



NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI-ABUJA
FACULTY OF COMPUTING
DEPARTMENT OF COMPUTER SCIENCE
2025_2 EXAMINATIONS

Course Code: CIT 310
Course Title: Algorithms and Complexity Analysis
Credit: 3 Units
Time allowed: 2½ Hours
Instruction: Answer Questions **ONE (1)** and any other **THREE (3)**

Question One

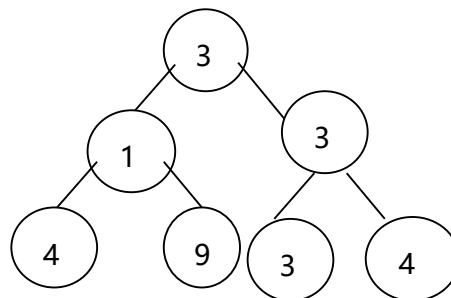
- a. Devise an algorithm to calculate the sum of N integers **(5Marks)**
- b. Write a simple algorithm to calculate the number of absentees in a class of 45 students. **(6Marks)**
- c. Explain the steps to search for 56 using Linear Search from the array of number 23, 34, 56, 67, 84 **(5Marks)**
- d. With the help of a flow chart, describe the evaluation of 5 factorial (5!) **(6Marks)**
- e. Enumerate the three (3) laws of recursion **(3Marks)**

Questions Two

- a. State three (3) disadvantages of insertion sort algorithm **(3Marks)**
- b. Generate a relation formula for total time taken to move n disks from peg A to peg C in the Tower of Hanoi Algorithm **(5Marks)**
- c. Write an algorithm to implement bubble sort **(7Marks)**

Questions Three

- a. List three (3) applications of Tower of Hanoi **(3Marks)**
- b. Given the Binary Search Tree below with key $[x] = 37$. State the value of key $[y]$ **(4Marks)**:
 - (i) If y is a node in the left subtree of x
 - (ii) If y is a node in the right subtree of x



- c. Sort this array of numbers 12 45 23 48 10 in ascending order, using the bubble sort algorithm **(8Marks)**

Question Four

- a. Write an Algorithm to implement Selection Sort **(4Marks)**
- b. Given three pegs A, B, C, show with illustrative diagrams the 7 steps for transferring all the disks from peg A to peg C in the Tower of Hanoi algorithmic problem **(7Marks)**
- c. Briefly explain any three disadvantages of a pseudocode. **(3Marks)**

Question Five

- a. Enumerate four (4) characteristics of Algorithm **(4Marks)**
- b. Write short notes on recurrence relation **(6Marks)**
- c. Using substitution method, show that $T(n) = T\left(\frac{n}{2}\right) + n$ is asymptotically bounded by $O(\log n)$ **(5Marks)**

Question Six

- a. Devise an algorithm to implement quick sort **(6Marks)**
- b. Distinguish between Binary Search Tree and Red-Black Tree **(6Marks)**
- c. Explain the two (2) properties of a Binary Search Tree **(3Marks)**