



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

**DEPARTMENT OF COMPUTER SCIENCE & INFORMATION
TECHNOLOGY**

**UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY
(BSIT MAY11/JAN12/MAY12)**

ICS 2105/EIT 4213: DATA STRUCTURES & ALGORITHMS

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consist of **FIVE** questions

Answer 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) Define the following terms:

(i) Program

(ii) Data structure

(iii) Data type

marks)

(3

b) Briefly discuss the general properties of any algorithm.

(3 marks)

c) (i) What do the term time efficiency and space efficiency mean with reference to an algorithm?

Discuss

(6 marks)

(ii) Why is it that we cannot use real time to measure time efficiency?

(2 marks)

(iii) What are the other parameters of concern when it comes to measuring time efficiency?

(3 marks)

d) (i) Define a list ADT.

(2 marks)

(ii) State any **TWO** advantages of using a list ADT.

(2 marks)

(iii) 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.

$$V[0]=1 \quad V[1]=2 \quad V[2]=3 \quad V[3]=4 \quad V[4]=5 \quad V[5]=6$$

(9 marks)

Question Two

a) (i) Explain what is meant by “divide-and-conquer” strategy.

(6 marks)

(ii) Briefly explain the **THREE** types of run time analysis of an algorithm.

(3 marks)

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

(ii) Compute the complexity of the insertion sort algorithm above.

(2 marks)

Question Three

a) What is a balanced binary tree?

(2 marks)

b) Assume visiting a node is printing its label, what would be the output from the following traversal strategies:

(12 marks)

(i) In order

(ii) Pre order

(iii) Post order

Figure 1

- c) Give any **THREE** importance of using a tree ADT data structure. **(3 marks)**
- d) What is a complete binary tree? Explain using a suitable example. **(3 marks)**

Question Four

- 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. **(6 marks)**
- c) Describe the following stack operations. **(2 marks)**
 - (i) POP
 - (ii) Push
- d) Write a pseudo code that explains the deletion in a stack ADT. **(6 marks)**

Question Five

- a) (i) What is hashing? **(2 marks)**
(ii) List any **TWO** objectives of hashing. **(2 marks)**
- b) (i) Define the term array. **(2 marks)**
(ii) Outline **THREE** reasons when an array should be the ADT choice to store data. **(3 marks)**
- c) Write a statement that store the value 75 in the third element of an array Ann **(2 marks)**
- d) Write a statement that passes the value of the third element of array Ann to a variable called a. **(2 marks)**
- e) Using a high level language, provide codes that implement an array that holds the values (3, 12, 5, 10) and prints the greatest value in the array. **(7 marks)**