Systems Programming
(English group)

Leganés, May 4, 2018 — Second midterm exam (test)
Duration: 20 min — Score: 3 points out of 10 in the exam

There is only one correct option for each question. Each correct answer adds 0.3 points. Each incorrect answer subtracts 0.1 points. Unanswered questions do not add or subtract points.

- Mark the answer to each question with an "X" in the table below.
- If there is no "X" in a question or you mark more than one option, the question is considered unanswered.
- Complete **your personal information** before starting the exam.

Name:	Group:

Signature:

NIA:

	A	B	C	D		A	B	C	D
1					6				
2					7				
3					8				
4					9				
5					10				

1.- Given the following recursive method, which returns in post-order the information of a binary tree, according to its recursive definition and with *root* the root of the binary tree, we can say that this is a...

```
public String toStringPostOrder() {
    if (isEmpty()) {
         return "";
    } else {
         return root.getLeft().toStringPostOrder() +
         root.getRight().toStringPostOrder() +
         root.getInfo().toString() + " ";
    }
}
```

(a) *** Cascade non-linear recursion

(b) Nested non-linear recursion

(c) Tail linear recursion

(d) Non-tail linear recursion

2.- Given the following recursive method, which is the result of m(3,4)?

```
public static int m(int a, int b) {
    if (b == 0)  return 0;
    if (b % 2 == 0) return m(a*a, b/2);
    return m(a*a, b/2) + a;
}
```

(a) *** 81

(b) 0

(c) 7

(d) 12

3.- If we go through a linked list, how do we know if the current node (*current*) is the penultimate (second-to-last) node?

(a) *** If *current.getNext().getNext() == null* returns *true*

(b) If *current == null* returns *true*

(c) If *current.getNext() == null* returns *true*

(d) If *current.getNext().getNext().getInfo() == null* returns *true*

4.- We use an array of capacity N and a linked list with N nodes to store N pieces of information of the same type. Which of these two data structures requires more memory space?

(a) *** The linked list, always

(b) The array, always

(c) The array, but only if the information to be stored is of a non-primitive data type

(d) The linked list, but only if the information to be stored is of a non-primitive data type

5.- Mark the *INCORRECT* statement on stacks and queues:

(a) *** The elements inserted in a stack are extracted in the same order, while those inserted in a queue are extracted in the reverse order

(b) Stacks use the same end for insertion and extraction

(c) Queues use different ends for insertion and extraction

(d) It is possible to implement both stacks and queues with arrays and linked lists

6.- The following method applied on a stack implemented with a linked list, with *top* pointing at the last element (node) inserted in the stack...

```
public void m(E info){
    Node<E> n = new Node<E>(info);
    n.setNext(top);
    top = n;
}
```

(a) *** inserts a new element in the top of the stack

(b) extracts the last inserted element without returning its information

(c) empties the stack

(d) extracts all the elements of the stack, except for the one whose information is info

7.- In a binary search tree, the following information is inserted sequentially, with the information also acting as a key: “Water polo”, “Tennis”, “Football”, “Basketball”, “Handball”, “Athletics”, “Hockey”, How many keys need to be compared to find out that “Baseball” is not stored in this binary search tree?

(a) *** 5

(b) 3

(c) 4

(d) 7

8.- The following elements are inserted into a heap (max-heap) sequentially 4,5,3,2,1,6, and then the element with key 6 is extracted. What is the in-order traversal of the resulting heap?

(a) *** 2,4,1,5,3

(b) 2,3,1,5,4

(c) 2,4,5,1,3

(d) 2,5,1,3,4

9.- How many swaps are needed to sort the following array 2,5,1,3,4 from highest to lowest using Bubble Sort?

(a) *** 6

(b) 5

(c) 7

(d) 8

10.- What sorting algorithm uses a pivot so that all the elements that are lower than the pivot are placed on its left, and all the elements that are higher than the pivot are placed on its right, repeating the process recursively?

(a) *** Quick Sort

(b) Merge Sort

(c) Heap Sort

(d) Insertion Sort