International Islamic University Chittagong
Department of Computer Science and Engineering
B. Sc. in CSE, Mid Term Examination, Sprint 2024
Course Code: **CSE 2421** Course Title: Computer Algorithms

Time: 1 hour and 30 minutes **Full Marks: 30**

[Answer the following questions]

		P	C	D
1.a)	Given an algorithm with a time complexity of O(n^2) and another with a time complexity of O(nlogn),discuss under what circumstances each algorithm would be preferable in terms of efficiency. Provide real-world examples to support your analysis.	3	2	1
b)	Discuss the properties of a good algorithm. How do these properties influence the efficiency and effectiveness of an algorithm in solving a given problem?	3	2	1
c)	Analyze the time complexity of the following algorithm, which computes the factorial of a non-negative integer n:	4	2	1

```
function factorial(n):
if n equals 0:
   return 1
else:
   result = 1
   for i from 1 to n:
      result = result * i
   return result
```

Explain the number of operations performed by the algorithm and justify its time complexity using Big O notation. Consider both the best-case and worst-case scenarios.

OR

c)	Find the complexity of the followings:	4	2	1

i)
```
void fun(int n) {
    int i, j, k, count = 0;
    for( i= n/2; i<=n; i++)
        for( j=1; j+n/2 <= n; j++)
            for( k=1; k<=n; k=k*2)
                count++;
}
```

ii)
```
void fun(int n) {
   if(n <=1) return;
   int i,j;
   for( i=1; i<=n; i++)
       for (j=1; j<=n; j++){
           printf("Hello\n");
           break;
       }
}
```

2. a)	Given an array of integers: [7, 2, 1, 6, 8, 5, 3, 4], apply the count-sort algorithm to sort this array. Provide a step-by-step sorting process for the algorithm.	4	3	1
b)	Consider the following recurrence relation: $T(n)=2T(n/2)+n$. Apply the master theorem and recurrence tree method to analyze the time complexity of this recurrence relation.	3	4	2
c)	Starting with the procedure MAX-HEAPIFY, write pseudocode for the procedure MIN-HEAPIFY(A,i), which performs the corresponding manipulation on a min-heap.	3	5	2

OR

c)	Show the steps of the operation **Extract-min()** on the following **min-heap** **A = { 4, 1, 3, 2, 16, 9, 10, 14, 8, 7}**	3	5	2
3. a)	Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is **{6, 5, 4, 8, 6}**.	6	3	1
b)	Given two strings: "abcdefgh" & "acbcfhgh", Apply dynamic programming to find the longest common subsequence (LCS) between these two strings.	4	3	2

OR

b)	Explain the concept of dynamic programming in the context of solving optimization problems. Illustrate the dynamic programming approach with an example to find the optimal solution.	4	3	2