UNIVERSITY OF NEW ENGLAND

NAME:_____

STUDENT NUMBER:_____

UNIT NAME: COMP132

PAPER TITLE: Computer Science II

PAPER NUMBER: First and Only

DATE: **Thursday 23 June 2011** **TIME:** **1:45 PM TO 4:00 PM**

TIME ALLOWED: Two (2) hours and fifteen minutes

NUMBER OF PAGES IN PAPER: FOUR (4)

NUMBER OF QUESTIONS ON PAPER: SIX (6)

NUMBER OF QUESTIONS TO BE ANSWERED SIX (6)

STATIONERY PER CANDIDATE:					
0	6 LEAF A4 BOOKS	1	ROUGH WORK BOOK	0	GENERAL PURPOSE ANSWER SHEET
1	12 LEAF A4 BOOKS	0	GRAPH PAPER SHEETS	0	SEE OTHER 'AIDS REQUIRED' BELOW

OTHER AIDS REQUIRED: NIL

POCKET CALCULATORS PERMITTED: NO

TEXTBOOKS OR NOTES PERMITTED: NIL

INSTRUCTIONS FOR CANDIDATES:

- Candidates MAY NOT start writing until instructed to do so by the supervisor
- Please pay attention to the announcements and read all instructions carefully before commencing the paper
- Candidates MUST write their name and student number on the top of this page
- Questions are NOT of equal value
- Answer all questions in the answer booklet provided. Any answers written on this examination paper **will not be marked**
- This examination question paper **MUST BE HANDED IN** with worked scripts. Failure to do so may result in the cancellation of all marks for this examination

REMEMBER TO WRITE YOUR NAME AND STUDENT NUMBER AT THE TOP OF THIS PAGE

STUDENTS SHOULD ATTEMPT ALL QUESTIONS

QUESTION 1 **[40 marks]**

Complete the following statements. Write the answers in your answer booklet.

a) A Java method that calls itself is known as a(n) _____ method.

b) An example of a sorting algorithm which executes in time O(n log n) is _____.

c) The sorting algorithm based on the following pseudocode:

// A[0.. index−1] is sorted

// put A[index] at the right place in A[0..index]

// Now A[0..index] is sorted

is called _____ sort.

d) A list variable 'myList' with the element type 'String' is declared as _____.

e) Assigning an 'int' value to an 'Integer' variable is an example of _____.

f) An upper bound on a generic type parameter can be specified by using the keyword _____.

g) The single method of the interface type 'Comparable' is called _____.

h) The Java compiler converts generic classes to non-generic classes via a process known as _____.

i) The interface type 'List' extends the interface type _____.

j) The method for removing all the elements in a collection is called _____.

k) An example of a class that implements the interface type 'Map' is _____.

l) Unchecked exceptions are those that are derived from the class 'Error' or the class _____.

m) A 'last-in-first-out' data structure is known as a(n) _____.

n) The operation of adding an element to a stack is called _____.

o) A double-ended queue is known as a _____.

p) The binary tree traversal in which nodes are visited in the order root, left, right is called _____.

q) In an AVL tree, the _____ of the subtrees at each node differs by no more than 1.

r) The average time complexity for finding an element in an AVL tree is _____.

s) A binary tree has the _____ property if at each node *N*, the value stored in *N* is greater than the value stored in the parent of *N*.

t) One advantage of linked-lists over arrays is _____.

QUESTION 2 **[12 marks]**

Write a recursive Java method with the signature:

```
public int addFirst(int[] a, int n)
```

which returns the sum of the first 'n' elements of the array 'a'.

QUESTION 3 **[12 marks]**

Write a generic Java class 'ThreeDPoint' which represents a three-dimensional point. The class should hold x, y and z values for the point and should specify that the type of x, y and z must be 'Comparable'. The class should include a method 'nice' which returns 'true' if x, y and z are all equal and 'false' otherwise. You should also include a constructor and any other appropriate methods.

QUESTION 4 **[12 marks]**

a) Write a Java method called 'outputPositive' which outputs the value of its 'int' parameter to 'System.out' if the value of the parameter is greater than zero. If the value of the parameter is less than or equal to zero, the method should throw an exception called 'BadParException'.

b) Write a method which calls 'outputPositive' passing a variable called 'val'. If the call causes an exception, the message 'Value not positive' should be written to 'System.err'.

QUESTION 5 **[12 marks]**

Write a Java program which puts the numbers 1 to 10 into a collection and then retrieves them from the collection (without removing them) to write them out to 'System.out' in reverse order. You should make best possible use of the appropriate interface and class types from the Java Collection Framework.

Question 6 is on page 4

QUESTION 6 **[12 marks]**

The following is an algorithm for constructing a Huffman tree for a string X:

```
Algorithm Huffman(X):
  Input: String X of length n with d distinct characters
  Output: Coding tree for X
compute the frequency f(c) of each character c of X
  initialise a priority queue Q
  for each character c in X do
    create a single-node binary tree T storing c
    insert T into Q with key f(c)
  while Q.size() > 1 do
    f1 := Q.min().key()
    T1 := Q.removeMin()
    f2 := Q.min().key()
    T2 := Q.removeMin()
    create a new binary tree T with left subtree T1 and
      right subtree T2
    insert T into Q with key f1+f2
  return tree Q.removeMin()
```

a) Construct a frequency table for the string:
"finds tongues in trees and books in the running brooks"

b) Construct a Huffman tree for this frequency table.

c) What binary coding does this tree give for the string?

Please remember - This examination question paper **MUST BE HANDED IN**.

Failure to do so may result in the cancellation of all marks for this examination. Writing your name and number on the front will help us confirm that **your** paper has been returned.