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

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2019

IT3CO06 Design and Analysis of Algorithms

Programme: B.Tech. Branch/Specialisation: 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. What is the asymptotic runtime for traversing all nodes in a binary search tree with n nodes and printing them in order? **1**

(a) O(n · log(n)) (b) O(n)

(c) O(n) (d) O(log(n))

ii. What is the best time complexity of bubble sort? **1**

(a) N^2 (b) NlogN (c) N (d) N(logN)^2

iii. What is recurrence for worst case of QuickSort and what is the time complexity in Worst case? **1**

(a) Recurrence is T(n)=T(n-2) + O(n) and time complexity is O(n^2)

(b) Recurrence is T(n)=T(n-1) + O(n) and time complexity is O(n^2)

(c) Recurrence is T(n)=2T(n/2)+O(n) and time complexity is O(nLogn)

(d) Recurrence is T(n)=T(n/10)+T(9n/10)+O(n) and time complexity is O(nLogn)

iv. In a Max heap the largest key is at **1**

(a) The root (b) A leaf (c) A node (d) None of these

v. Which of the following algorithms is the best approach for solving Huffman codes? **1**

(a) Exhaustive search (b) Greedy algorithm

(c) Brute force algorithm (d) Divide and conquer algorithm

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

(a) Directed and weighted graphs

(b) Graphs having negative weight function

(c) Unweighted graphs

(d) Undirected and unweighted graphs

P.T.O.

vii. The Knapsack problem is an example of _____ **1**
(a) Greedy algorithm
(b) 2D dynamic programming
(c) 1D dynamic programming
(d) Divide and conquer

viii. Bellmann ford algorithm provides solution for _____ problems. **1**
(a) All pair shortest path (b) Sorting
(c) Network flow (d) Single source shortest path

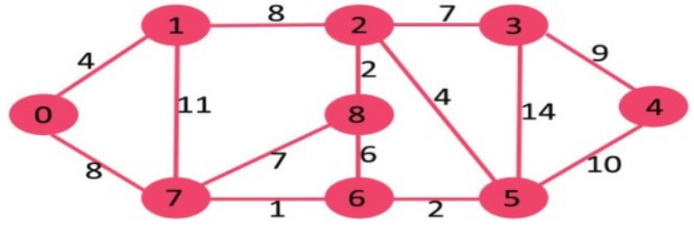
ix. What happens when the backtracking algorithm reaches a complete solution? **1**
(a) It backtracks to the root
(b) It continues searching for other possible solutions
(c) It traverses from a different route
(d) Recursively traverses through the same route

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

Q.2 i. Write an algorithm using recursive function to find the sum of n numbers. **4**
ii. Solve the following recurrence relations **6**
(a) x(n)=x(n -1) + 5 for n > 1 x(1)=0
(b) x(n)=3x(n-1) for n > 1 x(1)=4
OR iii. Write the asymptotic notations used for best case, average case and worst-case analysis of algorithms in detail. **6**

Q.3 i. Write a note on quick sort Algorithm. **3**
ii. Apply quick sort algorithm for the following array and sort the element **7**
(Take the first element as the pivot element)
24, 56,47,35,10,90,82,31,22,32,55,11.
Also discuss complexity of algorithm.
OR iii. Sort the following list using heap sort **7**
66,33,40,20,50,88,60,11,77,30,45,65.
Also discuss the complexity of the heap sort.

Q.4 i. State the general principle of greedy algorithm. **3**
ii. Using Dijkstra's algorithm, find the shortest path from the source node 0. **7**

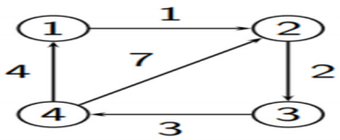


OR iii. Explain in detail the Huffman coding algorithm with example. **7**

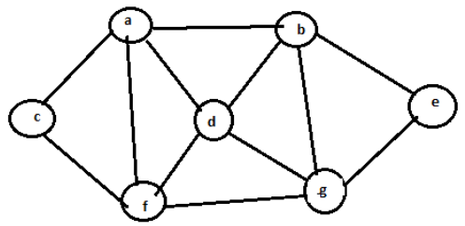
Q.5 i. Differentiate between divide and conquer and dynamic programming. **3**
ii. Solve the following instance of the 0/1 knapsack problem given the knapsack capacity is W=5 **7**

Items	Weight	Value
1	2	12
2	1	10
3	3	20
4	2	15

OR iii. Using Floyd Warshall's (all pair shortest path) algorithms find the shortest path of the given directed graph. **7**



Q.6 i. Give example for NP Complete problems **3**
ii. Explain how backtracking can be applied to solve 8-queen's problem. **7**
OR iii. Apply backtracking to the problem of finding a Hamiltonian circuit in the following graph. **7**



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Marking Scheme

IT3CO06 Design and Analysis of Algorithms

Q.1	i.	What is the asymptotic runtime for traversing all nodes in a binary search tree with n nodes and printing them in order? (b) O(n)	**1**
	ii.	What is the best time complexity of bubble sort? (c) N	**1**
	iii.	What is recurrence for worst case of QuickSort and what is the time complexity in Worst case? (b) Recurrence is T(n)=T(n-1) + O(n) and time complexity is O(n^2)	**1**
	iv.	In a Max heap the largest key is at (a) The root	**1**
	v.	Which of the following algorithms is the best approach for solving Huffman codes? (b) Greedy algorithm	**1**
	vi.	Dijkstra's Algorithm cannot be applied on _____ (b) Graphs having negative weight function	**1**
	vii.	The Knapsack problem is an example of _____	**1**
	viii.	Bellmann ford algorithm provides solution for _____ problems. (d) Single source shortest path	**1**
	ix.	What happens when the backtracking algorithm reaches a complete solution? (b) It continues searching for other possible solutions	**1**
	x.	Which one of the following is an application of the backtracking algorithm? (d) Crossword	**1**
Q.2	i.	Algorithm using recursive function to find the sum of n numbers	**4**
	ii.	Solve the following recurrence relations (a) x(n)=x(n -1) + 5 for n > 1 x(1)=0 3 marks (b) x(n)=3x(n-1) for n > 1 x(1)=4 3 marks	**6**
OR	iii.	Asymptotic notations used for best case, average case and worst-case analysis of algorithms Function 3 marks Graph 3 marks	**6**
Q.3	i.	Quick sort Algorithm.	**3**
	ii.	Apply quick sort algorithm for the following array and sort the element Sorting 4 marks Analysis 3 marks	**7**
OR	iii.	Sort the following list using heap sort Sorting 5 marks Analysis 2 marks	**7**
Q.4	i.	General principle of greedy algorithm.	**3**
	ii.	Using Dijkstra's algorithm, find the shortest path from the source node 0. Complete Solution	**7**
OR	iii.	Huffman coding algorithm 4 marks Example 3 marks	**7**
Q.5	i.	Differentiate between divide and conquer and dynamic programming 1 mark for each difference (1 mark * 3)	**3**
	ii.	Solve the following instance of the 0/1 knapsack problem given the knapsack capacity is W=5 Steps 5 marks Solution 2 marks	**7**
OR	iii.	Using Floyd Warshall's (all pair shortest path) algorithms find the shortest path of the given directed graph. Complete solution	**7**
Q.6	i.	Example for NP Complete problems	**3**
	ii.	Backtracking can be applied to solve 8-queen's problem. Explanation 4 marks Tree 3 marks	**7**
OR	iii.	Apply backtracking to the problem of finding a Hamiltonian circuit in the following graph. Complete Solution	**7**

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