



# **THE CO-OPERATIVE UNIVERSITY OF KENYA**

**END OF SEMESTER EXAMINATION DECEMBER -2022**

**EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER  
SCIENCE, INFORMATION TECHNOLOGY  
(YR III SEM I)**

**UNIT CODE: BCSC 3128**

**UNIT TITLE: DESIGN AND ANALYSIS OF ALGORITHMS**

**DATE: WEDNESDAY, 21<sup>ST</sup> DECEMBER, 2022**

**TIME: 2:00 PM – 4:00 PM**

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## **INSTRUCTIONS:**

- **Answer question ONE (compulsory) and any other TWO questions**

## **QUESTION ONE**

- (a) Declare an Array in C, named balance of data type double for ten elements as implied in the Design and analysis of Algorithm. **(3 Marks)**
- (b) Discuss any **THREE** classification of Data Structures as implied in the Design and analysis of Algorithm. **(3 marks)**
- (c) You have been invited to give a talk to diploma students in Cooperative University, Nairobi campus. Your presentation ought to cover the different categories of the compound data structures. Discuss **THREE** operations of one of the compound data structure category you presented. **(3 marks)**
- (d) You are doing a group project presentation on sorting techniques in the Design and analysis of Algorithm. Answer the following question.
- Explain what you understand by sorting techniques in the Design and analysis of Algorithm. **(2 marks)**
  - Describe one type of sorting algorithm you are familiar with. **(2 marks)**
  - Provide an Algorithm for the sorting algorithm you provided above and its time complexity. **(3 marks)**
- (e) Describe the Selection Sort by aid of an Algorithm. **(3 marks)**
- (f) Discuss why Insertion Sort is considered as an incremental algorithm. **(3 marks)**
- (g) Study the algorithm program provided below

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### **Program Statements**

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```
for k =1 to n do
    x = x + 2;
end;
```

Provide the total frequency count of the above program. Show how you arrived at the total frequency count. **(3 marks)**

- (h) Define a tree as implied in the Design and analysis of Algorithm. **(2 marks)**
- (i) Explain any difference between Trees and the Breadth First Traversal for a Graph as implied in the Design and analysis of Algorithm. **(3 marks)**

### **QUESTION TWO**

- (a) Explain any **TWO** possible ways of representing Binary Trees as implied in the Design and analysis of Algorithm. **(4 marks)**
- (b) Describe any **THREE** methods of traversing a Tree as implied in the Design and analysis of Algorithm **(3 marks)**
- (c) Discuss the **THREE** advantages of Linked List over Arrays as implied in the Design and analysis of Algorithm. **(3 marks)**
- (d) Explain any **TWO** types of Linked Lists in the Design and analysis of Algorithm. **(4 marks)**
- (e) Explain **TWO** Operations of the stack data structure in the Design and analysis of Algorithm **(4 marks)**
- (f) Describe **TWO** applications of Depth First Search in the Design and analysis of Algorithm. **(2 marks)**

### **QUESTION THREE**

- (a) Present **FOUR** properties of Binary Trees as implied in the Design and analysis of Algorithm **(4 marks)**
- (b) Illustrate a Balanced Binary Tree as implied in the Design and analysis of Algorithm. **(4 marks)**
- (c) Pointers are an intimate part of C and separate it from more traditional programming languages. Pointers make C more powerful by allowing a wide variety of tasks to be accomplished. Highlight **THREE** functions that Pointers enable us to achieve in the Design and analysis of Algorithm. **(3 Marks)**
- (d) You are doing a project group presentation on different approaches to design an Algorithm. Answer the following questions based on your project presentation.
- i. Explain the structure of an Algorithm you alluded to in your presentation. **(3 marks)**
- ii. Discuss any **THREE** properties of the Algorithm presented to your audience. **(3 marks)**
- Explain any **THREE** practical design issues of the Algorithm you presented. **(3 marks)**

### **QUESTION FOUR**

- (a) Represent the algorithm/pseudo code of the insertion sort. **(3 marks)**
- (b) Explain any **THREE** kinds of problems in the community that can be solved by the algorithms. **(3 marks)**
- (c) Discuss why an Algorithm is considered as a technology in Data Structures and Algorithms. **(2 marks)**
- (d) Provide any **THREE** reasons why we analyze algorithms. **(3 marks)**
- (e) Describe any **THREE** common computing times used in analyzing algorithms. **(3 marks)**

(f) Study the algorithm program provided below.

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**Program Statements**  
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```
for j = 1 to n do
  for x = 1 to n do
    x = x + 2;
  end
end;
```

Provide the total frequency count of the above program. Show how you arrived at the total frequency count. **(2 marks)**

(g) Discuss **TWO** differences between Recursion and Iteration Algorithm. **(2 marks)**

(h) Describe the Time Complexity of Linear Search algorithm. **(2 marks)**