11/11.30

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -1 EXAMINATION- 2026

B.Tech-IV Semester (CSE/IT)

COURSE CODE (CREDITS): 25B11CI412 MAX. MARKS: 15

COURSE NAME: Design and Analysis of Algorithms

COURSE INSTRUCTOR: Dr. (Amit, Amol, Arvind, Ravi) Mr. Saurav MAX. TIME: 1 Hour

*Note: (a) All questions are compulsory.*
*(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems*
*(c) Use of calculators is not allowed*

| Q.No | Question | CO | Marks |
|---|---|---|---|
| Q1 | a) If Big O( n ) + Big Ω( n ) + Big Θ( n ) = h (n). Then what will be the asymptotic growth rate of h(n)? Give proper justification. | 1 | 2 |
| | b) Statement 1 : f(n) + g(n) = Big O[ max{ f(n) , g(n) } ]<br>Statement 2 : f(n) + g(n) = Big Ω[ max{ f(n) , g(n) } ]<br>Statement 3 : f(n) + g(n) = Big Θ[ max{ f(n) , g(n) } ]<br>Which of the statements are true? Give proper justification. | | 1 |
| Q2 | a) Solve the following recurrence relation using the Master Theorem: $T(n) = 3T(\sqrt{n}) - n^3$ | 1 | 1 |
| | b) Determine the time complexity of the following recurrence relation using the substitution method: $T(n) = 3T(n-1) + \log n$, $n > 1$, $T(1) = 1$ | | 2 |
| Q3 | a) Prove that $(n + k)^m = O(n^m)$, where $n > k$. | 1 | 1 |
| | b) Consider the following recurrence and solve it with master method $T(n) = 2T(\sqrt{n}) + \log n$ | | 2 |
| Q4 | Consider the Quicksort algorithm. Suppose there exists a pivot selection procedure that guarantees that, after partitioning, the input set of n elements is divided into two subsets such that each subset contains at least 1/5 of the elements.<br>Let T(n) denote the number of comparison operations required to sort n elements using this version of Quicksort. | 1 | |
| | a) Formulate the recurrence relation for T(n). | | 1 |
| | b) Solve the recurrence relation and determine the asymptotic running time of the algorithm. | | 2 |
| Q5 | a) Mention the constraints of Max-Heap and prove that to build a Max-Heap, an order of linear time is required. If not then prove your order. | 2 | 2 |
| | b) Assume max sum is present at any contiguous subarray A[i…j] of A[low…high]. Mention the possible location of subarrays with appropriate notations. | | 1 |



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