JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS

UNIVERSITY EXAMINATION FOR THE

BACHELOR OF SCIENCE IN ACTURIAL SCIENCE

3RD YEAR 1st SEMESTER 2016 ACADEMIC YEAR

MAIN CAMPUS

CODE: SCS 301

COURSE TITLE: DATA STRUCTURES AND ALGORITHMS

EXAM VENUE: **STREAM: Bsc Acturial**

DATE: **EXAM SESSION:**

TIME: 2.00 HOURS

INSTRUCTIONS:

1. **Answer Question 1 (Compulsory) and ANY other two questions**
2. **Candidates are advised not to write on the question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

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QUESTION ONE 30 MARKS]

a) i) Define Abstract Data Type (ADT).   **(2 Marks)**

    ii) Object encapsulation is one of the features in ADT. Explain the meaning.   **(3 Marks)**

    iii) Give examples and explain the meaning of linear and nonlinear data structures.**(4 Marks)**

b) i) Explain the term algorithm as used in data structures and algorithm.   **(3 Marks)**

    ii) Differentiate between sorting and searching with reference to data structures and
        algorithm.   **(4 Marks)**

c) Describe one algorithm used for SEARCHING in data structures and algorithm.   **(4 Marks)**

d) When implementing the priority queue, what is the minimum number of queues are needed?.
        Explain with an example.   **(5 Marks)**

e) There are 8, 15, 13, and 14 nodes in 4 different trees. Which one of them can form a full
    binary tree?   (2Marks)

f) Explain using an example why you have chosen the answer to the above question.

                                                                           (3 Marks)

QUESTION TWO [20 MARKS]

a) Build a complete binary tree from the following:

    A, B, C, D, E, F   **(2 Marks)**

b) Give the major difference between a binary tree and the following.

    (i) Sorted linear array.   **(2 Marks)**

    (ii) Linked list   **(2 Marks)**

c) Build a heap H from the following list of numbers;

    {44, 30, 50, 22, 60, 55, 77, 55}   **(4 Marks)**

A binary tree T has 9 nodes. The inorder and preorder traversals of T yield the following sequences of nodes:

Inorder: E, A, C, K, F, H, D, B, G

Preorder: F, A, E, K, C, D, H, G, B

Draw the tree T.   **(5 Marks)**

d) Which data structure is used to perform recursion?   **(3 Marks**)

e)   When determining the efficiency of an algorithm, what factor/attribute of space is measured?   **(2 Marks)**

QUESTION THREE [20 MARKS]

a) Differentiate between a circular header list and a linked list   **(3 Marks)**

b) Briefly describe the merge sort algorithm and sort the following list of elements using the merge sort;

{66, 33, 40, 22, 55, 88, 60, 11, 80, 20, 50, 44, 77, 30}   **(6 Marks)**

c) Apply the bubble sort algorithm in the following list of numbers and sort them in ascending order.

{32, 51, 27, 85, 66, 23, 13, 57}   **(6 Marks)**

d) What is the complexity of bubble sort?. Show how you have arrived at your answer.
                                                                         (5 Marks)

QUESTION FOUR [20 MARKS]

a) Define a Deque as used in data structures and algorithm.   **(2 Marks)**

b) Differentiate between a binary search tree and a heap.   **(2 Marks)**

c) Apply the Selection sort algorithm in the following list of numbers and sort them in ascending order.

{77, 33, 44, 11, 88, 22, 66, 55} (**6 Marks**)

d) Differentiate between a Stack and a Queue. Give an application for each in computer
science. **(5 marks)**

e) Give two examples of dynamic data structures and explain why. **(5 Marls)**

QUESTION FIVE [20 MARKS]

a) Define PUSH and POP with reference to stacks. **(2 marks)**

b) Suppose S is the following list of 6 alphabetic characters:

P E O P L E

Suppose the characters in S are to be sorted alphabetically. Use the Quick Sort algorithm to
alphabetize S. **(5 marks)**

c) Explain the meaning of upper bound and lower bound with reference to arrays. **(4 Marks)**

d) Explain the difference between a Maxheap and Miniheap. **(4 Marks)**

e) What name is given to the operation of processing each element in a linked list? **(1 Mark)**

f) Give and explain two examples of algorithms that use the greedy approach . **(4 Marks)**