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Department/ School: SCS ET

MID TERM EXAMINATION, EVEN SEMESTER MARCH2023

COURSE CODE: CSET206   **MAX. DURATION:** 1 HRS

COURSE NAME: Design and Analysis of Algorithm

PROGRAM: BTECH   **TOTAL MARKS: 15**

Mapping of Questions to Course and Program Outcomes					
	Section A	**Section B**			
Q.No.	A1	B1	B2	B3	B4
CO	2	1	1	2	1
PO	1-5,9-12	1-5,9-12	1-5,9-12	1-5,9-12	1-5,9-12
BTL	L3	L3	L2	L3	L3

GENERAL INSTRUCTIONS: -

1. Do not write anything on the question paper except **name, enrolment number** and **department/school.**

2. Carrying mobile phone, smart watch and any other non-permissible materials in the examination hall is an act of **UFM.**

COURSE INSTRUCTIONS: -

1. Attempt **any five** questions from section A.

2. All questions of Section B are mandatory.

3. Section A carries **5** marks and Section B carries **10** marks.

4. **Any data you feel missing suitably be assumed and stated clearly.**

SECTION A

Max Marks: 5

(1x5 = 5 Marks)

A1) Answer **any five** questions

I. Explain and compare the worst- and best-case time complexity of Quick Sort.

II. Explain 0/1 Knapsack problem with example.

III. Solve the following recurrence relation using Master method:

$$T(n) = 4T\left(\frac{n}{16}\right) + \sqrt{n}$$

IV. Organize the following functions in increasing order of their growth

$$n\log_6 n, \quad \log_2 n, \quad \log_8 n, \quad 8n^2, \quad n\log_2 n, \quad 64, \quad 8^{2n}$$

V. Identify an example of a problem where greedy algorithm fails, also give a suitable algorithm design technique which can solve your problem optimally.

VI. Identify the truthiness of following statement with justification:

"If $f(n) = O(g(n))$ then $2^{f(n)} = O(2^{g(n)})$"

SECTION B

Max Marks: 10

B1) Solve the recurrence relation: $T(n) = 2T\left(\frac{n}{2}\right) + 2; T(2) = 1$ by using backward substitution method. **(2 Marks)**

B2) What is a loop invariant? Identify the loop invariant for the following code. Justify your answer. **(1 + 1 Marks)**

```
Fun(A, key):
  for (i = 1 to A.length)
  {
    key = A[i]
    j = i-1
    while (j >= 0 and A[j] > key)
    {
      A[j+1] = A[j]
      j = j-1
    }
    A[j+1] = key
  }
```

B3) Apply your expertise as a gardener strategizing for a day of tending to various plants using a specialized fertilizer mix carried in a basket. The basket has a weight constraint of 15 units, and there are seven distinct fertilizers, each with its weight and corresponding plant growth value as outlined in the table below:

Fertilizer	A	B	C	D	E	F	G
Weight	2	3	5	7	1	4	1
Plant growth value	10	5	15	7	6	8	13

With the objective of maximizing the overall plant growth value while adhering to the weight limit, accomplish the following **(1 + 2 Marks)**

    I.   Calculate the maximum achievable plant growth value.

    II.   Identify the specific combination of fertilizers to be carried

B4) I. Explain Big O, Big Ω and θ notation with example   **(1.5 Marks)**

    II. Solve the following recurrence relation $T(n) = 2T(\sqrt{n}) + \log_2 n$ **(1.5 Marks)**

-ALL THE BEST-