NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCE
COMPUTER SCIENCE DEPARTMENT
JUNE EXAMINATIONS 2004

SUBJECT: ADVANCED PROGRAMMING

CODE: SCS4105

INSTRUCTION TO CANDIDATES

Answer any five questions.
Each question carries 20 marks
Total marks 100
**Write all code in the Java programming language**

Time: 3 hours

QUESTION ONE

Implement a binary search tree using a static representation. Include in your class methods to perform the following operations:

(i)	insert, to insert an element into the tree;	[4]
(ii)	del, to remove an element from the tree;	[6]
(iii)	preorder, in order and postorder traversals;	[6]
(iv)	count to return the number of elements in the tree.	[4]

QUESTION TWO

Write a method swaptree which takes a binary search tree as input (using a dynamic representation) and then swaps the left and right children of every node. For example given the diagram on the left as input, the corresponding output would be the tree in the diagram at the right.
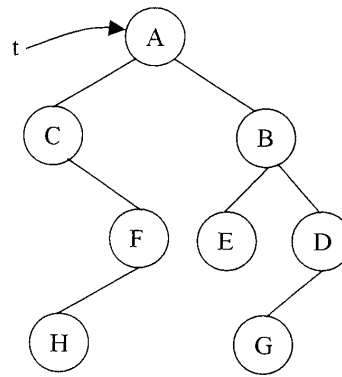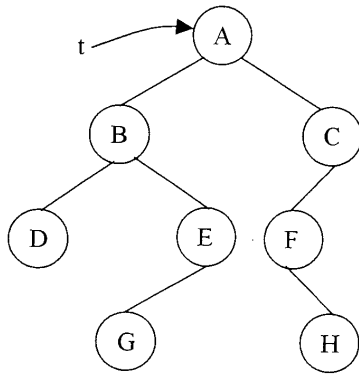
[20]

QUESTION THREE

Provide a general explanation of hashing, including:
  (i)   the purpose,   [2]
  (ii)   hash functions   [6]
  (iii)   approaches to collision resolution.   [4]
  (iv)   Provide an implementation of hashing using one of the collision resolution
          approaches.   [8]

QUESTION FOUR

For the digraph below obtain the following:
  (a)   The in degree and out degree of each vertex.   [4]
  (b)   Its adjacency matrix.   [4]
  (c)   Its adjacency list representation.   [6]
  (d)   Its adjacency multilist representation   [6]
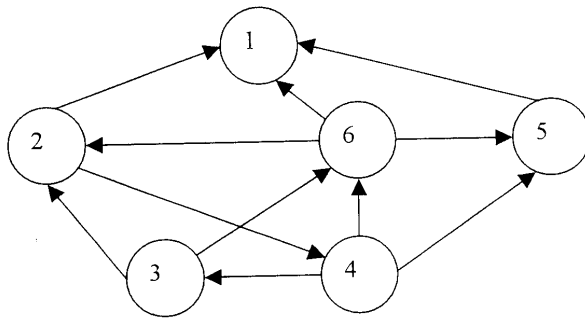
QUESTION FIVE

Compare and contrast the performance of a dynamically represented list and a statically represented list. Consider the following operations in your analysis:
  (i)   insert, to add an element to an ordered list;   [7]
  (ii) append, to add an element to the end of the list,   [6]
  (iii) deleteElement, to remove a specific element from the list.   [7]
Show all appropriate code.

QUESTION SIX

  (i)   Describe how the AVL tree differs from the Binary Search Tree (BST). [4]
  (ii) Show how the treenode declaration must be modified to represent an AVL Tree.   [4]
  (iii) Implement a modification of the BST insert algorithm to perform an insertion into an AVL Tree. Include all appropriate rebalance code. [12]

QUESTION SEVEN

Describe B-Trees with emphasis on B-Trees of order 3. Include in your description the:
  (i)   purpose of such trees   [6]
  (ii) details of the basic operations performed on such trees.   [6]
  (iii) Provide a suitable node declaration for a B-Tree of order 3.   [8]

END OF QUESTION PAPER

GOOD LUCK!