



TECHNICAL UNIVERISTY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY (BSIT 12J)

ICS 2105/EIT 4213: DATA STRUCTURES & ALGORITHMS

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2013

TIME: 2 HOURS

Instructions to Candidates:

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 **Four** printed pages

Question One (Compulsory)

- a) Define the following terms:
- (i) Array
 - (ii) List
 - (iii) Queue
 - (iv) Abstract Data Type (ADT) **(8 marks)**
- 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 structured English.
- (i) Define a pseudo code **(2 marks)**
 - (ii) Write a pseudo-code that represent how to swap two numbers **(4 marks)**
- c) Name ONE disadvantage of Binary search? **(1 marks)**
- d) List any THREE properties of an Algorithm. **(3 marks)**

- e) (i) In analyzing algorithms. Why is analysis of algorithms important? List TWO points. **(4 marks)**
(ii) List any THREE factors that determines the running time of an algorithm **(3 marks)**
- f) Recursive functions:
(i) What is recursive function in program development **(2 marks)**
(ii) Name one disadvantage of a recursive function **(1 mark)**
(iii) Briefly explain ONE situation in which a recursive function is most appropriate **(2 marks)**

Question Two

- a) What is the difference between a recursion and iteration in program development? Use a structured language to demonstrate the difference **(6 marks)**
- b) Demonstrate your understanding of the Divide and conquer paradigm by showing how it is used in one of the sorting algorithms. **(6 marks)**
- c) Using the diagram below, show the output after the Depth-first search and Breadth-first search algorithm have been used (You are searching for G) **(6 marks)**

- d) Define a tree ADT **(2 marks)**

Question Three

- a) Discuss any FOUR attributes of a good program. **(4 marks)**
- b) List any THREE conditions that should hold when to use an array structure **(3 marks)**
- c) Why are array structures efficient compared to dynamic (linked) structures **(3 marks)**
- d) Give THREE example of uses of tree ADT **(3 marks)**
- e) Describe what a stack is **(3 marks)**

- f) Summarize in form of a table the Algorithm Time complexity for the following sorting by filling the table below: **(4 marks)**

Sort Algorithm	Time Complexity
(i) Bubble Sort	
(ii) Insertion Sort	
(iii) Quick Sort	
(iv) Selection Sort	

Question Four

- a) A doubly linked list is a list where each link points to both its successor and its predecessor. Define the data structure needed to implement this. **(2 marks)**
- b) Write a pseudo code to show your understanding of the bubble sort. **(4 marks)**
- c) In algorithm analysis,
(i) What is the rationale of using the Big-O Notation **(2 marks)**
(ii) Give TWO limitations one faces in conducting complexity analysis of algorithms especially using mathematical analysis. **(2 marks)**
- d) Write an algorithm (pseudo code or structured English) to represent the dequeue operation in a queue data structure. **(4 marks)**
- e) Show the output of:
(i) Pre-order
(ii) In_order
(iii) Post-order traversal of the binary tree below tree

Question Five

- a) Describe a non-linear data structure. Give examples and operations in which you might perform on such a structure. **(3 marks)**
- b) Write codes that define an array data structure shown below, the array should print the array index and elements as described.

X[0] = 341; X[1] = 127; X[2] = 983; X[3] = 566; X [4] = 289 **(7 marks)**

- c) Consider the following statements in the pseudo code below, what list of elements would be in the array B. **(5 marks)**

```
Declare B[6] as integers
Index = 0
DO WHILE Index <6
    B[index] = index *2
    Index = index +1
```

END DO

- d) Describe the fundamentals properties of an ADT **(4 marks)**
- e) What is an atomic structure **(1 marks)**