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

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

2022_2 EXAMINATION

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

Questions

Question 1

a. Explain the three laws all recursive algorithms should obey. (3 marks)
b. Highlight the major difference between a pseudocode and an algorithm. (3 marks)
c. Discuss the term 'Algorithm'. **(5Marks)**
d. Explain briefly, how a selection sort works. (7Marks)

e. Recursion is said to be a powerful tool, but it can be a tricky concept to implement. Use python programming language to create a factorial algorithm. (3 marks)
f. Discuss the terms "Sorting in Ascending order" and "sorting in Descending order". **(4Marks)**

Question 2

a. In a short note briefly discuss the time complexity evaluation of the algorithm below; (8 marks)

```
A()
{
i = 1; S = 1;
while (S<=n)
{
i++;
SS = S + i;
printf("Abdullahi");
}
}
```

b. Describe the term linear search. **(5Marks)**

c. What is recursion base case? (2 marks)

Question 3

a. In radix sort algorithm, when does worst case complexity happens? **(3marks)**

b. With examples, illustrate the following Asymptotic Notations.

i. **Big-oh notation (5 marks)**

ii. **Big Omega (Ω) (4marks)**

iii. **Big Theta (θ) (4marks)**

Question 4

a. Define Red-Black tree, and enumerate its properties. **(5Marks)**

b. Consider the following recursive programs, and discuss the time complexity evaluation of the algorithm. (8 marks)

```
A(n)
{
if (n>1)
return (A(n-1))
}
```

c. Why is the Worst-case analysis the most important in algorithm analysis? **(2Marks)**

Question 5

a. There are two types of algorithms that are equivalent to each other, mention and briefly discuss. **(3Marks)**

b. Highlight ten (10) basic reasons, why algorithms are needed? **(10Marks)**

c. What is the importance of Asymptotic Notation? (2marks)

Question 6

a. Describe the difference between a recursion and iteration? (6 marks)

b. Design a recursive algorithm for reversing the *n* elements of an array, A, so that the first element becomes the last, the second element becomes the second to the last, and so on. (5 marks)

c. Consider the Recurrence

$T(n) = 2T\left(\frac{n}{2}\right) + n \quad n>1$

Find an Asymptotic bound on T. (4 marks)