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

**FACULTY OF SCIENCE**

**DEPARTMENT OF COMPUTER SCIENCE**

**2024 1 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. Explain the two (2) approaches of Dynamic Programming **(6Marks)**
b. What are the base cases for Fibonacci Series **(2Marks)**
c. Identify operations that can be implemented on Red-Black Trees **(6Marks)**
d. Write an algorithm to find the sum of all the integers in a list **(6Marks)**
e. Write a code for implementing the Fibonacci series using the bottom-upapproach of Dynamic Programming **(5Marks)**

2a. Given that $f(n) = 2^{n+5}$ and $g(n) = (2^n)$. Show that $f(n) = O(2^n)$ **(5Marks)**
b. Explain why Asymptotic estimations of algorithm running times are more important than exact running times **(4Marks)**
c. Distinguish between Stable Sort and Unstable Sort **(6Marks)**

3a. Sort the following key-value pairs in the increasing order of keys, Explain the output that adopts stable sort and unstable sort algorithms. INPUT: (6,5), (5, 2) (6, 3) (7,4) (9,4)**(6Marks)**
b. Mention three (3) applications of Binary Search **(6Marks)**
c. A binary search is to be performed on the list: [3 5 9 10 23]. How many comparisons would it take to find the number 9? Explain your answer **(3Marks)**

4a. Write an algorithm to implement Merge Sort **(7Marks)**
b. Enumerate three (3) application areas of Merge Sort **(3Marks)**
c. Identify five (5) disadvantages of Merge Sort **(5Marks)**

5a. Write an algorithm to implement Quick Sort **(6Marks)**
b. Write short notes on Quick Sort **(6Marks)**