TECHNICAL UNIVERSITY OF MOMBASA

Institute of Computing & Informatics

UNIVERSITY EXAMINATION FOR:

BTIT/SEP 2014Y2S2, BSIT/SEP 2014/J-FT Y2S1, BMCS 14S Y2S2, BSSC 14S Y2S2

ICS 2105/EIT 4213 DATA STRUCTURES & ALGORITHMS

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

Paper 2

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of Five questions. Attempt Question One and any two other

Do not write on the question paper.

Question 1

(a) Define the following terms. (4marks)

(i) Data structures;

(ii) Encapsulation

(iii) Queue

(iv) Abstract Data Type (ADT)

(b) A good programmer must be able to conceptualize a problem. This he can put down as an algorithm. Algorithms can be expressed in terms of pseudo code or Flowcharts

(i) List any four properties of an algorithm (4marks)

(ii) Why is analysis of algorithms important? (2 marks)

(iii) What is the difference between a recursion and iteration in program development? use a high level language examples to make your point clear (4 marks)

(iv) What is the Big Oh Notation? (2marks)

(c) (i) Name one disadvantage of Binary Tree Data structure? (2 marks)

(ii) List any two conditions that should be satisfied when an array type is appropriate for representing an abstract data type. (2 mark)

(d) Searching algorithms are used to read a particular record from a collection of records, write algorithms to demonstrate the following searching techniques.

(i) Selection sort algorithm (4marks)

(ii) Bubble sort (4marks)

(iii) State the most efficient of the two algorithms, justify your answer. (2marks)

QUESTION 2

a) Define an array data structure. [2marks]

b) Justify why one should implement a List over an array ADT. [2marks]

c) An array contains the following items

{45, 76, 57, 25, 89, 21, 15,22}

Using a high level language ,Write a program that contains the following features;

i. Initialize an array called *numbers* with the values given above [2 marks]
ii. Uses a loop to print all the elements in the array the array [6marks]
iii. Write a statement that prints only the first element in the array. [2marks]
iv. `Write a statement that declares a multi-dimensional` array structure called Ali of 3 by 5 elements of type `int.` `[2marks]`
v. Give a statement that refers to the 6^{th} element in array Ali: [2marks]
vi. Give a statement that passes the value of the 5^{th} element of `Ali` to a variable called `K` `[2marks]`

QUESTION 3.

a)Define the following terms. Where necessary draw a diagram to illustrate your answer. [8 marks]

i. Binary tree
ii. Balanced binary tree
iii. A binary search tree
iv. Depth of a tree

b)Given the following numbers:

34 52 9 2 84 6 38 94 65 83

i. Create a binary search tree using the given numbers [4 marks]

ii. Give the result of traversing the tree you have created in *i* above using the *post-order, in-order,* and *pre-order* traversal methods.

[6 marks]

c) List any Two applications for the tree data structure? [2marks]

QUESTION 4.

a)Give two properties that a liner list must adhere to [2 marks]

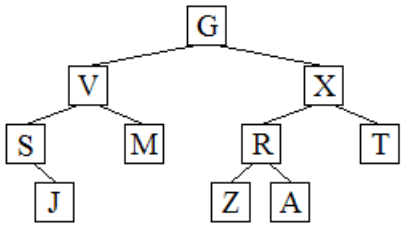
b) Write an algorithm that explains a linear list insertion. [8marks]

c) Write an algorithm that explains the Pop & Push operations in a Stack [8 marks]

d) With an illustration differentiate between a doubly linked list and a Circular list [2marks]

Question Five

(a) List the order in which the contents of the following tree would be visited, for each of the given traversals:



(i) Preorder [9marks]
(ii) In order
(iii)Post order

(b) Consider the following code segment

```
Arr [4]  = {6,4,3,1}
j = 0 , k = 10
While (j < 4) do
    If (arr [j] < k) then
            k =arr [j]
    Endif
    j = j+1
End while
Display k.
```

(i) What does the code display, dry run to show your answer [5marks]

(ii) Using a high level language, Implement the algorithm in to a program [4marks]

(c) Explain Djiksatras algorithm. [2marks]