Register Number:……..

KUMARAGURU
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B.E DEGREE EXAMINATIONS: APRIL / MAY 2024

(Regulation 2018)

Fourth Semester

COMPUTER SCIENCE AND ENGINEERING

U18CST4001**:** Design and Analysis of Algorithms

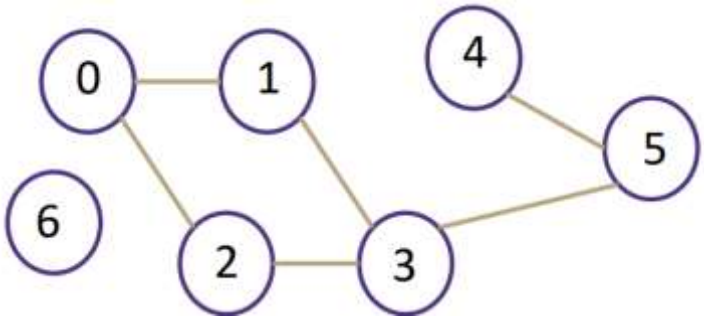
COURSE OUTCOMES

CO1: Compare various graph traversal techniques
CO2: Apply algorithm analysis techniques for a given algorithms
CO3: Examine algorithm design techniques for a given application
CO4: Analyse different algorithms for solving a given problem
CO5: Develop application using chosen algorithm technique

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1. Consider the following undirected graph: CO1 [K_3]



Construct the Adjacency matrix and compute the following:

a) Space Complexity

b) Time complexity of finding out neighbors of a vertex v

2. Define the transitive closure of a graph with an example CO1 [K_2]
3. List out the Steps in Mathematical Analysis of non-recursive Algorithms CO2 [K_2]
4. Solve the following recurrence relations using Backward substitution method : CO2 [K_3]

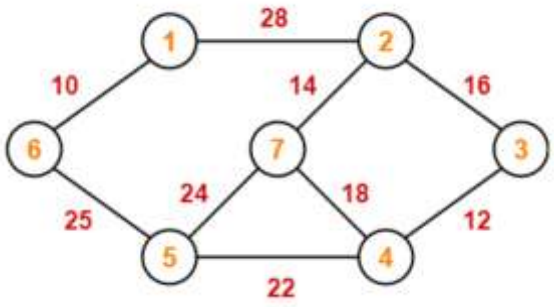
a) X(n) = X(n-1) + 5, for n > 1, X(1) = 0

5.	Consider the classical sequential search algorithm (of looking for a key in a list of keys) and a variation of sequential search that scans a list to return the number of occurrences of a given search key in the list. Compare the best-case, worst-case and average-case efficiency as well as the overall time complexity of the classical sequential search with that of its variation.		CO3	[K_3]
6.	How many comparisons (both successful and unsuccessful) are made by the brute-force string matching algorithm in searching for the following pattern: 01010 in the binary text of 1000 zeros		CO3	[K_3]
7.	Consider the following riddles: i. Coin Collector: I take your money but give the least in return. I grab the biggest first, no matter how many coins I churn. Who am I? ii. Lost in the Woods: Trails crisscross, all directions lead. I find the shortest path, with clever memory indeed. Who am I? iii. Fibonacci Follower: Numbers spiral, ever growing, each one the sum before. But why repeat the same old sum, when clever tricks explore? Who am I? iv. Cunning Thief: I pack my bag for the heist, with treasures rich and grand. But weight restricts my choices, so I take the most by hand. Who am I? Relate the above riddles with appropriate algorithmic design techniques		CO4	[K_1]
8.	Recall the purpose of Floyd's algorithm and write the formula to find the shortest path using Floyd's approach		CO4	[K_2]
9.	Define chromatic number of the graph		CO5	[K_2]
10.	Give examples for Tractable and Intractable problems		CO5	[K_2]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.	a)	Explain Dijkstra's algorithm for finding the shortest path in a graph. Include steps involved, data structures used, and space and time complexity of the chosen data structure	8	CO1	[K_1]

	b)	Apply the Prim algorithm to construct the Minimum Spanning Tree (MST) of the given graph.	8	CO1	[K_3]



12.	a)	State the Master's Theorem and solve the following recurrence relation using Master's Theorem i. $T(n) = 3T(n/2) + n^2$ ii. $T(n) = 16T(n/4) + n$ iii. $T(n) = 4T(n/2) + n^2$	10	CO2	[K_3]
	b)	Explain fundamentals of algorithmic problem solving with suitable diagram	6	CO2	[K_2]
13.	a)	Apply the Strassen's algorithm to compute the matrix multiplication for the 4*4 matrices:	8	CO3	[K_3]

2	2	3	1
1	4	1	2
2	3	1	1
1	3	1	2

Matrix A

X

2	1	2	1
3	1	2	1
3	2	1	1
1	4	3	2

Matrix B

	b)	Explain the algorithm for brute-force string matching problem and compute its time complexity.	8	CO3	[K_2]

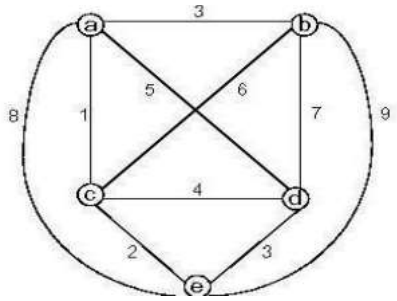
14. a) For the given set of items and knapsack capacity = 60 kg, Compute the optimal solution for the fractional knapsack problem making use of greedy approach. 8 CO4 [K_3]

Item	Weight	Value
1	5	30
2	10	40
3	15	45
4	22	77
5	25	90

b) Explain the dynamic programming algorithm for constructing an optimal search tree with a suitable example 8 CO4 [K_2]

15. a) Construct the state space tree for 4 Queen's problem and explain the algorithm and its time complexity 8 CO5 [K_2]

b) Solve Travelling Salesman Problem using Branch and Bound Algorithm in the following graph 8 CO5 [K_3]



16. a) Explain the concepts of P, NP, and NP – complete problems with suitable examples 8 CO5 [K_2]

b) Summarize the characteristics of following algorithmic design strategies and discuss the classical problems solved by each approach: 8 CO2 [K_2]

i. Greedy techniques
ii. Dynamic Programming
iii. Divide and Conquer
iv. Backtracking
v. Branch and Bound

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