RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. THIRD SEMESTER EXAMINATION, MARCH 2021

SECOND YEAR [BATCH 2019-22]

Date : 12/03/2021 **COMPUTER SCIENCE [HONOURS]**

Time : 11.00 am – 1.00 pm **Paper : V [CC 5]** Full Marks : 50

Answer **any five** question of the followings : [5×10]

1. a) Explain proof of correctness of an algorithm with an example.

   b) Differentiate between deterministic and non-deterministic algorithm.

   c) Explain any one type of amortized analysis of an algorithm with example. [5+2+3]

2. a) Explain different crossover operators in genetic algorithm.

   b) Show that

   $\sum_{i=1}^{n} i^k = \theta\ (n^{k+1})$ [6+4]

3. a) Write down the termination conditions of a genetic algorithm.

   b) Draw and explain clearly the Venn diagram showing relationship between P, NP, NP-hard and NP-complete Algorithms.

   c) Explain bounding function with respect to N-Queen's problem. [3+4+3]

4. a) Compare backtracking and branch and bound algorithms.

   b) Find out the time complexity of the following code segment.

```
i = 2;
    while (i<= n)
    {
i = i^(1/2);
    }
```

   c) Explain prefix code with example. [3+4+3]

5. a) Find an optimal parenthesization of a matrix chain product whose sequence of dimensions is <4,5,3,2,7,2>.

   b) Explain the advantages and disadvantages (if any) of the pivot selection strategy if we apply quicksort algorithm on the following of numbers 6,12,4,9,1,7,5,10,3 by selectingthe first element as pivot. [6+4]

6. a) Solve the following recurrence relation.

   T(n) =θ(1) and T(n) = $\sum_{i=1}^{n-1}[T(i) + T(n-i)] + 1$

   b) Use Strassen's algorithm to compute the following matrix product.

   $\begin{pmatrix} 1 & 3 \\ 7 & 5 \end{pmatrix}\begin{pmatrix} 6 & 8 \\ 4 & 2 \end{pmatrix}$ [5+5]

7. a) Consider an undirected graph with vertices labeled from 0 to 7 with the following edges.

0-1, 0-6, 0-7, 1-4, 1-6, 1-7, 2-3, 2-4, 2-5, 3-4, 3-6, 3-7, 5-6

Run BFS on the graph starting at node 0 and exploring edges incident to a vertex in numerical order of the labels of the vertex at the other end. Draw the BFS tree of the discovered edges produced by this algorithm.

b) Solve the following 0-1 knapsack problem using dynamic programming.

Number of items = 4, Maximum capacity of the knapsack = 5 units,

Weight of each item = 2,3,4,5 units respectively, Profit of each item = 3,4,5,6 units respectively [5+5]

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