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17CS43

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021 Design and Analysis of Algorithms

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define algorithm. Explain asymptotic notations Big oh, Big omega and Big theta with example. (08 Marks)
- b. List and explain the important problem types that are solved by computer. (07 Marks)
- c. Prove that : If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$. (05 Marks)

OR

- 2 a. Design an algorithm for checking whether all elements in a given array are distinct or not. Derive its time complexity. (08 Marks)
- b. Give general plan of analyzing recursive algorithm. Mathematically analyze the tower of hanoi problem and find its time efficiency. (08 Marks)
- c. Compare the order of growth $\frac{1}{2}n(n-1)$ and n^2 . (04 Marks)

Module-2

- 3 a. Explain divide and conquer method. Write the algorithm for binary search and derive its time complexity. (10 Marks)
- b. List out the advantages and disadvantages of divide and conquer method. Illustrate the topological sorting algorithm for the graph in Fig Q3(b), using DFS method.

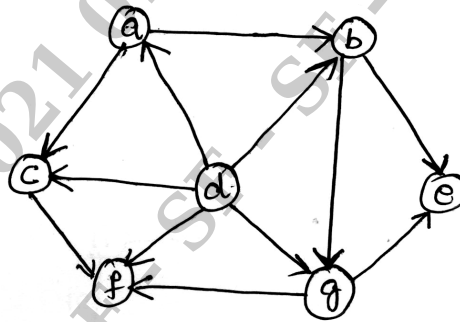


Fig Q3(b)

(10 Marks)

OR

- 4 a. Apply Quicksort algorithm for the following list of elements 5, 3, 1, 9, 8, 2, 4, 7. (08 Marks)
- b. Write algorithm for mergesort and Analyze its efficiency. (08 Marks)
- c. Explain Strassen's matrix multiplication. (04 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-3

- 5 a. Write Dijkstra's shortest path algorithm. Apply Dijkstra's shortest path algorithm on Fig Q5(a) to obtain shortest path. Assume vertex 6 as source.

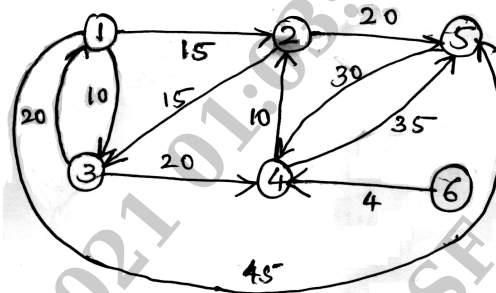


Fig Q5(a)

(10 Marks)

- b. Write an algorithm for the heapsort. Sort the given list of number using heapsort. Derive its time complexity: 100, 75, 80, 25, 50, 30, 45.

(10 Marks)

OR

- 6 a. Define minimum spanning tree. Apply Prim's algorithm on the graph Fig Q6(a).

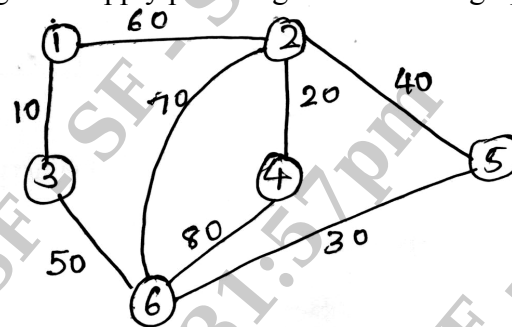


Fig Q6(a)

(08 Marks)

- b. Solve the knapsack problem using greedy method for $n = 3$, $m = 20$, $(P_1, P_2, P_3) = 25, 24, 15$ and $(w_1, w_2, w_3) = (18, 15, 10)$.
- c. Construct a Huffman code for the following data:

(04 Marks)

Character	A	B	C	D	-
probability	0.4	0.1	0.2	0.15	0.15

Encode the text ABACABAD and decode the encoded text 100010111001010. (08 Marks)

Module-4

- 7 a. Write the pseudocode to find an optimal Binary search tree by dynamic programming. (08 Marks)
- b. Write Bellman Ford algorithm to compute shortest path. (05 Marks)
- c. Find the optimal solution for the following instance of knapsack problem using dynamic programming.

Item	Weight	Value
1	2	12
2	1	10
3	3	20
4	2	15

(07 Marks)



OR

- 8 a. Explain dynamic programming. Apply Warshalls algorithm to compute transitive closure for the graph in Fig 8(a).

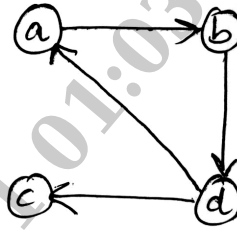


Fig 8(a)

(10 Marks)

- b. Write Floyd's algorithm. Find all pairs shortest path using Floyd's algorithm for the graph in Fig Q8(b).

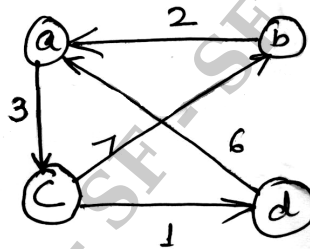


Fig 8(b)

(10 Marks)

Module-5

- 9 a. With necessary state space diagram, explain the solving of four-queens problem by backtracking. (10 Marks)
b. What is branch and bound technique? How it is different from backtracking? (05 Marks)
c. Explain how the Travelling Salesman Problem (TSP) can be solved using branch and bound. (05 Marks)

OR

- 10 a. Apply Backtracking method to solve subset sum problem for the instance $d = 15$, $s = \{3, 5, 6, 7\}$ (08 Marks)
b. Explain the classes of NP-hard and NP-complete. (06 Marks)
c. Draw portion of state space tree for m-colouring with $n = 3$ and $m = 3$ and explain m-colouring. (06 Marks)
