NATIONAL OPEN UNIVERSITY OF NIGERIA
University Village, Plot 91, Cadastral Zone, NnamdiAzikiwe Expressway, Jabi – Abuja

FACULTY OF COMPUTING
DEPARTMENT OF COMPUTER SCIENCE

2024_2 EXAMINATION

Course Code: **CIT310**
Course Title: **Algorithms and Complexity Analysis**
Credit: **3 units**
Time allowed: **2½ Hours**
Instruction: Answer Questions **ONE (1)** and any other **THREE (3)** Questions

1a. Enumerate six (6) characteristics of Algorithm **(6Marks)**
b. Write short notes on Fibonacci sequence **(3Marks)**
c. Hence, define a function F(*n*) to calculate the *n*th Fibonacci number **(4Marks)**
d. State the advantages and disadvantages of Pseudocode **(6Marks)**
e. Briefly explain the concept of Linear Search **(6Marks)**

2a. With the help of a diagram, explain indirect recursion **(6Marks)**
b. Given that the greatest common divisor, gcd is expressed as:

$$\gcd(p,q) = \begin{cases} p & if\ q = 0 \\ \gcd\left(q, remainder\left(\frac{p}{q}\right)\right) & if\ p \geq q\ and\ q = 0 \end{cases}$$

Compute gcd(48,12) **(4Marks)**
c. Describe the principle of the Tower of Hanoi **(5Marks)**

3a. Given three pegs A, B, C, show with illustrative diagrams the 7 steps for transferring all the disks from peg A to peg Cin the Tower of Hanoi algorithmic problem **(7Marks)**
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. List three (3) applications of Tower of Hanoi **(3Marks)**

4a. Briefly describe in steps how Dynamic Programming works **(5Marks)**
b. Write short notes on recurrence relation **(6Marks)**
c. Explain how bubble sort works **(4Marks)**

5a. Write an algorithm to implement Bubble Sort **(7Marks)**

b. Sort this array of numbers 12 45 23 48 10 in ascending order, using Bubble Sort algorithm **(8Marks)**

6a. Enumerate three (3) advantages and disadvantages of Bubble Sort **(6Marks)**
b. Explain the principle of Selection Sort **(5Marks)**
c. Write an Algorithm to implement Selection Sort **(4Marks)**