

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF

DIPLOMA IN COMPUTER SCIENCE

COMP 0241: DATA STRUCTURES AND ALGORITHMS

STREAM: DIP (COMP. SC) Y2S2

TIME: 2 HOURS

DAY/DATE: TUESDAY 9/12/2014

2.30P.M – 4.30 P.M

INSTRUCTIONS:

- Answer QUESTION ONE and any other TWO questions.
- This is a CLOSED BOOK exam. No reference materials are allowed in the exam room.
- No mobile phone allowed in the exam room (*make sure to switch it off and leave it with the invigilator if you carried one*).
- Write your answers legibly and use your time wisely

SECTION A: COMPULSORY

QUESTION ONE – COMPULSORY (30 MARKS)

- (a) State FIVE characteristics of algorithms (5 Marks)
- (b) Show that any sorting algorithm that moves five elements only one position at a time must have a time complexity of at least $O(n^2)$ where 'n' is the number of elements. (4 Marks)
- (c) Define the following terms (6 Marks)
- Data Structure
 - Abstract Data Type
 - Algorithms
 - Stack
 - Array
 - List
- (d) Describe two algorithms to show the **Push()** and **Pop()** operations on a stack (4 Marks)
- (e) List TWO Applications of a queue (2 Marks)

- (f) Explain the difference between: (6 Marks)
- vii. Linear and Non-linear Structures
 - viii. Arrays and Records
 - ix. Queue and Priority Queue
- (g) Write C Code that declares an array to store six elements (3 Marks)

SECTION B: ANSWER ANY TWO QUESTIONS

QUESTION TWO (20 Marks)

- (a) Explain each of the following types of lists (6 Marks)
- i. Single-linked lists
 - ii. Double-linked lists
 - iii. Circularly-linked lists
- (b) Consider a 25x4 two dimensional matrix array score of the COMP 0241 class. Suppose the base is 200 and there are 4 words per memory cell. Compute the address for the cell score [12,3] if:
- iv. The Programming Language stores elements in Row Major (5 Marks)
 - v. The Programming Language stores elements in Column Major (5 Marks)
- (c) List two advantages of an array (2 Marks)
- (d) List two disadvantages of an array (2 Marks)

QUESTION THREE (20 MARKS)

- (a) Give two applications of a stack (2 Marks)
- (b) With the aid of a diagram illustrate two examples of non-linear structures (6 Marks)
- (c) Differentiate between sparse array and sparse matrix (2 Marks)
- (d) Write an algorithm to create the matrix $C=A+B$ where A and B are two sparse matrices. Note: Your algorithm should leave the matrices unchanged and set up new matrix in accordance with this data representation. (6 Marks)

(e) List four operations that can be performed on linear structures. (4 Marks)

QUESTION FOUR (20 Marks)

(a) State ONE advantage and ONE disadvantage of the following sorting algorithms (6 Marks)

- i. Bubble Sort
- ii. Selection Sort
- iii. Quick Sort

(b) Consider the following sorted array of integers

Index	1	2	3	4	5	6	7	8
Value	1	6	9	10	12	17	23	24

vi. Suppose you are searching for the value 12 indicate the steps you would take to perform a binary search for 12. (8 Marks)

(c) Write a C Program to sort a list of 5 numbers using Bubble Sort (6 Marks)

QUESTION FIVE (20 Marks)

(a) Write an algorithm to perform a sorted linear search (4 Marks)

(b) List four operations that can be performed on a queue (4 Marks)

(c) Write a C Code to represent a queue of 5 integers using an array (4 Marks)

(d) Give FOUR differences between arrays and pointers (4 Marks)

(e) According to the Big Oh Notation, algorithms can be categorized in four ways. List them. (4 Marks)
