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10CS43

Fourth Semester B.E. Degree Examination, June/July 2019
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

PART – A

1 a. With the help of a flowchart, explain the various steps in the algorithm design and analysis process. **(08 Marks)**

b. Write an algorithm for Brute Force string matching. Find the number of character comparisons that will be made by the string matching algorithm for the pattern ABABC in the following text: B A A B A B A B C C A. **(06 Marks)**

c. If $f_1(n) \in o(g_1(n))$ and $f_2(n) \in o(g_2(n))$, prove that $f_1(n) + f_2(n) \in o(\max\{g_1(n), g_2(n)\})$. **(06 Marks)**

2 a. Solve the following recurrences:
$A(n) = A(n/3) + 1$ for $n > 1$, $A(1) = 1$, $n = 3^k$
$A(n) = A(n/2) + n$ for $n > 1$, $A(1) = 1$, $n = 2^k$ **(04 Marks)**

b. Give an algorithm for quicksort. Explain with a suitable example. Is quicksort a stable sorting algorithm? **(07 Marks)**

c. Give the general divide and conquer recurrence. How is it used in analyzing the worst case efficiency of binary search algorithm? Show the analysis with the algorithm and suitable examples. **(09 Marks)**

3 a. What are the characteristics of greedy design technique? Using Kruskal's algorithm, find the minimum spanning tree of the weighted graph shown below, Fig.Q.3(a). **(08 Marks)**

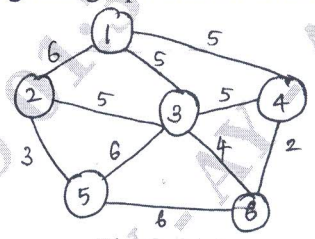


Fig.Q.3(a)

b. Solve the following instance of the knapsack problem using greedy design technique:

Item	1	2	3	4	5
Weight	3	2	1	4	5
Profit	25	20	15	40	50

Knapsack capacity W = 6

(05 Marks)

c. Solve the following single source shortest path problem using A as the source vertex, Fig.Q.3(c). **(07 Marks)**

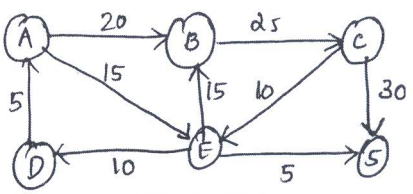
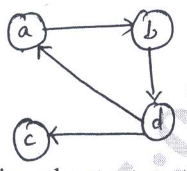


Fig.Q.3(c)

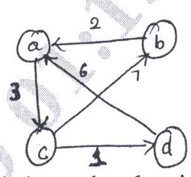
4 a. Explain Warshall algorithm to find transitive closure of a diagraph. Apply this algorithm to graph given below, Fig.Q.4(a) **(08 Marks)**

Fig.Q.4(a)



b. State Floyd's algorithm. Solve all pairs shortest paths problem for the graph, Fig.Q.4(b) using Floyd's algorithm. **(08 Marks)**

Fig.Q.4(b)

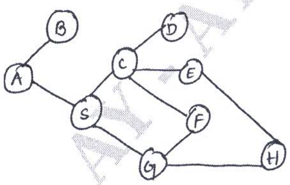


c. State 0/1 knapsack problem. How can it be solved using dynamic programming? **(04 Marks)**

PART – B

5 a. Construct a DFS tree for the following undirected graph, Fig.Q.5(a). Write algorithm and explain. **(10 Marks)**

Fig.Q.5(a)



b. Differentiate BFS and DFS. **(04 Marks)**

c. Explain sorting by counting. Write the algorithm and sort the list 62, 31, 84, 96, 19, 47. **(06 Marks)**

6 a. Define: i) Class P ii) Class NP iii) NP hard problem. **(03 Marks)**

b. What is numeric analysis? What is overflow and underflow in numeric analysis algorithms? **(04 Marks)**

c. What are decision trees? Draw the decision tree to sort elements using selection sort. **(08 Marks)**

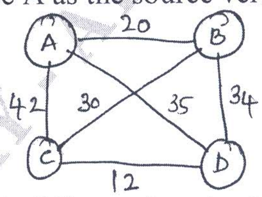
d. Discuss the challenges of numerical algorithms. **(05 Marks)**

7 a. State subset sum problem. Using backtracking obtain a solution to the subset sum problem for s = {3, 5, 6, 7} and d = 15. **(06 Marks)**

b. Draw state space tree to generate solutions to the 4-queens problem. **(04 Marks)**

c. Write the steps for the nearest neighbor algorithm on the travelling salesman problem. Apply the algorithm for the following instance of the problem, Fig.Q.7(c) and calculate the accuracy ratio of approximation. Use A as the source vertex. **(06 Marks)**

Fig.Q.7(c)



d. What is branch and bound? How is it different from back tracking? **(04 Marks)**

8 a. What is Prefix computation problem? Give algorithms for prefix computation which uses

i) n processors ii) $\frac{n}{\log n}$ processors.

Obtain time complexities of these algorithms. **(10 Marks)**

b. Explain different types of computational models. **(10 Marks)**

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