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

Enrollment No.....

Faculty of Engineering

End Sem Examination May-2024

CB3CO23 Design & Analysis of Algorithms

Programme: B.Tech. Branch/Specialisation: CSBS

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. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. Two main measures for the efficiency of an algorithm are- **1**

(a) Processor and memory (b) Complexity and capacity

(c) Time and space (d) Data and space

ii. How many cases are there under Master's theorem? **1**

(a) 2 (b) 3 (c) 4 (d) 5

iii. Fractional knapsack problem is solved most efficiently by which of the following algorithm? **1**

(a) Divide and conquer (b) Dynamic programming

(c) Greedy algorithm (d) Backtracking

iv. What is the auxiliary space complexity of merge sort? **1**

(a) O(1) (b) O(log n) (c) O(n) (d) O(n log n)

v. From the following algorithm design techniques which one is used to find all the pairs of shortest distances in a graph? **1**

(a) Backtracking (b) Greedy

(c) Dynamic programming (d) Divide and conquer

vi. Floyd Warshall algorithm can be used for finding _____. **1**

(a) Single source shortest path

(b) Topological sort

(c) Minimum spanning tree

(d) Transitive closure

vii. Which of the problems cannot be solved by backtracking method? **1**

(a) n-queen problem

(b) Subset sum problem

(c) Hamiltonian circuit problem

(d) Travelling salesman problem

viii. What is vertex coloring of a graph? **1**
(a) A condition where any two vertices having a common edge should not have same color
(b) A condition where any two vertices having a common edge should always have same color
(c) A condition where all vertices should have a different color
(d) A condition where all vertices should have same color

ix. _____ is the class of decision problems that can be solved by non-deterministic polynomial algorithms. **1**
(a) NP (b) P (c) Hard (d) Complete

x. To which of the following class does a CNF-satisfiability problem belong? **1**
(a) NP class (b) P class (c) NP complete (d) NP hard

Q.2 i. Define algorithm. Also state its characteristics. **2**

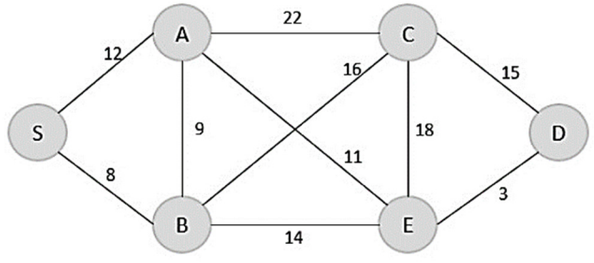
ii. Explain how algorithms performance is analyzed? Describe asymptotic notation. **3**

iii. What do you mean by recurrence relations? Solve this recurrence relation $T(n) = 2T(n/2) + n$ using recursive tree method. **5**

OR iv. $T(n) = 3T(n/2) + n^2$. Solve this in master theorem. Also state which case it follows. **5**

Q.3 i. Differentiate between greedy algorithm and divide and conquer. **2**

ii. Write short notes on spanning trees. Solve this graph using Prim's algorithm. **8**

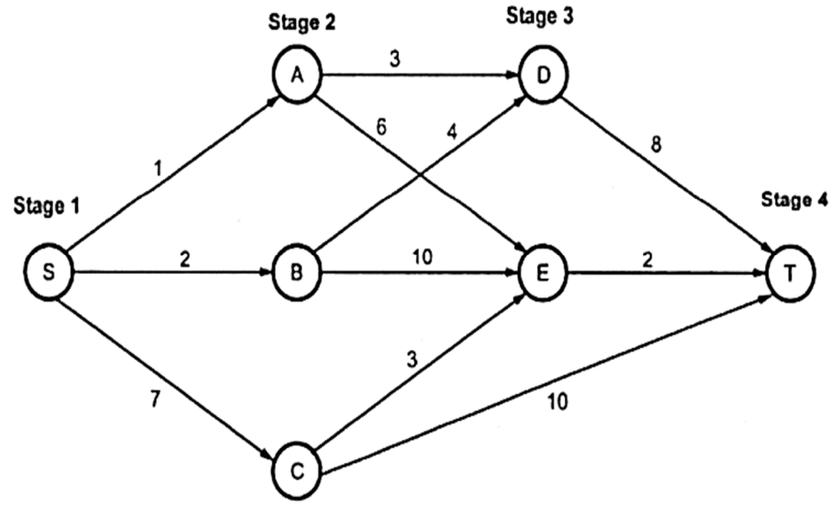


Compute its time complexity along with its algorithm.

OR iii. Illustrate with an example the knapsack problem along with algorithm using greedy approach. **8**

Q.4 i. Explain the following graph traversal- **3**
(a) Depth first search (b) Breath first search.

ii. Define dynamic programming. Solve multistage graph using dynamic programming also compute its time complexity. **7**



OR iii. Difference between fractional knapsack and 0/1 knapsack. **7**

Q.5 i. When to use a backtracking algorithm? Explain its term related to backtracking. Write its applications. **4**

ii. Suppose you have 4 vertices A, B, C, D. Apply graph colouring using backtracking. **6**

OR iii. Define branch and bound. **6**

	1	2	3	4	5
1	∞	20	30	10	11
2	15	∞	30	10	11
3	3	5	∞	2	4
4	19	6	18	∞	3
5	16	4	7	16	∞

Solve this TSP using branch and bound.

Q.6 Attempt any two:

i. Discuss in detail about the class P, NP, NP-hard and NP-complete problems. **5**

ii. What do you mean by Randomized algorithms? Explain its classification. **5**

iii. Define Quantum algorithms and Cook's theorem. **5**

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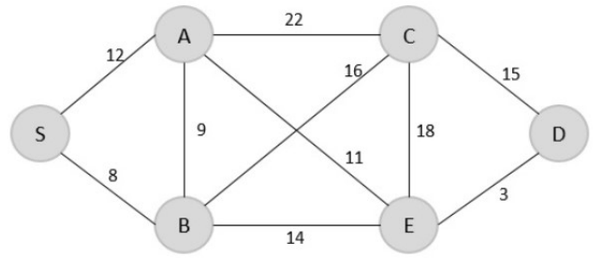
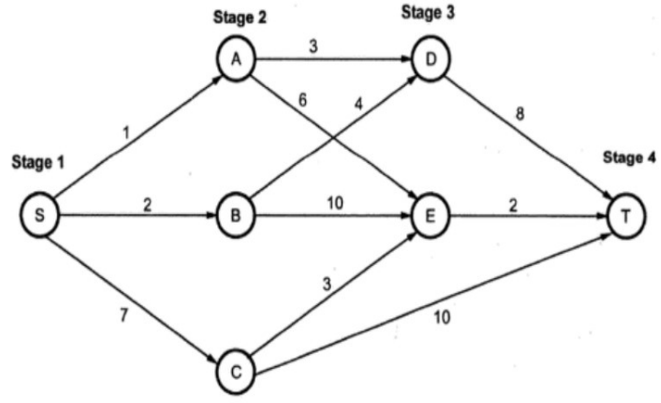
Marking Scheme

CB3CO23 (T) Design And Analysis of Algorithms

Q.1	i)	C		**1**
	ii)	B		**1**
	iii)	C		**1**
	iv)	C		**1**
	v)	C		**1**
	vi)	D		**1**
	vii)	D		**1**
	viii)	A		**1**
	ix)	A		**1**
	x)	C		**1**
Q.2	i.	Define Algorithm.Also state its characterstics		**2**
		Definition of Algorithm	-1mark	
		2 points in Characteristic	-0.5 mark each	
	ii.	Explain how algorithms performance is analyzed ? Describe asymptotic notation?		**3**
		Algorithm Performance	-1mark	
		Asymptotic Notation	-2mark	
	iii.	What do you mean by Recurrence Relations?		**5**
		Solve this recurrence relation T(n) = 2T(n/2) + n using recursive tree method.		
		Recurrence Relation Definition	-1mark	
		Solution to equation	-2mark	
		Time complexity	-2mark	
OR	iv.	T(n) = 3T(n/2) + n^2 .Solve this in master theorem.Also state which case it follows.		**5**
		Steps to solution	-3mark	
		T(n) = Θ(n^ 2) (case 3).	-2mark	
Q.3	i.	Differentiate between Greedy Algorithm and Divide and conquer.		**2**
		Greedy algorithm	-1mark	
		Divide and conquer	-1mark	
	ii.	Write short notes on spanning trees.		**8**
		Solve this graph using Prim's Algorithm.		



		Compute its time complexity along with its algorithm.		
		Short notes on spanning tree	-2marks	
		Solve graph	-2marks	
		Algorithm	-3marks	
		Time complexity	-1 mark	
OR	iii.	Illustrate with an example Knapsack problem along with algorithm using greedy approach.		**8**
		Example	-4 mark	
		Algorithm	-4mark	
Q.4	i.	Explain the following graph traversal (a) Depth First search (b) Breath First search		**3**
		Depth First search	-1.5 mark	
		Breath First search	-1.5 mark	
	ii.	Define Dynamic programming.		**7**
		Solve multistage graph using dynamic programming		



Definition of dynamic programming -2mark

Solve graph -4mark
Time complexity -1mark

OR iii. Difference between Fractional knapsack and 0/1 knapsack. **7**
Fractional knapsack -3.5mark
0/1 knapsack -3.5mark

Q.5 i. When to use a Backtracking algorithm?Explain its term related to backtracking.Write its applications. **4**
When to use backtracking -1 mark
Explain its term in backtracking -1 mark
Applications -2mark

ii. Suppose you have 4 vertices A,B,C,D .Apply graph colouring using backtracking. **6**
Diagram -2mark
Backtracking process -4mark

OR iii. Define branch and bound. **6**

	1	2	3	4	5
1	∞	20	30	10	11
2	15	∞	30	10	11
3	3	5	∞	2	4
4	19	6	18	∞	3
5	16	4	7	16	∞

Solve this TSP using branch and bound.
Definition -1mark
Solve matrix -5mark

Q.6

i. Discuss in detail about the class P, NP, NP-hard and NP-complete problems. **5**
Definition p -1mark
Definition NP -1 mark
Definition NP hard -1.5mark
Definition NP Complete -1.5mark

ii. What do you mean by Randomized algorithms.Explain its classification. **5**
Definition -2mark

Classification -3mark

iii. Define Quantum algorithms and Cook's theorem. **5**
Quantum algorithm -2.5mark
Cook's theorem -2.5mark

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