MURANGA UNIVERSITY COLLEGE

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

MAIN CAMPUS

SUPPLEMENTARY 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:29TH OCTOBER 2015 **TIME: 2HOURS**

INSTRUCTIONS TO CANDIDATES

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

Question one

ai) Differentiate direct recursion from indirect recursion. 3 marks

ii) Write and test a recursive function that returns the sum of the squares of the first n positive integers. 4 marks

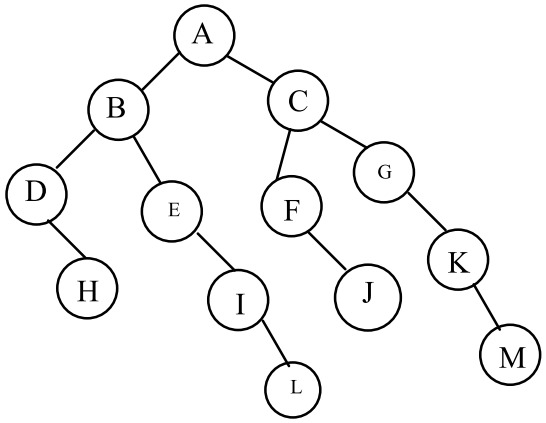
iii) Write and test a recursive function that returns the sum of the first n powers of a base b. 5 marks

b) In a Java platform, all the classes in a Java application form a single tree, called the Java inheritance tree. 2 marks

i) State the root of the Java inheritance tree.

ii) State the name given to the node also called the final class in the Java inheritance tree.

c) For the tree shown below, find; 8 marks



i) all ancestors of node F

ii) all descendants of node F

iii) all nodes in the subtree rooted at F

iv) all leaf nodes

d) 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. 8 marks

i) While loop

ii) For loop

iii) While loop

Question two

ai) Write and test a recursive function that returns the sum of the first n elements of an array.
5 marks

bi) With a relevant example, describe the main shortcoming of using linked lists data structures.
4 marks

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

c) the following program section illustrates operations in a queue. A loop outputs the elements in the queue by calling front() to access the value of the first element. It then deletes the element with a pop(). The loop terminates when the queue is empty.
Study the program and write the correct output. 6 marks

```
queue<int>q;
q.push(2);
q.push(3);
q.push(99);
while(!q.empty())
{
Cout<<q.front()<<" ";
q.pop();
}
```

Question three

ai) Write and test a recursive function that returns the maximum among the first n elements of an array.
8 marks

b) Write a method that uses an iterator to print the contents of a linked list, one object per line.5 marks

ci) Explain why the queue data structure is referred to as a FIFO structure. 4 marks

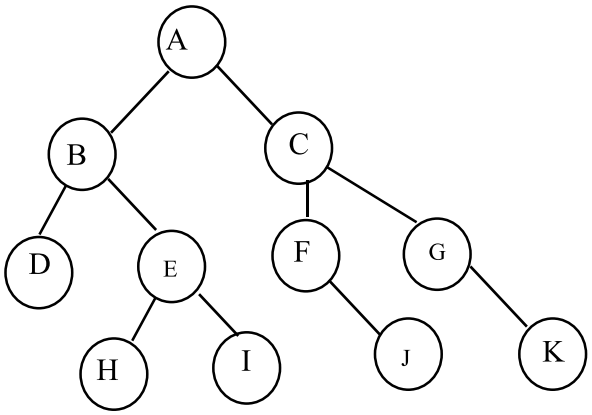
ii) Describe the three fundamental operations of a queue data structure. 3marks

Question four

ai) A stack is a data structure that relies upon some implementation strategies. List the two implementation strategies. 2 marks

ii) 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.
6 marks

b) Use the tree structure below to answer the questions that following.



i) What is the parent of node L? 1mark
ii) What is the depth of this tree structure? 1mark
iii) List the nodes in subtree B 3marks
iv) List all the leaf nodes 2marks
v) Write the order in which nodes are visited in an RNL (in-right) scan of the tree. 5marks