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10CS43

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With the help of a flow chart, explain the sequence of steps in design and analysis of an algorithm. **(10 Marks)**

b. Consider the following recursive algorithm for computing the sum of the first n numbers. $S(n) = 1+ 2+ 3+ - - - - +n$.

```
Algorithm S(n)
  if (n = 1) return 1
  else return(S(n – 1) + n)
end algorithm
```

set up and solve a recurrence relation for the number of times the algorithms basic operation is executed. **(05 Marks)**

c. Write a recursive algorithm to compute the factorial of a non-negative integer n and analyze its efficiency. **(05 Marks)**

2 a. Is merge sort stable? Suggest an algorithm for merge sort and analyze its efficiency. **(10 Marks)**

b. Write the algorithm for binary search and find its best, average and worst case efficiency. **(10 Marks)**

3 a. Explain the Kruskal's algorithm to find minimum spanning tree(MST). Apply it for the following graph, Fig.3(a). **(06 Marks)**

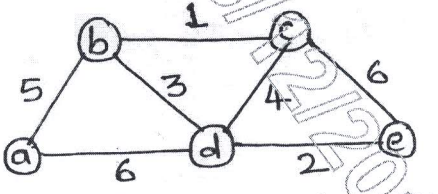

Fig.Q3(a)

b. Mention the three requirements to be specified by any greedy algorithm. For the given jobs with deadline, find the maximum profit by sequencing them. N = 5, $(P_1, P_2, P_3, P_4, P_5) = (20, 15, 10, 5, 1)$ and $(d_1, d_2, d_3, d_4, d_5) = (2, 2, 1, 3, 3)$. **(04 Marks)**

c. Write algorithm for greedy knapsack problem. Find the optimal solution for the Knapsack instance, number of objects(n) = 3, capacity of knapsack(M) = 20, Profits$(P_1, P_2, P_3) = (25, 14, 15)$ and weights $(w_1, w_2, w_3) = (18, 15, 10)$. **(10 Marks)**

4 a. Define transitive closure of a graph. Write Warshall's algorithm to compute transitive closure of a graph. Find its efficiency. **(07 Marks)**

b. Using Floyd's algorithm, find all pair shortest path for the graph of Fig.Q4(b). **(07 Marks)**

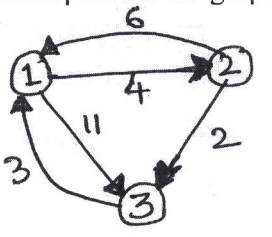

Fig.Q4(b)

c. Write Bellman and Ford algorithm to compute single source shortest path. **(06 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.

PART – B

5 a. Bring out the differences between DFS and BFS. Traverse the following graph of Fig.Q5(a) by DFS and construct the corresponding DFS forest and also show its stack content. **(10 Marks)**

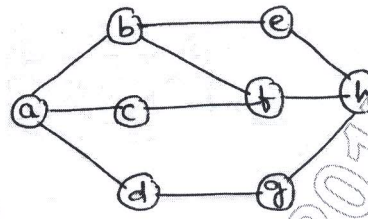

Fig.Q5(a)

b. What do you mean by space and time trade off? Explain the Horspool's string matching algorithm. **(10 Marks)**

6 a. What are decision trees? Give and explain the decision tree for 3-element selection sort. **(10 Marks)**

b. Explain the concepts of P, NP and NP – complete problems. **(10 Marks)**

7 a. Explain 4 – queen's problem using back tracking method and draw state – space tree for the same. **(05 Marks)**

b. Apply the branch –and-bound algorithm to solve the assignment problem of assigning n people to n jobs so that the total cost of the assignment is as small as possible.

Job → 1

$$c = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix} \begin{matrix} \text{Person a} \\ \text{Person b .} \\ \text{Person c} \\ \text{Person d} \end{matrix}$$

(10 Marks)

c. Write the steps and apply nearest neighbor approximation algorithm on the TSP problem with starting vertex a, and calculate the accuracy ratio of approximation. **(05 Marks)**

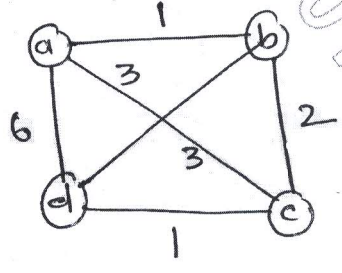

Fig.Q7(c)

8 a. Let the input to the prefix computation problem be 5, 12, 8, 6, 3, 9, 11, 12, 1, 5, 6, 7, 10, 4, 3, 5 and let ⊕ stand for addition. Solve the problem using work optimal algorithm. **(10 Marks)**

b. For an n × n matrix M with nonnegative integer coefficients, define $\tilde{M}$ and give an algorithm for computing $\tilde{M}$. Prove that $\tilde{M}$ can be computed from a n × n matrix M in O(log n) time using n^{3+E} common CRCW PRAM processors for any fixed $\epsilon > 0$. **(10 Marks)**

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