



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND  
TECHNOLOGY**

**SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS**

**UNIVERSITY EXAMINATION FOR THE DEGREE IN BUSINESS  
INFORMATION SYSTEMS AND THE DEGREE IN INFORMATION AND  
COMMUNICATION TECHNOLOGY**

**2<sup>ND</sup> YEAR 1<sup>ST</sup> SEMESTER 2023/2024 ACADEMIC YEAR**

**MAIN CAMPUS**

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**COURSE CODE: ITB 1207**

**COURSE TITLE: DATA STRUCTURES AND ALGORITHMS**

**EXAM VENUE: LAB 15**

**STREAM: BIS, ICT**

**DATE: 14/1/25**

**EXAM SESSION: 14-16.00 PM**

**TIME: 2 HOURS**

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**INSTRUCTIONS**

Answer question ONE and any other TWO questions

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**QUESTION ONE (30 MARKS)**

- a) i) Define the following data structures  
**One- dimensional Array** (2 Marks)  
**Stack** (2 Marks)
- ii) Write an algorithm for sorting the following numbers in ascending order:  
**0, 8 , 2** (4 Marks)
- b) Consider the following numbers: **5, 2, 6, 3, 7**
- i) State the pre-condition for a binary search to take place. (2 Marks)
- ii) Using the numbers above demonstrate how a binary search technique would be used to search for the element **3** (8 marks)
- c) i) Using the pseudo code, write algorithm for inserting the data at the end of a linked list data structure (4 Marks)
- ii) How can a stack data structure be dynamically created in the main memory?. (4 Marks)
- iii) With an example, differentiate between POSTFIX and INFIX expression (4 Marks)

**QUESTION TWO (20 MARKS)**

- a) Write an algorithm for computing the Fibonacci function (8 Marks)
- b) Constructing a binary tree from the expression:  $(A+B+C*D)-(A/B-CD+E)$ , hence illustrate the in-order and post- traversals (12 Marks)

**QUESTION THREE (20 MARKS)**

- a) Write the algorithm for inserting the data element into the following data structures. (9 Marks)
- i) Stack
- ii) Linked list
- iii) Queue
- b) Using **8, 5, 2, 7, 9, 4** as the data elements to be sorted in ascending order; demonstrate the process of quick-sort (11 marks)

**QUESTION FOUR (20 MARKS)**

- a) i) Construct a tree diagram from the expression:  $-b + \sqrt{(b^2 - 4ac)}/2a$  (6 Marks)
- ii) Write the algorithm for the linear search (6 Marks)
- b) Using flow charts illustrate the algorithm for comparing three numbers and displaying the largest (8 Marks)

**QUESTION FIVE (20 MARKS)**

- a) Given an input arr = {2,5,7,99,899}; key = 899; What is the level of recursion? (10 marks)
- b) Write an algorithm for a binary search. (10 marks)