



**Model Question Paper for CAT Exam**

Programme	:	<b>B.Tech</b>	Semester	:	<b>Fall 2022-2023</b>
Course	:	<b>Data Structures and Algorithms</b>	Code	:	<b>BCSE202L</b>
Time	:	<b>90 minutes</b>	Max.Marks	:	<b>50</b>

**ANSWER ALL QUESTIONS**

Q.No	sub Q.No	Question Description	Marks									
1		Given ‘N’ objects, which are coloured as red, white and blue. Sort these objects so that objects of the same colour are adjacent, with the colours in the order red, white and blue. Design an algorithm with a time complexity of $O(n \log n)$ .	10									
2		Given a sorted list L, design an efficient iterative/recursive algorithm that searches all pairs of elements whose sum is exactly equal to the given number X. Analyse the time complexity of the algorithm.	10									
3		Can the master method be applied to the recurrence $T(n) = 4T(n/2) + n^2 \log n$ ? Why or why not? Give an asymptotic upper bound for this recurrence.	10									
4		<p>Assume Two-Dimensional Sorted Array (TDSA) is a two-dimensional matrix of size <math>n \times n</math> such as the elements in the matrix are sorted row-wise and column-wise. For example, the following matrix is a TDSA.</p> <table><tr><td>1</td><td>2</td><td>3</td></tr><tr><td>4</td><td>5</td><td>6</td></tr><tr><td>7</td><td>8</td><td>9</td></tr></table> <p>Write an algorithm that should convert the given matrix of a dimension <math>n \times n</math> into TDSA. Analyse the running time of the algorithm.</p>	1	2	3	4	5	6	7	8	9	10
1	2	3										
4	5	6										
7	8	9										

5	<p>Compute the running time of a call <math>RKU(a,1,k)</math> of the following algorithm</p> <p>ALGORITHM <math>RKU(a,k,n)</math></p> <p>//Input: <math>a</math> is an array of <math>n</math> element and <math>k</math> is a value</p> <pre> { if( <math>k == n</math>) then { WRITE(<math>a[1:n]</math>); return 0; } else { for <math>i \leftarrow k</math> to <math>n</math> do { <math>t \leftarrow a[k]</math>; <math>a[k] \leftarrow a[i]</math>; <math>a[i] \leftarrow t</math>; <math>RKU(a, k+1, n)</math>; <math>t \leftarrow a[k]</math>; <math>a[k] \leftarrow a[i]</math>; <math>a[i] \leftarrow t</math>; } } } </pre>	10
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