Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2022

CS3CO13 / IT3CO06

Design and Analysis of Algorithms

Programme: B.Tech. Branch/Specialisation: CSE/IT

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. How many passes does an insertion sort algorithm consist of when an array of N elements is given- **1**

(a) N (b) N+1 (c) N-1 (d) N^2

ii. What is the worst time complexity of Insertion sort? **1**

(a) n^2 (b) n log n (c) n (d) $n (\log n)^2$

iii. When the given inputs are already sorted, which sorting technique gives worst performance? **1**

(a) Radix Sort (b) Quick Sort

(c) Heap Sort (d) Merge Sort

iv. Average case complexity of binary search is- **1**

(a) Θ (log n) (b) Θ (n/2) (c) Θ (1) (d) Θ (n^2)

v. Principle of optimality holds in- **1**

(a) Backtracking (b) Greedy method

(c) Divide and conquer (d) Dynamic Programming

vi. Number of Spanning tree of a complete graph with n vertices are- **1**

(a) n^{n-2} (b) nC(n-1) (c) n^{n-1} (d) $n^{n(n-2)}$

vii. Dijkstra's Algorithm cannot be applied on _____ **1**

(a) Directed and weighted graphs

(b) Unweighted graphs

(c) Graphs having negative weight function

(d) Undirected and unweighted graphs

P.T.O.

viii. Branch and bound applied on- **1**
(a) Minimization problems (b) Maximization problems
(c) Both (a) and (b) (d) None of these

ix. Which one of the following is an application of the backtracking algorithm? **1**
(a) Finding the shortest path
(b) Crossword
(c) Ludo
(d) Finding the efficient quantity to shop

x. What answers "are we building a right product"? **1**
(a) Verification (b) Performance
(c) Testing (d) Validation

Q.2 i. What are asymptotic notations? Explain. **4**

ii. Solve the recurrence relations using Masters Theorem. **6**
(a) $T(n)=3T(n-4)+n^2$
(b) $T(n)=4T(n/2)+\log n$
(c) $T(n)=3T(n/3)+\sqrt{n}$
(d) $T(n)=3T(n/4)+3n$

OR iii. Sort these elements using Selection Sort in ascending order. **6**
12 29 25 8 32 17 40
Also write best, worst and average case complexity of selection sort.

Q.3 i. Write a note on minimum Spanning tree. **3**

ii. How Strassen's matrix multiplication is different from simple matrix multiplication method. Also analyse their complexity. **7**

OR iii. Sort these elements using Heap sort (Max Heap) **7**
99, 70, 52, 81, 63, 95, 21, 85, 42, 64, 87, 92

Q.4 i. Find Optimal Merge Pattern for 7 files whose length are 12, 9,3,11,15,20,13. **4**

ii. A Knapsack capacity is 100.The weights and values of 5 objects is as follows: **6**

Weight (Wi)	10	20	30	40	50
Values (Pi)	20	30	66	20	60

Solve the Knapsack problem using Greedy Strategy & find the maximum profit that can be obtained.

OR iii. Find the longest common subsequence from X and Y X=(H,U,M,A,N) Y=(C,H,I,M,P,A,N,Z,E,E) **6**

Q.5 i. What do you mean by dynamic programming? Write any two benefits of using dynamic programming. **4**

ii. Solve the 0/1 knapsack problem using FIFO branch & bound **6**
n=4, m=15, (p1, p2, p3, p4) = (10,10,12,18), (w1, w2, w3, w4) = (2,4,6,9)

OR iii. Explain how a reliability design can be obtained using dynamic programming. **6**

Q.6 Attempt any two:

i. Define hamiltonian cycle with the example. **5**

ii. What is backtracking? Find a solution to the 4 queens problem using backtracking strategy. **5**

iii. Explain P, NP, NP-Complete and NP-Hard problem. **5**

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Marking Scheme

CS3CO13-IT3CO06 Design and Analysis of Algorithms

Q.1	i)	How many passes does an insertion sort algorithm consist of when an array of N elements is given (c) N-1	**1**
	ii)	What is the best time complexity of selection sort? (a) N^2	**1**
	iii)	When the given inputs are already sorted, which sorting technique gives worst performance. (b) Quick Sort	**1**
	iv)	Average case complexity of binary search is (a) Θ (log n)	**1**
	v)	Principle of optimality holds in (d) Dynamic Programming	**1**
	vi)	Number of Spanning tree of a complete graph with n vertices are (a) $n^{(n-2)}$	**1**
	vii)	Djkstra's Algorithm cannot be applied on _____ (c) Graphs having negative weight function	**1**
	viii)	Branch and bound applied on (a) Minimization problems	**1**
	ix)	Which one of the following is an application of the backtracking algorithm? (b) Crossword	**1**
	x)	What answers "are we building a right product?" (d) Validation	**1**
Q.2	i.	Asymptotic notations 1 mark for each	**4**
	ii.	Solve these Recurrence Relation (a) T(n)= 3T(n/3) + Θ (n) 2 marks (b) T(n)= T(n-1) + 5n 2 marks (c) T(n)= 8T(n/4) + Θ (n log n) 2 marks	**6**
OR	iii.	Sorting using Selection Sort 4 Marks best average and wort complexity 2 marks	**6**
Q.3	i.	Minimum Spanning tree 3 marks	**3**
	ii.	Strassen's matrix multiplication and simple matrix multiplication method comparison 5 marks analysis of their complexity 2 marks	**7**
OR	iii.	Sort these elements using Heap sort (Max Heap) 99, 70, 52, 81, 63, 95, 21, 85, 42, 64, 87, 92	**7**
		Stepwise 7 marks	
Q.4	i.	Find Optimal Merge Pattern for 7 files whose length are 12, 9,3,11,15,20,13 Stepwise 4 mark	**4**
	ii.	Stepwise 6 marks	**6**
OR	iii.	Longest common subsequence from X and Y Table 4 marks Subsequence from table 2 marks	**6**
Q.5	i.	Definition 2 Marks Any two benefits 2 Mark	**4**
	ii.	Solve the 0/1 knapsack problem using FIFO branch & bound Tree for FIFO branch and bound 7 marks stepwise	**6**
OR	iii.	Algorithm or complete definition 5 marks Example 2 marks	**6**
Q.6		Attempt any two:	
	i.	Definition 2 marks Example 1 mark	**5**
	ii.	Definition 2 marks Solution 3 marks	**5**
	iii.	P problem 1 mark NP problem 1 mark NP-Complete problem 1 mark NP Hard Problem 2 marks	**5**

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