

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

SUBJECT: OBJECT ORIENTED PROGRAMMING II
CODE: SCS5201

INSTRUCTION TO CANDIDATES

Answer any five questions.

Write all code in the Java programming language

Time: 3 hours

QUESTION ONE

- (a) Describe the circumstances under which you might use an AVL tree, and under what circumstances you might use a B-Tree. [5]
- (b) For a B-Tree of order 3, insert the following keys into an empty tree: 7, 10, 19, 23, 14, 8, 4, 5, 6, 3. Describe what happens at each insertion and draw the tree as it evolves. [5]
- (c) Now describe what happens when you delete the following keys from the tree you have just created; 8, 5, 14, 19. [8]

QUESTION TWO

- (a) What is an Abstract Data Type (ADT)? [1]
- (b) List four operations that must be provided for a Sorted List ADT. [1]
- (c) A Java programmer might represent a Sorted List of objects using either an array, a linked list or a Binary Search Tree. [1]
- i) Draw a representative diagram that illustrated how the data is stored in each of these implementations. [3]
- ii) Write Java code for the method that inserts an element into the correct position in the Sorted List for any one of these implementations. [10]

- iii) Compare the Big O time complexity, for both average and worst cases of searching for an element using the array, linked list and Binary Search Tree implementations of a Sorted List.

[5]

QUESTION THREE

Describe a stack together with the operations commonly performed on stacks. Implement a linked representation of a stack. Include the following methods in your implementation: push, a method to add an element to the top of the stack; isEmpty, a method that returns a boolean value indicating whether or not the stack is empty; pop, a method removes the topmost element from the stack and returns its contents.

[20]

QUESTION FOUR

- (a) Given a linked representation of a list, write a method which accepts a list reference as input and returns a list which is organized in the reverse order.

[10]

- (b) Given two linked stack representations, write a method which compares the two stacks and determines whether or not the stacks are equal.

[10]

QUESTION FIVE

- (a) Write a method to determine the number of nodes in a linked representation of a Binary Search Tree.

[10]

- (b) Write a method to determine the number of full nodes in a Binary Search Tree. A full node is a node with two non-empty subtrees.

[10]

QUESTION SIX

Provide a general explanation of how hashing works, including collision resolution techniques.

[8]

Implement insert and retrieve operations with linear probing collision resolution technique.

[12]

QUESTION SEVEN

Explain how does an AVL tree node differ from a Binary Search Tree node. [2]

Explain the balance criterion and the rotation operations performed on an AVL tree. [8]

Write Java code to implement one of the rotation operations described in (b). [10]

END OF QUESTION PAPER



GOOD LUCK!