BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2024)

CLASS: B. TECH **SEMESTER : IV**
BRANCH: CSE/AIML **SESSION : SP/2024**

SUBJECT: CS241 DESIGN AND ANALYSIS OF ALGORITHM

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	Consider the following pseudo-code and analyze the worst case time complexity: Function PseudoCode(array) for index from 1 to length(array) key = array[index] j = index – 1 while j >= 0 and array[j] > key array[j + 1] = array[j] j = j - 1 array[j + 1] = key	[2]	1	4
Q.1(b)	The Fibonacci numbers are define as $f_0=0$, $f_1=1$ and $f_i = f_{i-1} + f_{i-2}$ *for* $i>1$. Determine the time complexity of recursive algorithm to compute f_i .	[3]	1	4
Q.2 (a)	Consider the following equations. f(n) = n + log n, and g(n) = $\sqrt{}$(n). Is f(n) = O(g(n)) or g(n) = O(f(n)), or both? Explain.	[2]	1	5
Q.2(b)	Explain the procedure of solving recurrence relations using an appropriate example. Solve the following using Master's theorem. T(n) = 4T(n/3) + n , T(1)=1.	[3]	1	3
Q.3(a)	Solve the given recurrence relation using the substitution method for T(n)={ 1 if n=1 2T(n/2) +n , if n>1}	[2]	2	2
Q.3(b)	Create an outline for a sorting algorithm that uses O (n log n) for a list of size n in the best, worst, and average cases. Explain the claimed time complexity.	[3]	2	4
Q.4(a)	Calculate the time complexity of a method that performs matrix multiplication more efficiently than $O(n^3)$.	[2]	2	4
Q.4(b)	When does the worst case occur in quick sort algorithm? Calculate the worst case time complexity using recursion tree method.	[3]	2	3
Q.5	Write a divide-and-conquer algorithm that finds the maximum difference between any two elements of a given array of n numbers (not necessarily distinct) in O (n) time. For example, on input A =[4.5,10,−2,π,−7.115], your algorithm should return 17.115. Justify briefly that your algorithm is correct and runs within the required time bound."	[5]	2	4

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