UNIVERSITY OF NEW YORK TIRANA
Komuna e Parisit,Tirana, Albania
Tel.: 00355-(0)4-273056-8 – Fax: 00355-(0)4-273059
***Web Site Address*: http://www.unyt.edu.al**

Data Structures

Spring 2012

Midterm Exam
23/04/2012

Answer the following questions in Section 1 before starting work on practical exercises. You can start working on the laboratory part only after delivering to the instructor the answer sheet for Section 1. You have 180 minutes.

Section 1 – Theoretical arguments

Given the following program with n as parameter:

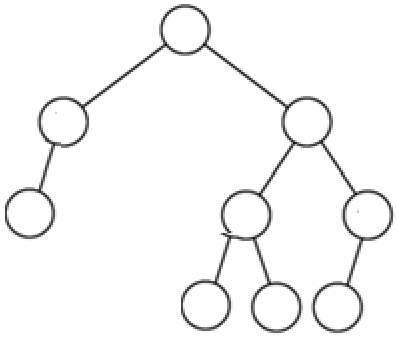
```
0       i = 0; j =0;
1       while(i<1000)
2               for( int k = i; k <= n; k++ ){
3                       i++;
4                       j++;}
5       for( int p = 0; p < n*n; p++ )
6               for( int q = 0; q < p; q++ )
7                       j—;
```

1. **How many times is the instruction 3 executed? (3 points)**
   a. O(N)
   b. O(N^2)
   c. O(N^3)
   d. O(N^4)
   e. none of the above

2. **How many times is statement 7 executed? (3 points)**
   a. O(N)
   b. O(N^2)
   c. O(N^3)
   d. O(N^4)
   e. none of the above

3. **What is the time complexity of the above program? (3 points)**
   a. O(N^4)
   b. O(N^5)
   c. O(N^6)
   d. O(N^7)
   e. none of the above

4. **What is the time complexity of finding the minimum in a random array with N elements? Why? (3 points)**
    a. O(N^2)
    b. O(N^3)
    c. O(N)
    d. O(logN)
    e. None of these
5. **Given the following tree:**



Number the nodes for different visits in the order in which they are visited: pre-order, post-order, in-order, level-order. (5 points).

6. Sketch in Java an algorithm that uses the queue for implementing the level-order visit. (8 points)

Section 2 – Practical section
Each Exercise has 15 points

In the doubly linked list develop the following operators:

1. Clone without duplicates.
   Clone a linked list by removing the duplicates.

   public LinkedList cloneWithoutDuplicates( )

2. At each occurrence of element x in the list, if y is the element before x and z is the one after x, substitute y with x and z with y.

   public void substitute(AnyType x, Comparator<AnyType> cmp)

3. Exchange elements in index1 and index2 with the following condition: if the element in index1 is larger than the one in index2 then swap, otherwise swap the elements in index1+1 and index2+1.

   public void checkAndSwap(index1, index2)

4. Copy elements from index1 to index2, and paste them before index3 preserving the order.
   public void copyAndPaste(index1, index2, index3)

In the Stack and Queue, implement the following operator:

1. Inversion of the stack and the queue. The operators should produce the inverse data structure.
   public Stack invert( )
   public Queue invert( )

Test all the above operators in a class called Test.