SOMAIYA
VIDYAVIHAR UNIVERSITY
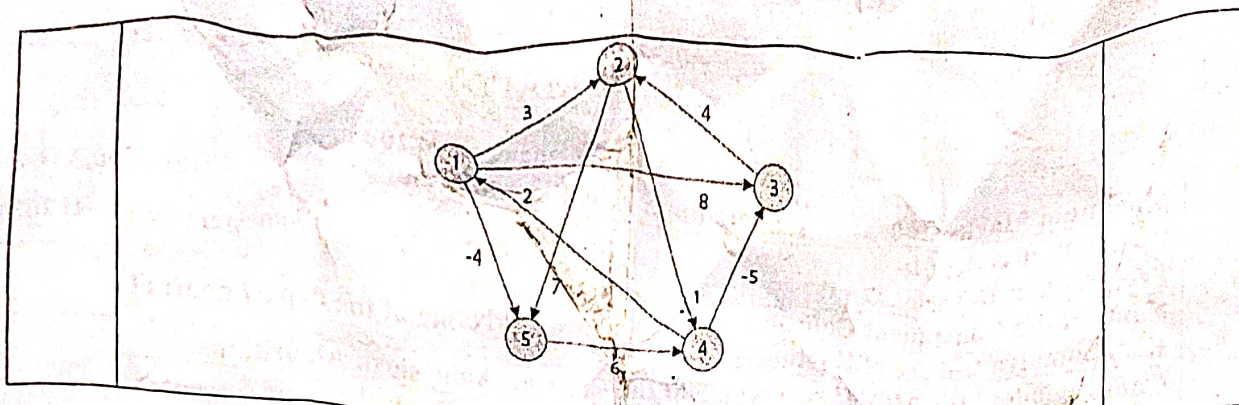
Maximum Marks: 100	Semester: January 2023 –May 2023	Duration:3 Hrs.
Programme code: 04	Examination: ESE Examination	Semester: IV (SVU 2020)
Programme: B-Tech IT	Class: SY	
Name of the Constituent College: K. J. Somaiya College of Engineering	Name of the department: IT	
Course Code: 116U04C403	Name of the Course: Analysis of Algorithms	

Instructions: 1)Draw neat diagrams 2) All questions are compulsory
3) Assume suitable data wherever necessary

Que. No.	Question	Max. Marks
Q1	Solve any **Four**	20
i)	Define and explain Big- O, Ω, Θ notations for time complexity with Diagram.	5
ii)	Find the complexity of following recurrence relation using recursion tree technique and prove the result using substitution technique. $T(n)= 4T(n/4) + n$	5
iii)	Sort the following element (8, 5, 2, 3, 9, 4) using Insertion Sort	5
iv)	Sort the following element (6, 4, 5, 2, 5, 4, 2, 4, 0) using Counting Sort	5
v)	Write the algorithm/pseudo code for Sum of Subset Problem using Backtracking Approach.	5
vi)	Write the algorithm/pseudo code for TSP Problem using Branch and Bound Approach.	5

Que. No.	Question	Max. Marks
Q2 A	Solve the following	10
i)	State the difference between Quick sort and Randomized Quick sort	5
ii)	Derive Quick sort recurrence relation time complexity using Substitution method & Master method.	5
	OR	
Q2 A	Explain what are Max Heap and Min Heap? Derive the time complexity of heap sort algorithm in detail?	10
Q2 B	Solve any **One**	10
i)	Consider the following table of Optimal Binary Search Technique (OBST)	10

Keys	A	B	C	D	E	F	G
Frequency	4	2	1	3	5	2	1

Using dynamic algorithm formulas find the optimal Cost and construct the final OBST.

ii)	Solve the following graph to find shortest path using Floyd-Warshall algorithm and state shortest path from source '4' to all destination with their cost.	10

Que. No.	Question	Max. Marks
Q3	Solve any **Two**	20
i)	Consider the instance of knapsack problem where n=6, M=15, profits are $\{p1,p2,p3,p4,p5,p6\}=\{1,2,4,4,7,2\}$ and weights are $\{w1,w2,w3,w4,w5,w6\}=\{10,5,4,2,7,4\}$. Find Maximum Profit using Fractional Knapsack and 0/1 knapsack Approach. Also explain which Approach is better in different scenario and justify the same.	10
ii)	Given the jobs, their deadlines and associated profits are as follows:-	10

Jobs	J1	J2	J3	J4	J5	J6
Deadlines	5	3	3	2	4	2
Profits	200	180	190	300	120	130

Answer the following questions :-
   a) Write the optimal schedule that gives maximum profit.
   b) Are all the jobs completed in the optimal schedule?
   c) What is the maximum earned profit?
   d) Write the algorithm for job sequencing with deadline.

Que. No.	Question	Max. Marks
iii)	Distinguish between Greedy and Dynamic Programming with example (**Min 6 Points**)	10

Que. No.	Question	Max. Marks
Q4	Solve any **Two**	20
i)	What do you understand by P, NP, NP-Hard, NP-Complete Problems/Algorithms?	10
ii)	Prove that 0/1 Knapsack problem is NP-Complete?	10
iii)	Prove that Travelling salesman problem is NP-Complete?	10

Que. No.	Question	Max. Marks
Q5	(Write notes / Short question type) on any **four**	20
i)	Write the algorithm/pseudo code for Selection Sort Algorithm.	5
ii)	Write the algorithm/pseudo code for Radix Sort Algorithm.	5
iii)	Write the algorithm/pseudo code for Kruskal's Algorithm for MST	5
iv)	Write the algorithm/pseudo code for TSP using dynamic approach.	5
v)	Write the algorithm/pseudo code for Hamiltonian Circuit Problem using Backtracking Approach.	5
vi)	Write the algorithm/pseudo code for 15 Puzzle Problem using Branch and Bound Approach.	5

2/2