TECHNICAL UNIVERISTY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

UNIVERSITY EXAMINATIONS FOR DEGREE IN:
BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY
BACHELOR OF SCIENCE IN MATHEMATICS & COMPUTER SCIENCE

ICS 2105: DATA STRUCTURES & ALGORITHMS

END OF SEMESTER EXAMINATION
SERIES: APRIL 2015
TIME: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions.
Attempt question **ONE (Compulsory)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Consider the algorithm represented by the following java program fragment. What value does bar compute? Derive a big oh expression for running time of the method bar

```
Static int bar (int x int n)
{
int sum = 0;
for (int I = I; I < = n; + + i)
sum = sum + i
return {x + sum}
}                                            (4 marks)
```

b) Discuss what the terms time efficiency and space efficiency mean with reference to an algorithm? Explain any other four parameters of concern when it comes to measuring time efficiency of an algorithm? **(8 marks)**

c) Write an algorithm that reads three numbers and prints the largest number **(10 marks)**

d) Draw the flow chart of the above algorithm **(8 marks)**

Question Two

a) Demonstrate your understanding of the divide and conquer paradigm by showing how it is used in one of the sorting algorithms **(4 marks)**

b) The basic operation of the insertion is the insertion of a single element into a sequence of sorted elements so that the resulting sequence is still sorted. The process illustrated below for an array of five integers. The original array is shown in (i)

(i)

(i)	235	45	182	205	390
(ii)	45	235	182	205	390
(iii)	45	182	235	205	390
(iv)	45	182	205	235	390

Write a method that accepts as a parameter an array of integers and uses this algorithm to sort the elements in the array. **(9 marks)**

c) (i) Define the term array **(2 marks)**

(ii) Outline THREE reasons when an array should be the ADT choice to store data **(3 marks)**

d) Write a statement that passes the value of the third element array Ann to a variable called a **(2 marks)**

Question Three

a) Define a linear list ADT **(2 marks)**

b) By use of a high level language write codes, that declares a linear list, the list elements to be 1, 2, 3, 4, 5 and 6. The program should also display the indices with corresponding elements as follows:

V[0] = 1 V[1] = 2 V[2] = 3 V[3] = 4 V[4] = 5 [V5] = 6 **(6 marks)**

c) List and explain any FOUR characteristics used to evaluate a search a graph algorithms **(8 marks)**

d) Analyze the running time of the following graph traversal strategies **(4 marks)**
(i) Depth First Search
(ii) Breath First Search

Question Four

a) Define a binary tree traversal **(2 marks)**

b) Consider the following binary tree

B

c) Write an algorithm that will traverse the tree using the following strategies **(9 marks)**
    (i) Pre-order
    (ii) In-order
    (iii)   Post-order

d) Traverse the binary tree and give the output in the following traversal **(9 marks)**
    (i) Pre-order
    (ii) In-order
    (iii)   Post-order

Question Five

a) Describe the ADT stack and give any THREE examples of application of the ADT in both system and application programming. **(6 marks)**

b) Write a pseudo code that explain the insertion in a stack data structure **(4 marks)**

c) Describe the following stack operations **(4 marks)**
    (i) Pop
    (ii) Push

d) Write a pseudo code that explains the deletion in a stack ADT **(6 marks)**