

## Theory of Algorithms

**Solution time: 90 min.**

<b>Name:</b>																		
<b>Neptun code:</b>																	<b>Mark:</b>	

### Test (5 scores)

In the below table all the **Statements** are *true* or *false*. Give your answers to the column **Answer**: **0**: false, **2**: true, **1**: you do not know the answer. Leave empty the column **Difference**. The differences between the right and your answers will be written into column **Difference**. *The empty answer means 2 differences*. The score **S** of the test is calculated:  $S=5-D$ , if  $S < 0$  then  $S=0$ , where **D** is the sum of the differences.

	Statements	Ans. 0..2	Diff. 0..2
1.	The interval-tree is not search tree, but it is a red-black tree.		
2.	Using hash tables all dictionary operations take $O(1)$ time.		
3.	$2n = O(n^2)$ .		
4.	An unsorted array can transform to a heap in $O(\lg n)$ time.		
5.	The height of an $n$ -node binary tree is at most $O(\lg n)$ .		
	<b>Sum of the differences</b>		

### Exercises (15 scores)

1. Illustrate the operation of QUICKSORT( $A, 1, 9$ ) call with array  $A$ . Give the contents of the array after each exchange. (3 scores)

$A = \langle 3, 6, 7, 2, 9, 4, 8, 5, 1 \rangle$

2. What red-black tree is built with inserting keys 15, 20, 25, 18, 12, 6, 8, 3, 4 into an initially empty tree? What is the black-height of the result tree? (4 scores)

3. Give  $c$  and  $b$  result tables and the result LCS of LCS-LENGTH with below given  $X$  and  $Y$ . (3 scores)

$X = (1, 0, 0, 1, 0, 1, 0)$

$Y = (0, 1, 0, 1, 1)$

4. Give the transition function  $\delta$  and draw the state-transition diagram of the string-matching automaton for the pattern  $P = \text{ababbab}$  over  $\Sigma = \{a, b\}$ . (3 scores)

5. What  $(d, x, y)$  triple is the result of EXTENDED-EUCLID? Give the table of computing with below given input data? (2 scores)

$a = 35, b = 80$

**Rating:** 0-9:1, 10-12:2, 13-15:3, 16-18:4, 19-20:5.