RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. THIRD SEMESTER EXAMINATION, MARCH 2022

SECOND YEAR [BATCH 2020-23]

Date : 02/03/2022 **COMPUTER SCIENCE (HONOURS)**

Time : 11 am – 1 pm **Paper : V [CC5]** Full Marks : 50

Answer **any five** questions of the following: [5×10]

1. a) Explain proof of correctness for finding the maximum element of an array.
   b) Explain potential method of amortized analysis of an algorithm with example. [5+5]

2. a) Explain the basic structure of genetic algorithm.
   b) Solve the following recurrence relation.
   $T(1) = \theta(1)$ and $T(1) = \sum_{i=1}^{i=n-1} T(i) + 1$ [5+5]

3. a) Write down various mutation operators of genetic algorithm.
   b) Explain reduction. Why it is useful in computational complexity?
   c) Explain backtracking with respect to 4-Queen's problem. [3+(2+2)+3]

4. a) Differentiate between backtracking and branch and bound algorithms.
   b) Find out the time complexity of the following code segment.

```
int f(int n)
{
 if(n <= 2)
  {
   return 1;
  }
 else
  {
   return (f(√n) + 1);
  }
}
```

   c) Explain why the concept of prefix code is necessary in Huffman coding. [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) What value does PARTITION procedure of QUICKSORT return when all elements in the array A[p .. r] have the same value? Explain. [6+4]

6. a) What is the optimal Huffman code for the following set of frequencies, based on first eight Fibonacci numbers?
   a:1 b:1 c:2 d:3 e:5 f:8 g:13 h:21
   b) How would you modify Strassen's algorithm to multiply nxn matrices in which n is not an exact power of 2? [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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