University of Engineering & Management, Kolkata

Even Semester Term- I Examination, March, 2021

Course: B.Tech(CS) Semester: IV

Paper Name: Design & Analysis of Algorithm

Paper Code: PCCCS 402

Full Marks: 70 Time: 2 hours

Answer all questions. Each question is of 10 marks.

1. **A) i) Describe the asymptotic notation using proper example.**
   ii) Discuss about best, worst and average case using an example.

   OR

   B) i) Write any algorithm and specify the different properties of algorithm.
   ii) State the properties of divide & conquer design approach with an example.

2. **A) Determine the time complexity of merging two singly linked list. Mention also the algorithm.**

   OR

   B) Determine the time complexity of Insertion sort. Mention also the algorithm.

3. **A) Write down the quick sort algorithm and derive the best and worst-case time complexity.**
   .

   OR

   B) Write down the merge sort algorithm and derive the best and worst-case time complexity.

4. **A) Derive the average case complexity of quick sort.**

   OR

   B) Write the tower of Hanoi algorithm and specify the recurrence relation. Also find the time complexity of the recurrence.

5. **A) Derive the time complexity of factorial algorithm both using and without using recursion.**

   OR

   B) Derive the time and space complexity of Binary search algorithm by specifying the proper algorithm.

6. **A) Write down the randomized quick sort algorithm and derive it's time complexity.**

OR

B) i) Find the time complexity of the following recurrence:

$T(n) = 2T(n/2) + n \log n$

ii) State the rules of Master Theorem.

iii) Solve the following using Master Theorem:

$T(n) = 2T(n/2) + n/\log n$

7. **A) Solve the following:**

i) To sort a list of 2050 Aadhaar card numbers using quick sort, a certain configured pc takes 150 seconds. To sort 640 Aadhaar numbers, how much maximum time is required approximately?

ii)

Consider the following two functions:

$$f(n) = \begin{cases} n^3, & \text{if } 0 \le n < 10{,}000 \\ n^2, & \text{otherwise} \end{cases}$$

$$g(n) = \begin{cases} n, & \text{if } 0 \le n < 100 \\ n^2 + 5n, & \text{otherwise} \end{cases}$$

Which of the following is/are true?

1. f(n) is $O(n^3)$

2. g(n) is $O(n^3)$

3. 0(f(n)) is same as O(g(n))

4. g(n) is $O\{n^2)$

iii) State the difference between big O and little o.

OR

B) a) Solve the following recursion:

i) T(1)=2

T(n)=3T(n/4)+n

ii) Find the complexity of the following code snippet:

b)

```
A() {    int n= 2^k;

    for (I= 1;I<= n;I++)

      {     j=2;

        while (j<=n) {
```

```
                    j=j^2;
                    print("R")
                    }
            }
        }
```

c) State the different properties of asymptotic notations.