JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF ACTUARIAL SCIENCE WITH IT

3RD YEAR 2ND SEMESTER 2023/2024 ACADEMIC YEAR

MAIN CAMPUS

COURSE CODE: ITB 9302 / SCS 318

COURSE TITLE: DESIGN AND ANALYSIS OF ALGORITHMS

DATE: 26/04/2024　　　　　　　　　　**EXAM SESSION: 9.00 – 11.00 AM**

TIME: 2　HOURS

Instructions:

1. **Answer QUESTION ONE (Compulsory) and any other two questions**
2. **Tick the most correct alternative in Section A.**
3. **Candidates are advised not to write on the question paper.**
4. **Candidates MUST hand in their answer booklets to the invigilator while in the examination room.**
5. **Mobile phones are NOT allowed in the examination room.**

QUESTION ONE 30 MARKS

a) What do the term time efficiency and space efficiency mean with reference to an algorithm. Discuss. (6 marks)

b) What are the differences between merge sort and quick sort (6 marks)

c) Write a Java method that repeatedly selects and removes a random entry from an array until the array holds no more entries. (3 marks)

d) Compute the running time of the following code segment (6 marks)

```
for(int i =1;i<=n;i++)
{
    for(int j =1;j<=n;j++)
    {
        for(int k =1;k<=n;k++)
        {
            System.out.println("k");
        }
    }
}
```

e) Explain the three types of tree traversals (9 marks)

QUESTION TWO 20 MARKS

a) State Master's Theorem. (5 marks)

b) Briefly explain about recurrence relation with an example. (5 marks)

c) What is Quick sort and Write the Analysis for the Quick sort? (5 marks)

d) Explain Divide and Conquer Method. (5 marks)

QUESTION THREE 20 MARKS

a) Define a binary search tree (BST). Describe the conditions that a binary tree must satisfy to be considered a BST. Provide an algorithm to find the minimum value in a BST.
(10 marks)

b) Explain the concept of a doubly linked list. Compare it with a singly linked list, highlighting advantages and disadvantages. Provide a code snippet for inserting a node at the end of a doubly linked list. (10 marks)

QUESTION FOUR 20 MARKS

a) Explain in detail about Traveling Salesman Problem using exhaustive search. (5 marks)

b) Define multistage graph. Give Example. (5 marks)

QUESTION FIVE 20 MARKS

a) Describe the Breadth-First Search (BFS) algorithm for traversing a graph. Provide the key steps, pseudocode, and discuss its applications. Analyze the time complexity of BFS.   . (5 marks)

b) Compare and contrast QuickSort and MergeSort. Include their time complexity analyses, advantages, and situations where one might be preferred over the other. Provide pseudo-code for both algorithms. (5 marks)