Last name	
First name	
Group	

$\overline{\text{Grade}}$	
---------------------------	--

# Algorithmics Undergraduate $1^{st}$ year (S2)

Final Exam #2 (P2) 6 June 2016 - 10:00

> (D.S. 307430.1 BW)**Answer Sheets**

1	
2	
3	
4	

Answers 1 (Leonardo trees - 5 points)

1	Graphical	representation	of	4.
1.	Grapincai	representation	OΙ	$A_5$ .

2. Values of  $H_n$ ,  $T_n$ ,  $F_n$  and  $Fib_n$ :

n	$H_n$	$T_n$	$F_n$	$Fib_n$
0				0
1				1
2				
3				
4				
5				
6				

- 3. Give, as functions of n, and potentially the Fibonacci number  $Fib_n$ :

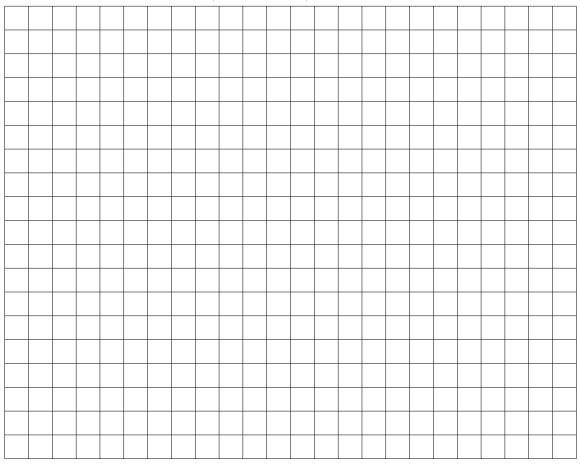
  - $\bullet \ H_n =$   $\bullet \ T_n =$

-					
swers	2 (BST and my	ystery – E	5 points)		
1. Retur	$rned\ results?$				
(a)	call(25, $B_1$ ):				
(b)	call(21, $B_1$ ):				
(c)	call(20, $B_1$ ):				
	call(9, $B_1$ ):				
(())					
	call(53, $B_1$ ):				
(e)					
(e) 2. bst_1	call(53, $B_1$ ):				
(e) 2. bst_1 At th	call(53, $B_1$ ):	B any BST			
(e) 2. bst_1 At th	call(53, $B_1$ ): mystery(x, B) (Integrated are end of part 1:	B any BST			
(e) 2. bst_1 At th	call(53, $B_1$ ): mystery(x, B) (Integrated are end of part 1:	B any BST			
(e)  2. bst_1  At th  (a)	call(53, $B_1$ ): mystery(x, B) (Integrated are end of part 1:	B any BST esent?			
(e)  2. bst_1  At th  (a)	call(53, $B_1$ ):  mystery(x, B) (1 are end of part 1:  What does B repr	B any BST esent?			
(e)  2. bst_1  At th  (a)	call(53, $B_1$ ):  mystery(x, B) (1 are end of part 1:  What does B repr	B any BST esent?			
(e)  2. bst_1  At th  (a)	call(53, $B_1$ ):  mystery(x, B) (1 are end of part 1:  What does B repr	B any BST esent?			
(e)  2. bst_1  At th  (a)	call(53, $B_1$ ):  mystery(x, B) (1 are end of part 1:  What does B repr	B any BST esent? esent?			
(e)  2. bst_1  At th  (a)	mystery(x, B) (In e end of part 1:  What does B reproduces  What does P reproduces	B any BST esent? esent?			
(e)  2. bst_1  At th  (a)	mystery(x, B) (In e end of part 1:  What does B reproduces  What does P reproduces	B any BST esent? esent?			
(e)  2. bst_1  At th  (a)	mystery(x, B) (In e end of part 1:  What does B reproduces  What does P reproduces	B any BST esent? esent?			
(e)  2. bst_1  At th  (a)	mystery(x, B) (In e end of part 1:  What does B reproduces  What does P reproduces	B any BST esent? esent?			

## Answers 3 (Add the size)

### **Specifications:**

The function copyWithSize(B) with B a "classic" binary tree (BinTree()) returns a copy of B with the size specified in each node (BinTreeSize()).



# Answers 4 (Median - 7 points)

1.	B  BST	with $n$	elements	$\operatorname{such}$	that	the	$k^{th}$	element	$(1 \cdot$	$\leq k$	< n	) is i	n the	root	:
----	--------	----------	----------	-----------------------	------	-----	----------	---------	------------	----------	-----	--------	-------	------	---

$$\operatorname{size}(\operatorname{l}(\operatorname{B})) = \operatorname{size}(\operatorname{r}(\operatorname{B})) =$$

2. Abstract definition of the operations nth and median

#### **OPERATIONS**

 $\begin{array}{l} kieme: \, \text{BinaryTree} \times \text{Integer} \rightarrow \text{Node} \\ median: \, \text{BinaryTree} \rightarrow \text{Node} \end{array}$ 

PRECONDITIONS

nth (A, k) is defined if-and-only-if  $1 \le k \le size(A)$  median (A) is defined if-and-only-if  $A \ne emptytree$ 

AXIOMS

 $A \neq \text{emptytree} \Rightarrow median (A) = nth (A, (size (A)+1) \text{ div } 2)$ 

## 3. Specifications:

The function nthBST(B, k) with B a nonempty BST and  $1 \le k \le size(B)$  returns the tree with the  $k^{th}$  element of B as root.

The function median(B) returns the median value of the binary search tree B if it is non empty. Otherwise, it returns None.

