



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST SEMESTER EXAMINATION FOR DEGREE IN BACHELOR OF SCIENCE IN COMPUTER SCIENCE

SIT 204: DATA STRUCTURES AND ALGORITHMS

Date: 8/8/2016

Time: 2:00- 4:00

INSTRUCTIONS

This paper consists of FIVE questions.

Answer QUESTION ONE and other TWO questions in this paper.

QUESTION ONE

- (a) (i) Outline **two** reasons for using data structures in a program. (2 marks)
- (ii) Explain each of the following terms: (8 marks)
- I. Structured data type;
 - II. Linear data structure;
 - III. Abstract data type;
 - IV. Data hiding.
- (b) (i) Distinguish between *constructor* and *destructor* as used in data structures. (4 marks)
- (ii) Explain **three** operations that could be carried out on a stack. (3 marks)
- (c) (i) A programmer would like to use a data structure in a program. Explain **three** factors he could consider when choosing a data structure to use. (6 marks)
- (ii) Write a C language statement that may be used to declare a two dimensional array. (2 marks)

- (d) The following is a list of students' marks in a certain unit. Use it to answer the questions that follow.

58, 64, 40, 70, 45, 63, 49

- (i) Construct a binary tree; (3 marks)
- (ii) Write the output generated when the tree in (i) is traversed using:
 - I. Preorder strategy; (2 marks)
 - II. Inorder strategy. (2 marks)

QUESTION TWO

- (a)
 - (i) Outline **two** limitations of using array data structure. (2 marks)
 - (ii) Write a program in C language that could be used to determine the sum of 50 integers. Use array data structure. (4 marks)
- (b)
 - (i) The following is a list created by a student during a Data Structures and Algorithm class. Use it to answer the question that follows.

List = {45, 70, 56, 48, 78, 80, 36, 62}

Write the output when each of the following operations are carried out on the list.

- I. Head(Tail)(List)
 - II. Tail(Tail)(List) (4 marks)
 - (ii) Distinguish between *malloc* and *calloc* functions as used in linked lists. (4 marks)
- (c) Explain the most suitable data structure for each of the following scenarios: (3 marks)
 - (i) Marking students' examination answer booklets;
 - (ii) Maintaining computers in a busy organization;
 - (iii) Storing data about a single entity.
- (d) Write a pseudocode that could be used to implement quick sort. (5 marks)

Question Three

- (a)
 - (i) Explain the term *heap* as used in Data Structures and Algorithms. (2 marks)
 - (ii) Given data items 56, 42, 30, 20, 36, 49, 19
Create a minimum heap for the data items. (3 marks)
- (b)
 - (i) Describe the merge sort as used in data structures. (3 marks)

- (ii) Using selection sort organize the following data items. (3 marks)

89	57	42	29	37
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- (c) A supermarket stores its items details in a database. The database contains fields such as *ItemNo*, *ItemName*, *Description* and *ItemSize*.
Using C programming language create a data structure that could be used to store the item details in the database. (3 marks)
- (d) Explain **three** types of time complexity. (6 marks)

QUESTION FOUR

- (a) (i) Distinguish between *complete* and *balanced* trees as used in data structures. (4 marks)
- (ii) Represent the expression $(w - y) / (x + z) * p$ in an expression tree. (3 marks)
- (b) Write a *pseudocode* that may be used to remove an item into a queue. (4 marks)
- (c) Compare *heap* and *tree* data structures. (3 marks)
- (d) Joan, a computer scientist used an algorithm in a program. Describe **three** characteristics of algorithms she must have considered. (6 marks)

QUESTION FIVE

- (a) (i) Outline **two** mathematical notations used to classify algorithms. (2 marks)
- (ii) Describe **three** classes of algorithms used in computer science. (6 marks)
- (b) (i) Compare *graph* and *stack* data structures in terms of:
I. memory utilization; (2 marks)
II. speed of execution. (2 marks)
- (ii) During a programming lesson students were required to carry out a performance analysis of a program they had created. Outline **four** importance of this exercise. (4 marks)
- (c) A student represented data using a graph. Describe **two** strategies he could use to traverse the graph. (4 marks)