

Theory of Algorithms

Solution time: 90 min.

Name:																			
Neptun code:																		Mark:	

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.	0	
2.	Using hash tables all dictionary operations take $O(1)$ time.	0	
3.	$2n = O(n^2)$.	2	
4.	An unsorted array can transform to a heap in $O(\lg n)$ time.	0	
5.	The height of an n -node binary tree is at most $O(\lg n)$.	0	
	Sum of the differences		

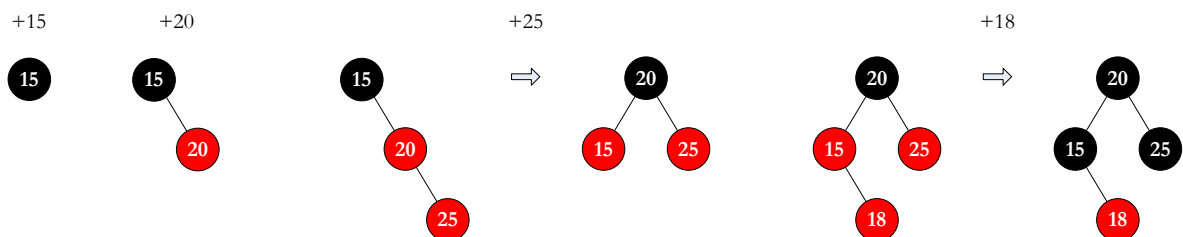
Exercises (15 scores)

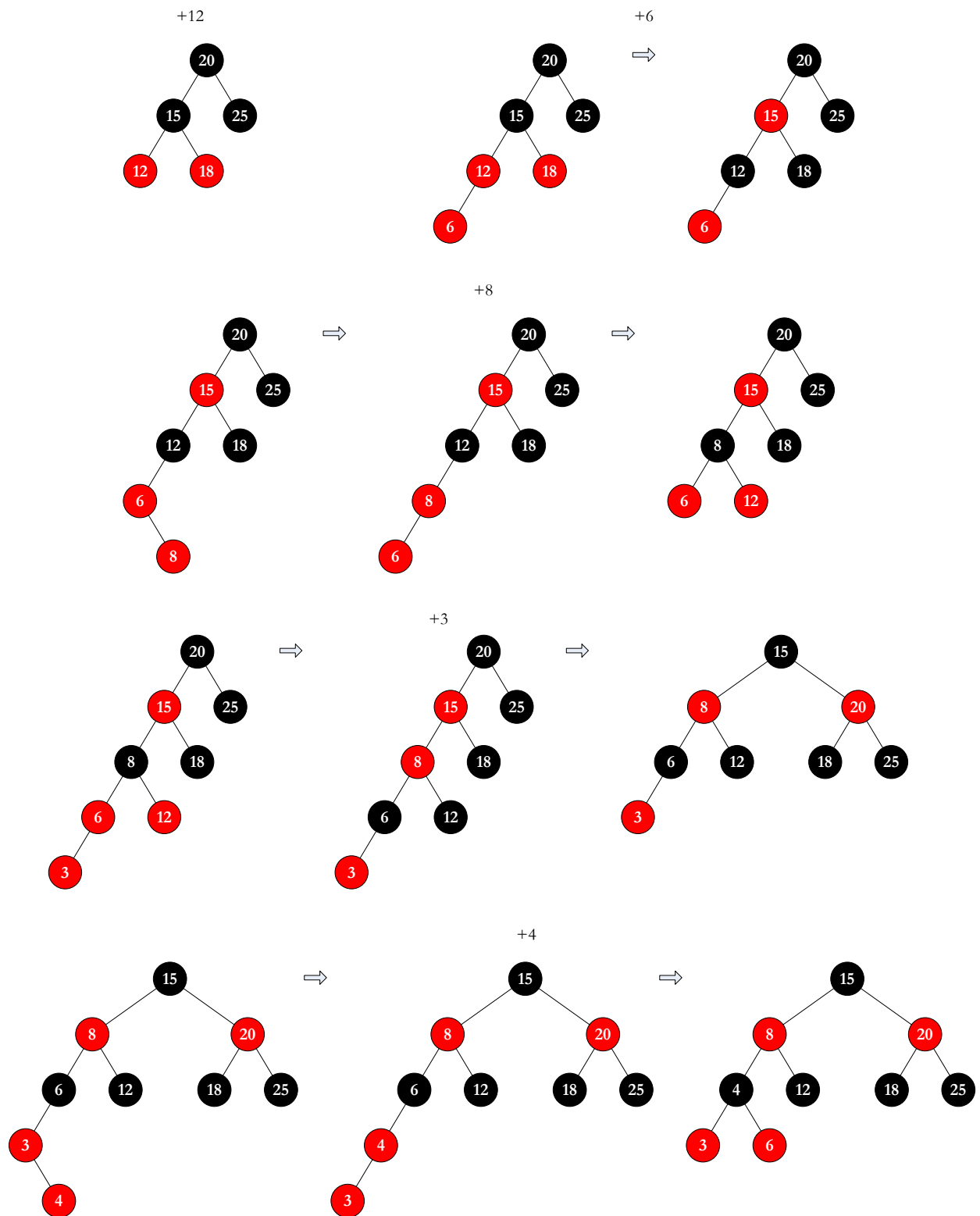
1. Illustrate the operation of QUICKSORT(A , 1, 9) call with array A . Give the contents of the array after each exchange. (3 scores)

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

Initial state: 3, 6, 7, 2, 9, 4, 8, 5, 1
 1. exchange: 1, 6, 7, 2, 9, 4, 8, 5, 3
 2. exchange: 1, 2, 7, 6, 9, 4, 8, 5, 3
 3. exchange: 1, 2, 3, 6, 9, 4, 8, 5, 7
 4. exchange: 1, 2, 3, 6, 4, 9, 8, 5, 7
 5. exchange: 1, 2, 3, 6, 4, 5, 8, 9, 7
 6. exchange: 1, 2, 3, 6, 4, 5, 7, 9, 8
 7. exchange: 1, 2, 3, 4, 6, 5, 7, 9, 8
 8. exchange: 1, 2, 3, 4, 5, 6, 7, 9, 8
 9. exchange: 1, 2, 3, 4, 5, 6, 7, 8, 9

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)





Black height of the tree: 2

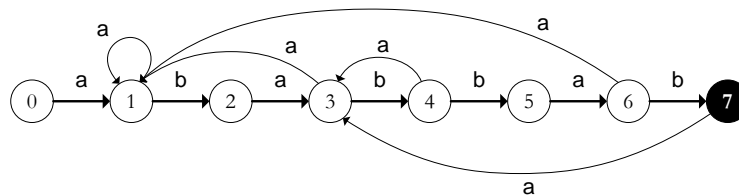
3. Give c and b result tables and the result LCS of LCS-LENGTH with below given X and Y . (3 scores)
 $X=(1, 0, 0, 1, 0, 1, 0)$
 $Y=(0, 1, 0, 1, 1)$

		j	0	1	2	3	4	5
i		y_j	0	1	0	1	1	
0	x_i		0	0	0	0	0	0
1	1		0	↑	↖	↖	↖	↖
2	0		0	↖	↑	↖	↖	↖
3	0		0	↖	↑	↖	↖	↖
4	1		0	↑	↖	↖	↖	↖
5	0		0	↖	↑	↖	↖	↖
6	1		0	↑	↖	↖	↖	↖
7	0		0	↖	↑	↖	↖	↖

LCS=(1, 0, 1, 1)

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

	a	b	P
0	1	0	a
1	1	2	b
2	3	0	a
3	1	4	b
4	3	5	b
5	6	0	a
6	1	7	b
7	3	0	



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

$a=35, b=80$

a	b	$ a/b $	d	x	y
35	80	0	5	7	-3
80	35	2	5	-3	7
35	10	3	5	1	-3
10	5	2	5	0	1
5	0	-	5	1	0

$(d, x, y)=(5, 7, -3)$

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