MURANGA UNIVERSITY COLLEGE

(A constituent College of Jomo Kenyatta University of Agriculture & Technology)

MAIN CAMPUS

ORDINARY UNIVERSITY EXAMINATIONS

2014/2015 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER, AND
FIRST YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREES
OF
BACHELOR OF BUSINESS INFORMATION TECHNOLOGY (BBIT)
AND
BACHELOR OF SCIENCE MATHEMATICS COMPUTER

COURSE CODE: ICS2105

COURSE TITLE: DATA STRUCTURES AND ALGORITHMS

DATE: 21ST APRIL **TIME:** 2 HOURS

INSTRUCTIONS TO CANDIDATES

Question ONE (1) is compulsory
Answer THREE (3) questions

QUESTION 0NE

a) Using a programing language of your choice, show how the following looping structures, can be used with a one dimensional array to display a list of four integers.

[12 marks]

I. While loop
II. For loop
III. Do…while loop

b) Trace the following code, showing the contents of the queue q after each call of the array ArrayQueue q[]; [4 marks]

```
q.enqueue("A");
q.enqueue("B");
q.enqueue("C");
q.dequeue();
q.dequeue();
q.enqueue("D");
q.enqueue("E");
q.enqueue("F");
q.dequeue();
q.enqueue("G");
q.dequeue();
q.dequeue();
q.dequeue();
```

ci) If the binary search is so much faster than the sequential search, why would the latter ever be used? [2 marks]

ii) Explain what happens if the sequential search is applied to an element that occurs more than once in the array. [2 marks]

d) The stack data structure is applied in certain operations of arithmetic expressions, namely the prefix, infix and postfix notations.

i) With an example in each case, differentiate the following notations. [6 marks]

I. Prefix notation
II. Infix notation

III. Postfix notation

ii) Determine whether each of the following arithmetic expression is true of false about the postfix notation. [4 marks]

a. x y+ z+ = x y z+ +
b. x y+ z– = x y z– +
c. x y– z+ = x y z + –
d. x y– z– = x y z —

Question two

ai) Explain what happens when the binary search is applied to an element that occurs more than once in the array. [3 marks]

ii) If the sequential search took 50 ms to run onan array of 10,000 elements, how long would you expect it to take to run on an array of 20,000 elements on the same computer? [2 marks]

bi) A recursive function must have two parts; its basis and its recursive part. With an example, explain what each of these is and why it is essential to recursion. [6 marks]

ii) Explain the possible advantages and disadvantages of implementing a recursive solution instead of an iterative solution. [4 marks]

c) Using the pop and push operational requirements of a stack, write a code of a generic stack interface which should be written as a formalized java interface code with isEmpty() and the size() methods. [5 marks]

Question three

ai) If the binary search took 5 ms to run on an array of 1,000 elements, calculate the time taken to run an array of 1,000,000 elements on the same computer. [2marks]

ii) Explain the reasons why an array is an inefficient data structure for a dynamic sorted list. [3 marks]

bi)Stating the correct order of each operation, differentiate the three fundamental operations found in a stack data structure. [6 marks]

ii) Explain why the queue data structure is referred to as a FIFO structure. [3 marks]

iii) Describe the three fundamental operations of a queue data structure. [3marks]

c) Explain the reasons why an insertion at the front of a linked list is done differently from any other insertion else-where. [3 marks]

Question four

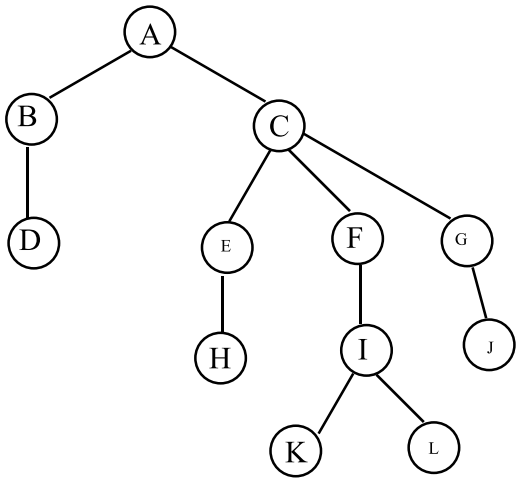
a) Give the order of visitation of the binary tree using the figure below. Make use of the specified traversal algorithm: [12 marks]

i) The level order traversal

ii) The preorder traversal

iii) The inorder traversal

iv) The postorder traversal



bi) Define an index array. 2 marks

ii) If linked lists are so much better than arrays, why are arrays used at all? 2 marks

c) Write a method that uses an iterator to print the contents of a linked list, one object per line. 4 marks