Scheme of Valuation/Answer Key

(Scheme of evaluation (marks in brackets) and answers of problems/key)

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2022

Course Code: CST306

Course Name: ALGORITHM ANALYSIS AND DESIGN

Max. Marks: 100		Duration: 3 Hours

PART A

		Answer all questions, each carries 3 marks.	Marks
1		The definition of the big mega notation is that $f(n) \geq c.g(n)$.Hence show that $7n + 4 \geq 7n$for all c>7.	(3)
2		a) Here $a = 8, b = 2, \wedge f(n) = n^2. compare f(n) with n^{log_b a}$. Case I of master theorem and $T(n) = \theta(n^3)$- Case I b) Here $a = 2, b = 2, \wedge f(n) = n$ $. compare f(n) with n^{log_b a}$. Case II of master theorem and $T(n) = \theta(nlogn)$-Case 2	(3)
3		Make_set(x) creates a new set containing an element x. Example: MAKE_SET(2)= {2} UNION(x, y): Unites the dynamic sets that contain x and y, say Sx, Sy, into a new set and deletes Sx and Sy. Example: S={{1,2,3},{5,6},{11,12}} UNION(5, 11) S={{1,2,3},{5,6,11,12}} FIND_SET(x):This operation returns the representative of the set in which x is present. FIND_SET(6) returns 5(here we assume that 5 is the representative of the set {5,6}.	(1+1+1)
4		Write any two: here we can place F anywhere. Example1. A B F C D E and A B C D E F	(1.5+1.5)
5		Refer the page no 99 of the text book titled “Fundamentals of Computer Algorithms” by Ellis Horowitz.	(3)
6		Sort the items in Pi/Wi ratio. Order is {3,1,2}. Answer is 20*1+24*1+18*2/9 = 48	(3)
7		Refer page 373 of text book “ Introduction to Algorithms” by Cormen (3rd	(3)

		Edition)	
8		Write any three points – Both solves optimization problems. Both uses state space tree and bounding functions. But the search strategy in backtracking is usually DFS, but in branch-and-and-bound it is sometimes DFS or BFS.. Branch and bound usually applied in combinatorics optimization problems. Example TSP Backtracking any hard computational problem. Example n Queens.. See the answer and give marks	(3)
9		Discuss briefly the need for approximation algorithm.	(3)
10		Define the colouring problem. There will be k colours and adjacent vertices must have different colours. The graph colouring problem is to determine the minimum number of colours needed to colour a given graph.	(3)
PART B			
Answer one full question from each module, each carries 14 marks.			
		Module I	
11	a)	Give the definition (refer the text book Introduction to algorithms by Coremen); One mark each for definition and one mark for drawing graphs of big oh, big omega, and theta.	(5+1)
	b)	Unfold the recurrence equation systematically and the answer is O(lgn) for first one and $O(n^2)$ for second one	(4+4)
		OR	
12	a)	1) $O(n^2)$ – double for loops 2) O(n) – recursive algorithm for factorial. T(n)=T(n-1)+1	(3+3)
	b)	Linear search algorithm – 2 marks Best case: Key element appears as first element – one comparison- 2 marks Worst case: Key element is last element or key element is not in the list- n comparison- O(n) – 2 marks Average case: Key element can be any position in the list with equal probability and O(n) – 2 marks	(2+2+2+2)
		Module II	

13	a)	Operations : Make-Set(x), Union(x,y), Find-Set(x). Refer page no 563 of text book Introduction to Algorithms by Corment (3rd Edition)	(3+4)
	b)	Advantage : AVL tree is a height balanced tree where height of the tree is O(log n) which is better than BST where the worst case height is O(n). Discuss Single rotations required: left rotation and right rotation. Discuss double rotation: left-right rotation, and right-left rotation.	(3+4)
		OR	
14	a)	Write the BFS algorithm using Queue. Complexity is O(V+E). Write the analysis statements with respect to the algorithm.	(4+3)
	b)	1) Perform BST insertion and do balance the tree by applying suitable rotation 2) perform BST deletion and do balance the tree by applying suitable rotation	(3+4)
		Module III	
15	a)	Write algorithm MergeSort() and algorithm Merge(). Write the recurrence $T(n) = 2T\left(\frac{n}{2}\right) + cn$ and solve it using any method and complexity is O(nlgn).	(4+3)
	b)	Write kruskals algorithm using makeSet(), FindSet() and Union() disjoint set operations. MST Cost is 5+15+10+30=60	(4+3)
		OR	
16	a)	Write Dijkstra's Algorithm. Analysis: The total time dependent on the implementation. If it is implemented using a priority queue as a binary heap, then the algorithm takes V(|E|+|VlogV|)	(4+3)
	b)	Write the control abstraction of greedy. Objective function, candidate solutions, selection procedure, feasibility check and solution check. Write algorithm fractional knapsack Sort the items of the order of profit/weight ratio	(2+5)
		Module IV	

17	a)	Write the algorithm - Key point is the recurrence: D[i,j]=min{D[i,j], D[i,k]+D[k,j] – 4 marks Analysis - 1 marks $O(n^3)$	(4+1)
	b)	Definition of TSP – 1 mark Solving the instance -8 mark Optimal TSP is 1-3-4-2-5-1 Draw the state space tree.	(1+8)
		OR	
18	a)	Here student has to draw the m-table and s-table. M[1,1]=M[2,2]=M[3,3]=M[4,4]=0 M[1,2]=60, M[2,3]=30,M[3,4]=42 M[1,3]=70 at split, k=1. M[2,4]=100 at k=3 M[1,4]=126 at k=3 Optimum cost is 126. Optimal parenthesization is (A(BC)D). Give partial marking seeing the intermediate steps.	(8)
	b)	Definition of n queens problem – 1 mark State space tree – 5 mark- two solutions -like mirror images	(1+5)
		Module V	
19	a)	Discuss the benefits by citing bad inputs – 2 marks Types are Las Vegas and Monte Carlo- 1 mark Explanation of Las Vegas and Monte Carlo- 2+2 marks Example - 1 mark	(7)
	b)	Define bin packing problem – 1 mark Discuss First fit heuristic strategy - 5 marks State approximation ratio – 2 mark. Here Approximation ratio is 2.	(7)
		OR	
20	a)	Randomized quick sort algorithm – 4 marks Analysis – 3 marks	(7)
	b)	Show the proof by reducing the problem to any known NP complete problem. Refer the text book Introduction to Algorithms by Cormen or any other standard text book.	(7)
****			