Silicon
...beyond teaching

SIC No.-

Silicon Institute of Technology
Silicon Hills, Bhubaneswar
| An Autonomous Institute |

Total No. of Pages:-**01**

4th Semester B.Tech. Mid Term Examination 2022-23
DESIGN & ANALYSIS OF ALGORITHMS(BTCS-T-PC-011)
BRANCH(S) - Computer Engineering,Computer Science and Technology,Computer Science & Engineering

Duration: 01:30 hr   Full Marks: 25

1 *Answer All*

a Differentiate between Big-Oh notation and Little-Oh notation.   1

b Justify your answer: Is $2^{2n} = O(2^n)$?   1

c When a function is called polynomially bounded. Is the function ($\lfloor \log(n) \rfloor$)! polynomially bounded ?   1

d What is the height of an n-element HEAP?   1

e When a product of matrices is called fully parenthesized. In how many different ways a chain of 4 matrices <A1, A2, A3, A4> can be fully parenthesized.   1

f What are the elements of Dynamic Programming?   1

2 *Answer All*

a Solve the following recurrence: 3
$$T(n) = T\left(\frac{9n}{10}\right) + n$$

b Order the following functions by decreasing order of their asymptotic growth: 3
$2^{lg\,n}, lg(n!), 10^6, n!, n^3, n^{lg\,n}, 2^n, lg^2 n$

c Show that any comparison based sorting algorithm requires $\Omega(n\ lg\ n)$ comparisons in worst case to sort **n** elements.   3

3 *Answer any One*

a When Master's method fails to solve a recurrence relation of the form   5
$T(n) = a\,T\left(\frac{n}{b}\right) + f(n),$ with $a \geq 1$ and $b > 1$. Justify your answer with the recurrence relation : $T(n) = 2\,T\left(\frac{n}{2}\right) + \frac{n}{lg\,n}$, also solve it using other suitable method.

b Write the QUICKSORT algorithm along with the PARTITION procedure. Discuss when the QUICKSORT algorithm will attain worst-case running time. Write the recurrence and solve it to find the worst case running time of QUICKSORT.   5

4 *Answer any One*

a Write the **MAX-HEAPIFY(A, i)** algorithm and show that the running time of MAX-HEAPIFY on a subtree of size **n** rooted at a given node i is $O(lg\,n)$ 5

b Define matrix chain multiplication problem. Write the algorithm for computing m and s table. Find the m and s table computed by the algorithm for the following matrix dimensions: A1(25,35), A2(35,15), A3(15,5), A4(5, 40)   5