

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- FEB-2023

COURSE CODE(CREDITS): 18B11CI412 (3)

MAX. MARKS: 15

COURSE NAME: DESIGN & ANALYSIS OF ALGORITHMS

COURSE INSTRUCTORS: DHA, SGL, RKI, AMN

MAX. TIME: 1 Hour

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q1. Let $f(n)$ and $g(n)$ be asymptotically non-negative functions. Using the basic definition of θ - notation, show $\max(f(n), g(n)) = \theta(f(n) + g(n))$. **[CO- 1, Marks: 2]**

Q2. Solve the following recurrences:

[CO- 1, Marks: 3*1.5]

a) $T(n) = 3T\left(\frac{n}{4}\right) + n^2$ using recursion tree method.

b) $T(n) = 2^n T\left(\frac{n}{2}\right) + n^n$ using masters method.

c) $T(n) = 2T\left(\frac{n}{2}\right) + n^2$ using substitution method.

Q3. Produce the time complexity with some upper bound and sum value for $n=4$ of the following algorithm:

[CO- 1, Marks: 3]

```
int func(int p) {
    if (p>1)
        return 1;
    else
        return p*func(⌊p/2⌋);
}

main(){
    for(int i=0;i<n;i++)
        sum=sum + func(i);
    print(sum);
}
```

Q4. Perform the time and space complexity analysis of Quick Sort Algorithm in worst, best and average cases. Assume n as the input size of the array to be sorted. **[CO- 3, Marks: 3]**

Q5. For the given input array, 1,2,3,4,5,6,9,8,10,7, which sorting algorithm will be preferred and why? Write complete steps to sort the given input array using the chosen sorting algorithm.

[CO- 3, Marks: 2.5]