, not just the asymptotics.*