



# **MAASAI MARA UNIVERSITY**

**REGULAR UNIVERSITY EXAMINATIONS  
2021/2022 ACADEMIC YEAR  
THIRD/FOURTH YEAR FIRST SEMESTER**

**SCHOOL OF PURE, APPLIED AND HEALTH  
SCIENCES**

**BACHELOR OF SCIENCE (MATHEMATICS)**

**COURSE CODE: COM 2204**

**COURSE TITLE: DATA STRUCTURES AND  
ALGORITHMS**

**DATE: 1<sup>ST</sup> APRIL, 2022**

**TIME: 8:30AM-10:30AM**

## **INSTRUCTIONS TO CANDIDATES**

- Question ONE in Section "A " is Compulsory
- Answer any Two (2) Questions from Section "B"
- Illustrate your answers where necessary

**SECTION A**

**QUESTION ONE (COMPULSORY 30 MARKS)**

a) Describe **THREE** reasons for analyzing an algorithm. **[3 Marks]**

b) Using depth first search traversal, traverse the directed graph in fig 1 below:

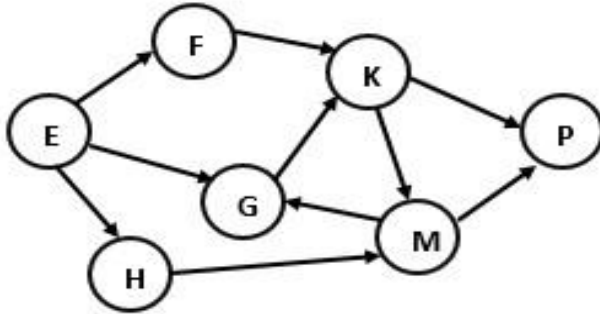


Fig 1: Directed graph

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**[5marks]**

c) Describe the procedure for constructing a binary search tree (BST) **[3Marks]**

d) Briefly explain how divide and conquer algorithms work

**[3marks]**

e) Discuss greedy algorithms. Give two examples.

**[6marks]**

f) Define what is meant by an algorithm, clearly discussing some important characteristics that a good algorithm must meet and the steps involved in algorithm development.

**[5marks]**

g) Describe the procedure for constructing a binary search tree (BST)

**[5marks]**

**QUESTION TWO [20 MARKS]**

a) State and explain the **TWO** sufficient conditions for a binary tree to be a heap. **[4 Marks]**

b) Discuss the various ways of classifying algorithms. Give examples.

[6marks]

c) Differentiate between **deque** and **dequeue** as used in queue ADT.

[4marks]

d) Explain three ways in which an algorithm can be represented [6marks]

### QUESTION THREE [20 MARKS]

a) Assuming you are given the complexity function  $f(n)$  of an algorithm, explain, using an example any **THREE** rules that can be used when estimating the big O complexity of that algorithm. [6marks]

b) The elements stored in a hash table are not always sorted.

Explain.

[3marks]

c) Discuss any **FOUR** techniques for resolving a collision in a

hash table ADT.

[8marks]

d) State and explain any **THREE** applications of stack ADT.

[3marks]

### QUESTION FOUR

[20MARKS]

a) Define a graph ADT.

[2marks]

b) Represent the graph constructed in b) using adjacency matrix.

[6marks]

- b) The tree data structure represented by fig 5 below is a binary search tree, give three reasons to support this claim.

**[6marks]**

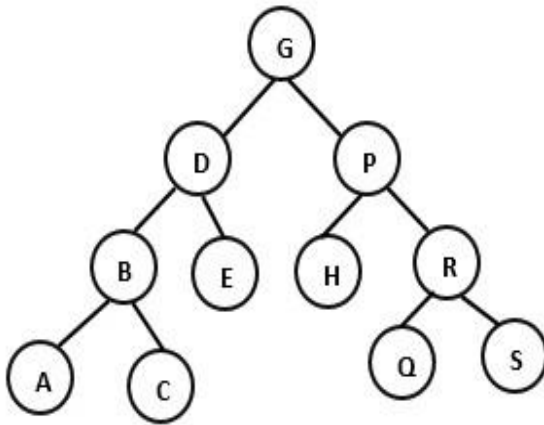


fig 5: Tree ADT

- d) Traverse the tree ADT in fig 5 using in-order traversal. **[4marks]**

- e) Explain your observation of the output after the traversal in d). **[2marks]**

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