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RAMAIAH Institute of Technology

(Autonomous Institute, Affiliated to VTU)
(Approved by AICTE, New Delhi & Govt. of Karnataka)
Accredited by NBA & NAAC with 'A+' Grade

SEMESTER END EXAMINATIONS – AUGUST / SEPTEMBER 2023

Program	:	**B.E. - Computer Science and Engineering**	**Semester**	:	**IV**
Course Name	:	**Design and Analysis of Algorithms**	**Max. Marks**	:	**100**
Course Code	:	**CS43**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.

UNIT - I

1. a) With example explain worst case, best case and average case timing with example. CO1 (06)
   b) Explain the various Asymptotic notations with example. CO1 (10)
   c) List out the steps in mathematical analysis of non-recursive algorithms. CO1 (04)

2. a) Explain with example stable matching algorithm. CO1 (10)
   b) Discuss linear time and quadratic time with examples. CO1 (10)

UNIT - II

3. a) Write an algorithm to sort the 'n' numbers using divide and conquer approach. CO2 (06)
   b) Compute Breadth First Search and Depth First Search for the following graph. Verify the bipartiteness of the given graph? CO2 (08)

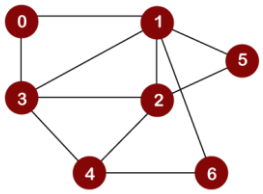

Fig.3(b)

   c) Prove that if graph G=(V,E) has a topological ordering, then G is a DAG. CO2 (06)

4. a) Illustrate the Depth First Search algorithm and find its worst case efficiency when graph is given by adjacency list representation. CO2 (06)
   b) Find the number of inversions for the following set of numbers. CO2 (08)

55	66	44	77	33	11	99	88	100

   c) Prove that the time complexity of merge sort is O(n log n) using "unrolling method" and deduce the recurrence relation for the same. CO2 (06)

UNIT - III

5. a) Design the greedy algorithm for Interval Scheduling for minimizing the maximum lateness. Outline the running time of the algorithm. Apply the same for calculating the lateness for each task, where T_i is Time length for Task i and D_i is deadline for that task. CO3 (08)

Task	1	2	3	4	5	6
T_i	6	4	2	8	6	4
D_i	12	16	18	18	28	30

b) Explain the concept of greedy technique for Prim's algorithm. Obtain the minimum cost spanning tree for the given weighted graph. CO3 (06)

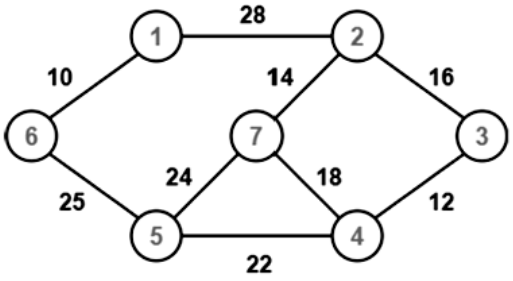

Fig.5(b)

c) Construct the Huffman tree for the following symbols. Find the code words and average code word length. CO3 (06)

Character	A	B	C	D	E	-
Probability	0.5	0.35	0.5	0.1	0.4	0.2

Encode : (i) DAB (ii) AB_CD

6. a) Design the single source shortest path algorithm and Apply the same for the given graph by considering **'S'** as the source vertex, Show the step by step execution of the algorithm using a table.: CO3 (08)

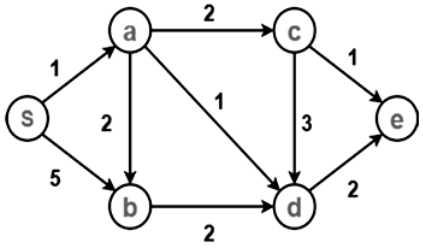

Fig.6(a)

b) Differentiate between fixed-length encoding, variable length encoding and optimal prefix encoding for a given set of alphabets. Which encoding is more suitable and why? CO3 (06)

c) Develop an algorithm for greedy based optimal caching problem. Illustrate the optimized cache misses with the following values. a, b, c, d, a, d, e, a, d, b, c with cache size k=3 and 3 and items {a, b, c} initially in the cache. CO3 (06)

UNIT- IV

7. a) Solve the Knapsack instance with the given input data by identifying the items to be placed in the knapsack with capacity W=10 and write an algorithm for the same: CO4 (08)

Item	Weight	Value
1	7	42
2	3	12
3	4	40
4	5	25

b) Find the shortest path from node 1 to every other node in the given graph using Bellman-Ford algorithm. CO4 (08)

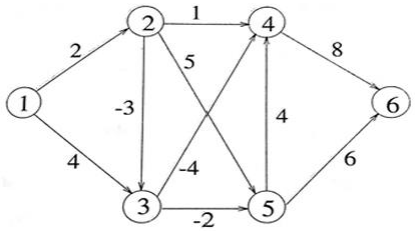

Fig.7(b)

c) Discuss survey-design problem for a given set of customers and products with an algorithm. CO4 (04)

8. a) Design a recursive procedure to find the optimal weight of the intervals for a given set of intervals with their weights. List the intervals that needs to be selected so that maximum weight of the intervals is achieved for the following set of intervals? CO4 (08)

Interval	1	2	3	4	5
Start	3	10	16	13	19
Finish	11	15	17	20	25
Weight	5	4	3	1	1

b) Demonstrate the Ford-Fulkerson algorithm to find the maximum flow in the given graph. CO4 (08)

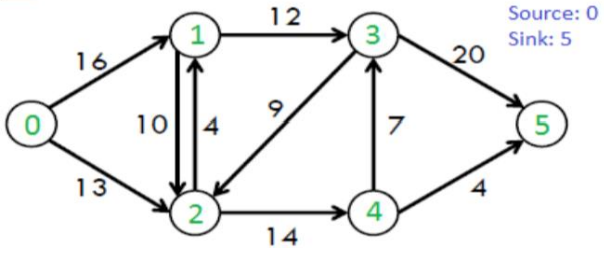

Fig.8(b)

c) Discuss the airline scheduling problem with an example. CO4 (04)

UNIT- V

9. a) With proper assumptions prove the following: CO5 (06)
   i) Let G = (V,E) be a graph. Then S is an independent set if and only if its complement V - S is a vertex cover.
   ii) Vertex Cover<=p independent set
   iii) Vertex cover <=p set cover.

   b) Explain with example Travelling Salesman Problem. CO5 (08)

   c) Discuss Hamiltonian Cycle Problem with example. CO5 (06)

10. a) Explain General Strategy for Proving New Problems NP-Complete. CO5 (06)

    b) Explain with example Circuit Satisfiability. CO5 (08)

    c) With example explain how to solve n-queen's problem using backtracking method. CO5 (06)

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