Last name	
First name	
Group	

Grade	

Algorithmics
Undergraduate 1^{st} year (S2)
Final Exam #2 (P2)
6 June 2016 - 10 : 00
(D.S. 307430.1 BW)
Answer Sheets

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2	
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Answers 1 **(Leonardo trees – *5 points*)**

1. Graphical representation of 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:
   - $H_n =$ _____
   - $T_n =$ _____
   - $F_n =$ _____

4. *Prove that the tree A_n is height-balanced.*

***Answers 2* (BST and mystery – *5 points*)**

1. *Returned results?*
   (a) `call(25,` B_1`)` :
   (b) `call(21,` B_1`)` :
   (c) `call(20,` B_1`)` :
   (d) `call(9,` B_1`)` :
   (e) `call(53,` B_1`)` :

2. `bst_mystery(x, B)` (`B` any BST, with distinct elements).
   At the end of part 1:
   (a) *What does `B` represent?*
   (b) *What does `P` represent?*

3. *What does `call(x, B)` do?*

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 such that the k^{th} element ($1 \leq k \leq n$) is in the root:

   size(l(B)) = _____ size(r(B)) = _____

2. *Abstract definition of the operations nth and median*

   OPERATIONS

   kieme : BinaryTree × Integer → Node
   median : BinaryTree → Node

   PRECONDITIONS

   nth (A, k) **is defined if-and-only-if** 1 ≤k≤ *size*(A)
   median (A) **is defined if-and-only-if** A ≠ emptytree

   AXIOMS

   _____

   _____

   _____

   _____

   _____

   A ≠ emptytree ⇒ *median* (A) = *nth* (A, (*size* (A)+1) div 2)

3. **Specifications:**

   The function `nthBST(`B`,` k`)` with B a nonempty BST and $1 \leq k \leq size(B)$ 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`.