CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF DIPLOMA IN

COMPUTER SCIENCE

COSC 0243: DATA STRUCTURES AND ANALYSIS OF ALGORITHM

STREAMS: DIP COMP SCI. **TIME: 2 HOURS**

DAY/DATE: MONDAY 4/12/2017 **2.30 P.M – 4.30 P.M**

INSTRUCTIONS:

- **Answer question ONE and TWO other questions**
- **Do not write anything on the question paper**
- **This is a closed book exam, no reference materials are allowed in the examination room**
- **There will be NO use of mobile phones or any other unauthorized materials**
- **Write your answers legibly and use your time wisely.**

SECTION A

Question one (30 marks)

a. Describe four properties that an algorithm should possess [4 marks]

b. Giving an example distinguish the following terms.

i. Linear vs Non-linear data structures [2 marks]

ii. Decreasing order and non-increasing order [2 marks]

iii. Data structure [2 marks]

c. State any four application areas of data structures [4 marks]

d. List four benefits of using Abstract Data Type (ADTs), giving a short explanation of each. [4 marks]

e. Distinguish between a binary tree and a binary search tree [4 marks]

f. Define best case, average case and worst case time complexities of a program. [6 marks]

g. Differentiate between compilation time and run time of an algorithm [2 marks]

SECTION B

Question two (20 marks)

a. Discuss the following asymptotic notations that are used in data structures and algorithms.
   i. Big ‘Oh’ notation [2 marks]
   ii. Define ‘Omega’ [2 marks]
   iii. Define ‘theta’ [2 marks]

b. Draw a binary-tree of order 4 created by inserting the following data arriving in sequence. 1, 5, 6, 8, 11, 13, 18, 20, 7, 9 [6marks]

c. Develop a hash table of size 20 to store the following items.
   1, 2, 42, 4, 12, 14, 17, 13, 37. [8 marks]

Question three (20 marks)

a. Draw a picture of a {linked list, circular linked list, and doubly linked list} with nodes containing the integer values 1, 16, 27, 92. Do not use any dummy nodes. [10 marks]

b. Define what a stack is and describe four operations that can be performed on a stack. [6 marks]

c. What is a greedy algorithm, give two examples of greedy algorithms [4 marks]

Question four (20 marks)

a. Sorting refers to arranging data in a particular format. Differentiate the following sorting techniques using the following data. 14, 33, 27, 10, 35, 19, 42, 44.
   i. Bubble sort [4 marks]
   ii. Insertion sort [4 marks]
   iii. Selection sort [4 marks]
   iv. Merge sort [4 marks]
   v. Shell sort [4 marks]

Question five (20 marks)

a. Briefly describe the following graph concepts
   i. Vertex [2 marks]
   ii. Edge [2 marks]

iii. Weight [2 marks]

b. State and briefly explain two basic operations on a queue [4 marks]

c. Differentiate between a full binary tree and complete binary tree. [4 marks]

d. Below is a tree associated with an arithmetical expression. Write its In-order traversal, Pre-order traversal and Post-order traversal [6 marks]