

Q.1) 1 to 5

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The asymptotic notation used to determine Average case running time of an algorithm is:
Option A:	Big Oh
Option B:	Big Omega
Option C:	Big Theta
Option D:	Small Theta
2.	Time Complexity for Merge Sort algorithm using Divide and Conquer is
Option A:	$O(n)$
Option B:	$\Theta(n \log n)$
Option C:	$O(\log n)$
Option D:	$O(n^2)$
3.	If a problem can be broken into subproblems which are reused several times, the problem possesses _____ property.
Option A:	Overlapping subproblems
Option B:	Optimal substructure
Option C:	Memorization
Option D:	Greedy
4.	Identify the data structure used for multilevel indexing :
Option A:	B Tree
Option B:	B+ -tree
Option C:	AVL Tree
Option D:	Red-black Tree
5.	Identify the correct technique used for solving fractional Knapsack problem.
Option A:	Greedy Technique
Option B:	Divide and conquer
Option C:	Dynamic programming
Option D:	Cannot be solved

Q.1) 6 to 8

6.	Which of the following statement is True for TSP.
Option A:	In TSP, we know that Hamiltonian Tour exists
Option B:	In TSP, many Hamiltonian tours exist
Option C:	In TSP, we find a minimum weight Hamiltonian Cycle.
Option D:	In TSP, we find a maximum weight Hamiltonian Cycle.
7.	To merge two files containing m and n records respectively using Greedy Optimal Merge Pattern, the number of comparisons needed to merge them is :
Option A:	$m - n$
Option B:	$m + n$
Option C:	$m * n$
Option D:	m / n
8.	Best case number of comparisons to for a Naive string matching algorithm is :
Option A:	$O(m*(n-m+1))$
Option B:	$O(m*n)$
Option C:	$O(n)$
Option D:	$O(1)$

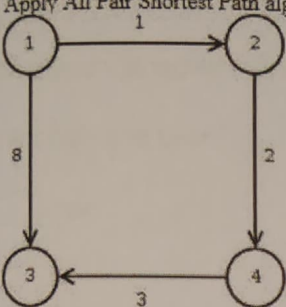
Q.1) 9 to 10

9.	Predict an optimal schedule using Job sequencing with deadlines that gives maximum profit.						
	Jobs	J1	J2	J3	J4	J5	J6
	Deadlines	4	2	3	3	3	3
	Profits	60	50	26	42	20	84
Option A:	1—2—6--3.						
Option B:	4—2—6--1.						
Option C:	3—2—6--4.						
Option D:	4—5—6--2.						
10.	State which of the following options is True:						
Option A:	P is set of problems that can not be solved by a deterministic Turing machine in Polynomial time.						
Option B:	NP is set of decision problems that can be solved by a Non-deterministic Turing Machine in Polynomial time.						
Option C:	NP is subset of P						
Option D:	P, NP, NP-Hard and NP-Complete are not related						

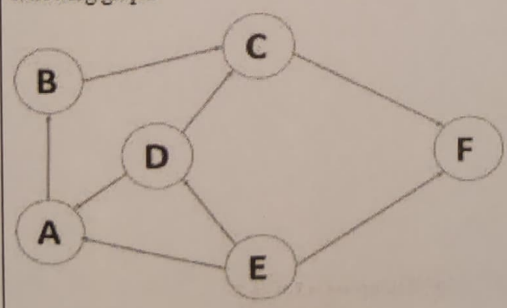
Q.2

Q2	Solve any Four out of Six	5 marks each
A	Define the Asymptotic notations with suitable diagrams.	
B	Explain different methods used for solving recurrences.	
C	Analyze Time complexity of Binary Search using Divide and Conquer. Also write the algorithm for the same.	
D	Describe Genetic algorithms and its importance.	
E	Explain approximate algorithms with a suitable example.	
F	Describe NP-Hard and NP-Complete	

0.3

Q3	<div>Solve any Two Questions out of Three</div> <div>10 marks each</div>															
A	<div>Apply All Pair Shortest Path algorithm to solve following problem.</div>  <pre> graph TD 1((1)) -- 1 --> 2((2)) 1((1)) -- 8 --> 3((3)) 2((2)) -- 2 --> 4((4)) 4((4)) -- 3 --> 3((3)) </pre>															
B	<div>Illustrate the process of finding LCS to find the Longest Common Subsequence for the following set of strings:</div> <div>ABCDGH</div> <div>AEDFHR</div>															
C	<div>Solve the following Knapsack problem using Greedy method. $W = 45$</div> <table data-bbox="50 869 359 1068"> <tr> <th>Item (O_i)</th><th>A</th><th>B</th><th>C</th><th>D</th></tr> <tr> <td>Value (P_i)</td><td>50</td><td>140</td><td>60</td><td>60</td></tr> <tr> <td>Size (W_i)</td><td>5</td><td>20</td><td>10</td><td>12</td></tr> </table>	Item (O _i)	A	B	C	D	Value (P _i)	50	140	60	60	Size (W _i)	5	20	10	12
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Value (P _i)	50	140	60	60												
Size (W _i)	5	20	10	12												

0.4

Q4	Solve any Two Questions out of Three 10 marks each
A	<p>Explain B Tree and Illustrate the insertion operation in a B tree of degree 3 by inserting following data values. 16,70,30,10,18,22,24,5,75,9,7,2,12.</p>
B	<p>Explain Matrix Chain Multiplication problem.</p>
C	<p>Demonstrate the use of adjacency matrix method to find the topological sorting order for following graph.</p>  <pre> graph TD B((B)) --> C((C)) B((B)) --> A((A)) C((C)) --> D((D)) C((C)) --> F((F)) A((A)) --> D((D)) D((D)) --> E((E)) E((E)) --> F((F)) </pre>

Advanced Data Structures & Analysis of Algorithms

University of Mumbai
Examination 2020 under cluster 7 (Lead College: SCSJCE)

Program: Information Technology

Curriculum Scheme: Rev2016

Examination: TE Semester V

Course Code: ITDLO5011 and Course Name: Advanced Data Structures & Analysis of Algorithms
Time: 2 hour

Max. Marks: 80

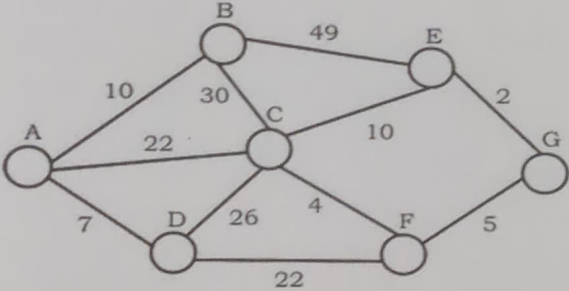
10

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.2	Which one of the following is Substitution method
Option A:	Forward
Option B:	Linked list
Option C:	Master's
Option D:	Stack
2.3	Recursion is a method in which the solution of a problem depends on
Option A:	Smaller instances of the same problem
Option B:	Larger instances of the same problem
Option C:	Larger instances of different problems
Option D:	Smaller instances of different problems
3.4	Which of the following is NOT recurrence method
Option A:	Substitution Method
Option B:	Master's Theorem
Option C:	Array
Option D:	Tree Method
4.5	What is probabilistic analysis for hire assistant example?
Option A:	$T(n)=O(n/2)$
Option B:	$T(n)=O(n)$
Option C:	$T(n)=O(\log n)$
Option D:	$T(n)=O(1)$
5.6	A _____ is a special Tree-based data structure in which the tree is a complete binary tree.
Option A:	Graph
Option B:	Heap
Option C:	List
Option D:	Stack
6.7	Which is not an application of Topological Sorting
Option A:	Ordered Statistics
Option B:	Finding prerequisite of a task
Option C:	Finding Deadlock in an Operating System
Option D:	Finding Cycle in a graph

7.8	In which of the following graph Topological Sort can be implemented?
Option A:	Directed Acyclic Graphs
Option B:	Undirected Cyclic Graphs
Option C:	Directed Cyclic Graphs
Option D:	Undirected Acyclic Graphs
8.9	In most of the cases, topological sort starts from a node which has
Option A:	Maximum Degree
Option B:	Minimum Degree
Option C:	Any degree
Option D:	Zero Degree
9.10	Matrix A is of order 3×4 and Matrix B is of order 4×5 . How many elements will be there in a matrix $A \times B$ multiplied recursively.
Option A:	12
Option B:	15
Option C:	16
Option D:	20
10.11	What is the worst case time complexity of merge sort?
Option A:	$O(n \log n)$
Option B:	$O(n^2)$
Option C:	$O(n^2 \log n)$
Option D:	$O(n \log n^2)$
11.12	Given an array $arr = \{45, 77, 89, 90, 94, 99, 100\}$ and $key = 100$; What are the mid values (corresponding array elements) generated in the first and second iterations?
Option A:	90 and 99
Option B:	90 and 100
Option C:	89 and 94
Option D:	94 and 99
12.13	Kruskal's algorithm is used to find
Option A:	Single Source Shortest Path
Option B:	Graph Traversal
Option C:	Minimum Spanning Tree
Option D:	All pair shortest Path
13.14	Which of the following is not greedy problem?
Option A:	Container loading
Option B:	Fractional Knapsack
Option C:	Flow Shop Scheduling
Option D:	Job Sequencing with deadlines
14.15	What is the optimal storage on tapes value when $n=3$, $(I_1, I_2, I_3) = (5, 10, 3)$?
Option A:	29
Option B:	31
Option C:	34
Option D:	43

15.16	Which is not correct solution method of Flow shop scheduling problem?
Option A:	Branch and Bound
Option B:	Dynamic Programming
Option C:	Greedy algorithm
Option D:	Heuristic algorithm
16.17	Which of the following are the characteristics of dynamic programming approach?
Option A:	Overlapping sub problems
Option B:	Greedy approach
Option C:	Optimal substructure
Option D:	Both optimal substructure and overlapping sub problems
17.18	When a problem can be solved by combining optimal solutions to non-overlapping problems, the strategy is called
Option A:	Recursion
Option B:	Divide and Conquer
Option C:	Memorization
Option D:	Greedy
18.19	What is the time complexity of the above dynamic programming implementation of the longest common subsequence problem where length of one string is "m" and the length of the other string is "n"?
Option A:	$O(n)$
Option B:	$O(m)$
Option C:	$O(m+n)$
Option D:	$O(mn)$
19.20	What is the worst case running time of Rabin Karp Algorithm?
Option A:	$\Theta(n)$
Option B:	$\Theta(n-m)$
Option C:	$\Theta((n-m+1)*m)$
Option D:	$\Theta(n * \log m)$
20.21	Which of the following is a substring of "engineering"
Option A:	engg
Option B:	gineer
Option C:	ning
Option D:	eiee

Q2. (20 Marks Each)	Solve any Two Questions out of Three	10 marks each
A	Explain Probabilistic Analysis & Randomized Algorithm with the help of example.	
B	Sort the following numbers using Heap Sort. [25, 67, 56, 32, 12, 96, 82, 44]. Show the contents of the array after every iteration. Also Derive time complexity for the same.	
C	Explain Strassen's matrix multiplication rules. Solve the following example with the help of Strassen's matrix multiplication. $A = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$	

Q3. (20 Marks Each)	Solve any Two Questions out of Three	10 marks each
A	Explain Minimum Spanning Tree. Find Minimum spanning tree of the following graph using prim's and kruskal's algorithm. 	
B	Explain 0/1 knapsack problem using dynamic programming approach.	
C	Explain Rabin Karp Algorithm with a suitable example.	

(3 Hours)

[Total Marks: 80]

10

N.B.: (1) Question No.1 is compulsory.

(2) Attempt any three out of remaining questions.

(3) Assume Suitable data if necessary.

(4) Figures to the right indicate full marks.

- Q1 a. Differentiate between Greedy method and Dynamic Programming 5
b. Write an algorithm for finding minimum and maximum number from a given set 5
c. Explain coin changing problem 5
d. Explain Flow Shop Scheduling Technique 5

Q2a. Define AVL tree. Construct an AVL tree for the following data 10

63, 9, 19, 27, 18, 108, 99, 81

b. Write an algorithm for implementing Quick sort. Also, comment on its complexity. 10

Q3a. What is longest common subsequence problem? Find LCS for the following string: 10

String X: ABCDGH

String Y: AEDFHR

b. Explain Rabin Karp Algorithm in detail. 10

Q4a. Which are the different methods of solving recurrences? Explain with suitable examples. 10

b. Explain Travelling Salesman Problem with an example. 10

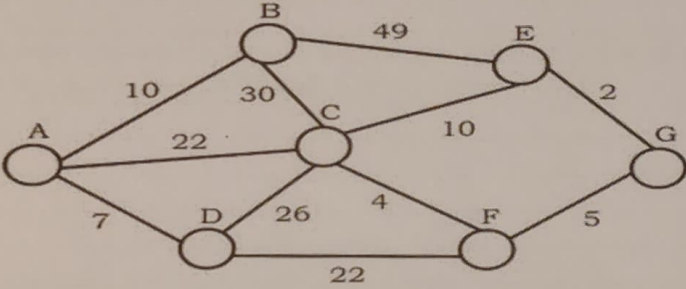
Q5a. Explain Huffman Algorithm. Construct a Huffman Tree and find Huffman code for the message: KARNATAKA 10

b. Explain Knapsack Problem with an example. 10

Q6 Write Short notes on (any four) 20

- a. Genetic Algorithm
b. Red and Black Tree
c. Merge Sort
d. Knuth Morris Pratt Algorithm
e. Optimal Binary Search Tree (OBST)

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E/IT/SEM V / Choice Base/ Advance Data Structures & Analysis of Algorithms

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