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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fourth Semester, B.E. - Computer Science and Engineering

Semester End Examination; June - 2016

Analysis and Design of Algorithms

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1. a. Define Algorithm. Draw a flow chart indicating the various stages of algorithm design and analysis process and explain. 10

   b. Define asymptotic notations and prove that $\frac{1}{2}n(n-1) \in \theta(n^2)$. 6

   c. Solve the recurrence $x(n) = 3x(x-1)$ *for* $n > 1, \quad x(1) = 4.$ 4

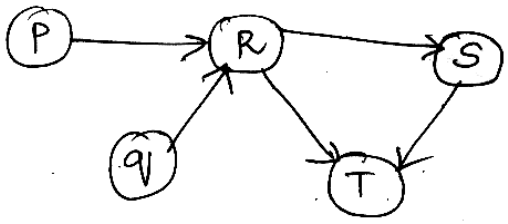
2 a. List the steps for mathematical analysis of a non-recursive algorithm. Write the element uniqueness algorithm and apply the analysis steps. 10

   b. What are the characteristic features of Brute force method? Write selection sort algorithm and analyse it clearly expressing its complexity using asymptotic notation. 10

UNIT - II

3 a. Write at least two differences between Quick sort and Merge sort. Apply Quick sort on 5, 3, 1, 9, 8, 2, 4, 7. Draw the recursive tree. 7

   b. What is topological sorting? Apply DFS based algorithm to get the topological sequence for the following graph,



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   c. Write a presorting based algorithm for mode computation and comment on its efficiency. 8

4. a. Write the insertion sort algorithm. Derive its best case and worst case efficiency. Apply it to 45, 5, 62, 37, 8, 98. 10

   b. Define heap. Construct a heap for 2, 9, 7, 6, 5, 8, using bottom up approach. Derive the complexity of the construction procedure. 10

UNIT - III

5. a. Briefly explain the use of input enhancement technique for designing Linear sorting algorithm. Write the algorithm for the same. 8

Contd…2

b. Write Horspool algorithm for string matching and use to find the pattern BAOBABS in the text BESS-KNEW-ABOUT-BAOBABS — 8

c. Compute $C(6,3)$ using dynamic programming. — 4

6. a. For the input 30, 20, 56, 75, 31, 19 and hash function $h(k) = k \bmod 11$, Find average number of key comparisons for successful and unsuccessful searches. — 4

b. Find the transitive closure of matrix below using Warshall's algorithm,

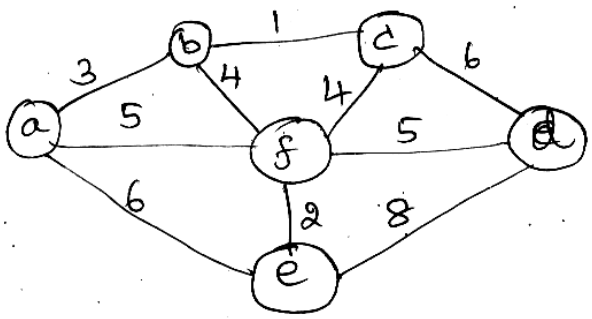
$$R = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$ — 8

c. Solve all pair shortest problem for graph below using Floyd's algorithm,

$$\begin{bmatrix} 0 & \infty & 3 & \infty \\ 2 & 0 & \infty & \infty \\ 0 & 7 & 0 & 1 \\ 6 & \infty & \infty & 0 \end{bmatrix}$$ — 8

UNIT - IV

7. a. What is a spanning tree? Write Prim's algorithm and apply it to the following graph,

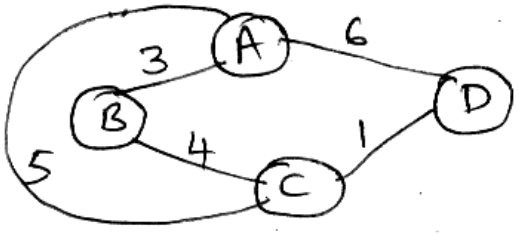


— 10

b. What is a decision tree? Write the decision tree for 3 element selection sort. — 7

c. Write the difference between P and NP problems. — 3

8. a. Find the minimum cost spanning tree for the graph shown below using both Prim's and Kruskal's algorithm. Indicate each stage clearly.



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Contd…3

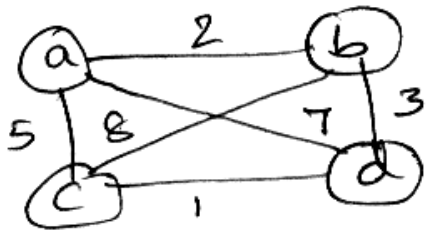
b. Derive recurrence relation to solve Knapsack problem using dynamic programming. Apply it *to solve* $\rightarrow n = 4,\ m = 5$ *valves* 12, 10, 20, 15 *and weights* 2, 1, 3, 2 *respectively*. 10

c. What are decision trees? Explain with an example. 4

UNIT - V

9 a. Explain backtracking method. Give state space tree for solving 4 queens problem and explain. 10

b. Apply branch and bound method to solve travelling salesman problem for graph below. Write state space tree. Explain your answer. 10



10a. Explain different types of computational models. 10

b. For the input 5, 12, 8, 6, 3, 9, 11, 12, 1, 5, 6, 7,10, 4, 3, 5 to prefix computation, solve the *problem using work optimal algorithm assuming* $\oplus$ *for addition.* 10

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