Sardar Patel Institute of Technology

(Autonomous College Affiliated to University of Mumbai)
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

End Semester Examination
MAY 2021-22

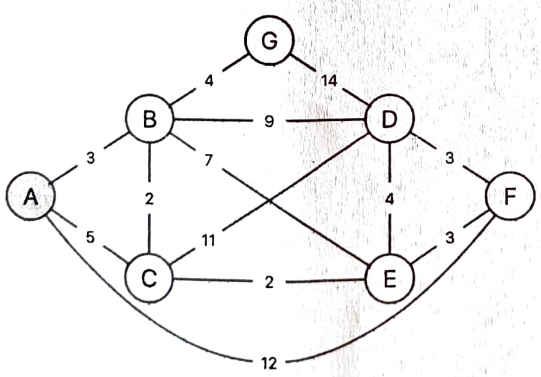
Max. Marks: 60 | **Duration: 120 min.** | **Class: S.E.**

Semester: IV | **Course Code: IT 205/CS205** | **Branch: IT/COMP**

Name of the Course: Design and Analysis of Algorithm

Instructions:
(1) **All Questions are Compulsory**
(2) **Draw neat diagrams**
(3) **Assume suitable data if necessary**

Question No.	Question	Max. Marks	CO
Q. 1 a-	Analyze the time complexity of a given Recurrence equation using the Recursion tree method. 1- W(n) = W(n/3) + W(2n/3) + n 2- T(n) = T(n/4) + T(n/2) + n^2	*05*	CO1
Q1.b-	Consider the given original array A[ ]={2,8,7,1,3,5,6,4} Apply the quicksort algorithm on the above array Quicksort(A,1,8) assuming the last element as pivot element. For the intermediate call Quicksort(A,5,8), what will be the index q (partition index). Show the calculations of each pass. **OR** iii) Apply Binary search algorithm to search given numbers. Show indices of low, mid and high pointers in each iteration for each search. **Numbers to be searched: 151, -14** -15 | -6 | 0 | 7 | 9 | 23 | 54 | 82 | 101 | 112 | 125 | 131 | 142 | 151	*05*	CO2

Q. 2 a-	i) You are going on a long trip. You start on the road at mile post 0. Along the way there are n hotels, at mile posts a1 < a2 < · · · < an, where each ai is measured from the starting point. The only places you are allowed to stop are at these hotels, but you can choose which of these hotels to stop at. You must stop at the final hotel (at distance an), which is your destination. You would ideally like to travel 200 miles a day, but this may not be possible (depending on the spacing of the hotels). If you travel x miles during a day, the penalty for that day is (200 – x)^2 . You want to plan your trip so as to minimize the total penalty – that is, the sum, overall travel days, of the daily penalties. Give an efficient Dynamic programming approach that determines the optimal sequence of hotels at which to stop.	*05*	**CO3**
Q. 2 b-	Consider the following assembly line problem: time_spent[2][4] = {{6, 5, 15, 7}, {5, 10, 11, 4}} time_to_reach[2][3] = {{17, 2, 7}, {19, 4, 9}} entry_time[2] = {8, 10} exit_time[2] = {10, 7} num_of_stations = 4 show the solution matrix with final cost and solution path. Show all intermediate calculations. **OR** Using the below graph, if we apply Dijkstra's algorithm to find the shortest distance between node A and all the others, in what order do the nodes get included in the visited set (i.e their distances have been finalized)? Show the iteration of each pass. 	*07*	**CO3**

Q.3.a	i) Solve the following instance of 0/1 knapsack problem by using LC branch and bound technique. N=4, m=15 (p1, p2, p3, p4) = (10,10, 12,18) (w1, w2, w3, w4) = (2, 4, 6, 9) Show the state space tree generated to get the optimal solution, also Label each node by its *c* and *u* cost and state the bounding condition applied at each pruned node. Write the optimal solution.	*08*	*CO4*
Q.3.b	i) Write a recursive backtracking function for the Sum of subsets problem. ii) State the Bounding conditions to prune the nodes and iii)draw the portion of pruned state space tree after applying bounding conditions to show at least one feasible solution for the given instance of input. n=6, m=30, w[1:6}={5,10,12,13,15,18}	*10*	*CO4*
Q.4.a	In modern times, Alibaba and forty thieves used to rob the citizens and collected the loot in a secret cave, which can be opened by the code word "**onions** ". To protect the code word from others he says a long sentence comprising the code word in it. That sentence must contain the code word, 3 times or multiple of 3 times in that sentence, then only the door will be opened. Suppose sample sentence input is: ("*My brother who came from Mumbai got onions for lunch to prepare good onions chutney with delicious dessert* of onions") then Door will open as, above statement contains code word "onions" 3 times. (i) Write an algorithm/ pseudo code which will accept a sentence and prints "Door is open" or "door is closed". (ii) Solve the above problem with String matching with finite Automata. Draw state transition diagram and table both.	*10*	*CO5*
Q.4.b	i) What is the Vertex Cover Problem? ii) Prove that Vertex cover is an NP complete problem. iii) Give an approximation algorithm for Vertex cover problem and justify its approximation ratio with example	*10*	*CO1*