

Indian Institute of Technology Kharagpur
CS21203 Algorithms-I, Autumn 2022

Class Test 1

31-August-2022

6.30pm - 7.30pm

Full Marks: 20

Name: _____

Roll Number: _____

Write your answers in the question paper itself. Be brief and precise. Answer all questions.

- 1. (5 marks)** Solve the following recurrence relation:

$$T(n) = 297^2 \cdot T(\sqrt[297]{n}) + 297 \cdot (\log n)^2$$

2. (5 marks) Work out the computational complexity of the following piece of code.

```
for ( i=1; i < n; i *= 2 ) {  
    for ( j = n; j > 0; j /= 2 ) {  
        for ( k = j; k < n; k += 2 ) {  
            sum += (i + j * k );  
        }  
    }  
}
```


3. (5 marks) Algorithms A and B spend exactly $T_A(n) = 0.1 n^2 \log_{10} n$ and $T_B(n) = 2.5 n^2$ microseconds respectively, for a problem of size n . Choose the algorithm, which is better in the Big-Oh sense, and find out a problem size n_0 such that for any larger size $n > n_0$ the chosen algorithm outperforms the other. If your problems are of the size $n \leq 10^9$, which algorithm will you recommend to use?

4. (5 marks) Let $A[1 \dots n]$ be an array of n distinct numbers. A is unimodal, i.e., for some i , $1 \leq i \leq n$, $A[1] < \dots < A[i]$ and $A[i] > A[i+1] > \dots > A[n]$. Design and analyze an efficient algorithm to find i . It will be okay to write the idea in plain text instead of writing in formal algorithm format.

