



PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR
DEPARTMENT OF COMPUTER TECHNOLOGY
ACADEMIC SESSION: 2022-23 (ODD SEMESTER)
QUESTION BANK FOR CAT-I

Subject	:	Design and Analysis of Algorithms (BECT304T)	Semester	:	V - A and B
Subject Teacher	:	Prof. C. R. Pote Prof. P. U. Tembhare	Date of Display	:	11-09-2022
Unit	:	I, II and III			

Course Outcomes:

After completing the course, students will be able to

- CO1 :** Argue the correctness of algorithms using inductive proofs and Analyze worst-case running times of algorithms using asymptotic analysis.
- CO2 :** Explain and apply Divide-and-Conquer and Greedy algorithmic design paradigms.
- CO3 :** Explain and apply Dynamic-Programming algorithmic design paradigms.

Que. No.	Questions	Mapping with CO	BT Level
1. a)	Solve the following Inhomogeneous recurrence relation by the method of characteristic equation $t_n = \begin{cases} 1 & \text{if } n=0 \\ 4t_{n-1} - 2^n & \text{otherwise} \end{cases}$	CO1	II
1. b)	Derive the closed form computation for the summation: $\sum_{i=1}^k i \cdot a^i$	CO1	II
2. a)	What is an algorithm? Explain in detail about various characteristics of an algorithm.	CO1	II
2. b)	Analyse the run time complexity of following program code: <pre> A() { int i, j, k; for (i=n/2; i<=n; i++) for (j=1; i<=n; j=2*j) for (k=1; k<=n; k=2*k) printf ("PCE NAGPUR"); }</pre>	CO1	II
3. a)	Solve the following recurrence relation $T(n) = 3T(n/4) + \Theta(n^2)$ using Recursion Tree Method.	CO1	II
3. b)	Solve the given recurrences using Master Theorem: I. $T(n) = 6 T(n/3) + n^2 \log n$ II. $T(n) = \sqrt{2} T(n/2) + \log n$	CO1	II
4. a)	Consider the following recurrence: $T(n) = 2T(\sqrt{n}) + \log n$ Solve this recurrence using change of variable method.	CO1	II
4. b)	Explain in detail about various asymptotic notations for analyzing algorithms.	CO1	I

5. a) Write an algorithm for Binary search using divide and conquer strategy. Also give its stepwise execution for search element $X = 45$ in the following Input array.
 $A = \langle 9, 12, 15, 24, 30, 36, 45, 70 \rangle$ CO2 III
5. b) Illustrate stepwise execution of Quick sort on following input array:
 $A = \langle 13, 19, 7, 5, 12, 9 \rangle$ CO2 III
 Also find recurrence relation for the algorithm and analyze its time complexity.
6. a) Illustrate stepwise execution of Heap sort on following input array:
 $A = \langle 5, 13, 2, 25, 7, 17, 20, 8, 4 \rangle$ CO2 III
 Also find recurrence relation for the algorithm and find its time complexity.
6. b) Illustrate multiplication of following two 4-digit numbers using divide and conquer paradigm.
 $A = 2812$
 $B = 3712$ CO2 III
7. a) Explain in detail about Strassen's Matrix Multiplication. CO2 II
7. b) Illustrate stepwise execution of merge sort on following input array:
 $A = \langle 15, 10, 5, 20, 25, 30, 40, 35 \rangle$ CO2 III
 Also find recurrence relation for the algorithm and analyze its time complexity.
8. a) Write the algorithm for Insertion Sort? CO2 II
8. b) Derive worst case and best case run time complexity for Insertion Sort. CO2 II
9. a) What is minimum spanning tree? Write Prim's algorithm for finding minimum cost spanning tree. Also give stepwise illustration of this algorithm using suitable example. CO3 III
9. b) Explain Job sequencing approach. Find best possible sequences for following instances of deadlines using Greedy approach. CO3 II

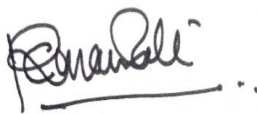
Job	1	2	3	4	5	6	7
Gain	3	5	20	18	1	6	30
Deadline	1	3	4	3	2	1	2

10. a) Consider 5 Items along with their respective weights and values as follows: CO3 II

Item	1	2	3	4	5	6	7
Value	10	5	15	7	6	18	3
Weight	2	3	5	7	1	4	1

Capacity of Knapsack $W = 15$. Solve this fractional knapsack problem using Greedy strategy.

10. b) State Dijkstra's algorithm for solving single source multiple destination shortest path problems? Illustrate your answer by stepwise execution by assuming suitable example. CO3 II



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