



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF SCIENCE, MATHEMATICS AND TECHNOLOGY EDUCATION
DATA STRUCTURES AND ALGORITHMS
PST 2277

MAIN EXAMINATION

SPECIAL EXAMINATION AUGUST 2024

This Examination Paper consists of 3 pages

Time Allowed: 3 hours
Total Marks: 100
Special Requirements: NONE
Internal Examiner: Ms D Moyo
External Examiner: Dr B Moyo

INSTRUCTIONS

1. Answer **ALL** in **SECTION A** and any **THREE (3)** questions in **SECTION B**

MARK ALLOCATION

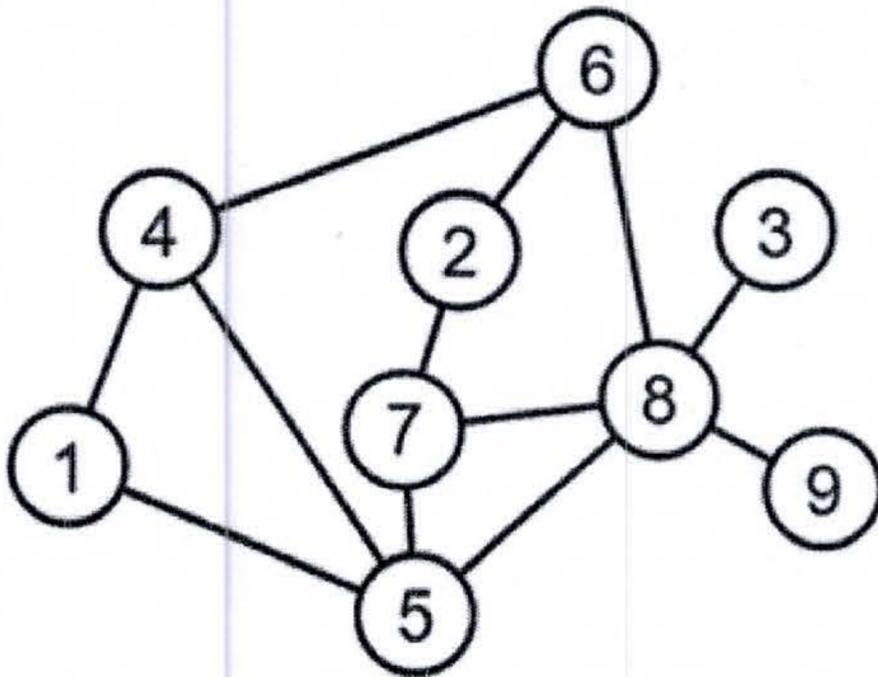
QUESTION	MARKS
1.	20
2.	20
3.	20
4.	20
5.	20
6.	20
7.	20
TOTAL	100

Question 1

Discuss the following concepts as applied in algorithm design

- a) Space complexity, (4marks)
- b) Worst case, (4 marks)
- c) Greedy algorithm (4 marks)
- d) Prior analysis, (4 marks)
- e) Time complexity. (4 marks)

Question 2



- a)
 - i. Starting with node 2 show the BFS (7 marks)
 - ii. Starting with node 2 show the DFS (7 marks)
- b) Discuss the application of graph structure. (6 marks)

SECTION B (60 MARKS)

Question 3

- a) Using the first item as the pivot. Sort the array below using the divide and conquer method. (12 marks)

54	26	93	17	77	31	44	55	20
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- b) Using simple steps clearly write an algorithm to implement the Quick sort.

(8 marks)

Question 4

A stack is an abstract data type used in programming. It allows all data operations at one end only which makes it a LIFO data structure.

- a) Discuss using a diagram the basic operations of a Stack. (8 marks)
- b) Write an algorithm of PUSH operation. (5 marks)
- c) Using C, design a program of implementing PUSH operation (7 marks)

Question 5

- a) Binary search is a fast search algorithm with run-time complexity of $O(\log n)$. The search algorithms work on the principle of divide and conquer. Using diagrams explain how to locate **10** in the following sorted array. (10 marks)

2	9	10	13	15	19	20	25	29
0	1	2	3	4	5	6	7	8

- b) Discuss the bubble sort using examples giving the advantages and disadvantages. (10 marks)

Question 6

Transversal is a process to visit the nodes of a tree and print the values. The nodes cannot be randomly accessed. Using diagrams and algorithms explain the following ways of tree traversal.

- a) In-order, (7 marks)
- b) Pre-order, (7 marks)
- c) Post-order. (6 marks)