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Total Number of Pages : 02

MCA  
MCC301

**3<sup>rd</sup> Semester Back Examination 2019-20**  
**ANALYSIS AND DESIGN OF ALGORITHMS**

**BRANCH : MCA**

**Max Marks : 70**

**Time : 3 Hours**

**Q.CODE : HB555**

**Answer Question No.1 which is compulsory and any FIVE from the rest.**  
**The figures in the right hand margin indicate marks.**

**Q1 Answer the following questions : (2 x 10)**

- Define 0/1 Knapsack problem.
- Whether Backtracking always produces optimal solution.  
Justify your answer.
- Solve the following recurrence equation:  
$$T(n) = 5T(n-1) + 2n + n^2$$
- Is  $O(g(n)) \cap \omega(g(n))$  the empty set.  
Justify your answer.
- What is "approximation ratio" of an algorithm for solving a NP-complete problem?
- Define Hamiltonian Circuit problem in an undirected Graph.
- Give the time efficiency and drawback of merge sort algorithm.
- What are the minimum and maximum numbers of elements in a heap of height  $h$ ?
- What is meant by Chromatic number for a graph? Explain with one example briefly.
- Draw a graph for the following matrix

$$\begin{bmatrix} \infty & 0 & 1 \\ -2 & 0 & 1 \\ 0 & \infty & \infty \end{bmatrix}$$

- What do you mean by asymptotic notations? State the criteria that should be satisfied by all Algorithms. (5)
  - Compare Backtracking and Branch and Bound techniques with an example. (5)
- Compare how Dijkstra's and Floyd's algorithms solve the shortest-path problem. Should these two both be categorized as greedy, or both as dynamic-programming, algorithms? (5)
  - Write an algorithm/a pseudo code to find the Kth smallest elements in an array of  $n$  numbers. (5)
- Explain the differences between Greedy versus dynamic programming. (5)
  - Briefly state, what are the classes P, EXPTIME, NP, NP-Hard, and NPC? Give several containment relationships among them. (5)
- Define Amortized analysis? Explain with example, how amortized analysis is differing from average case analysis? (5)
  - Using Backtracking enumerate how can you solve the following problem : Hamiltonian circuit problem (5)

- Q6**   a) Write a recursive procedure to compute height of a binary tree. (5)  
      b) Two computational problems P1 and P2 are called polynomial-time equivalent (5)  
          if there exist polynomial-time reductions  $P1 \leq P2$  and  $P2 \leq P1$ . Prove or  
          disprove: Every two NP-Complete problems are polynomial time equivalent.
- Q7**   a) What do you mean by algorithm? State the criteria that should be satisfied by (5)  
          all Algorithms.  
      b) Find an optimal parenthesization of a matrix-chain product whose sequence of (5)  
          dimensions is  $\langle 5, 10, 3, 12, 5, 50, 6 \rangle$
- Q8**        Write short answer on any TWO : (5 x 2)  
          a) Huffman Coding  
          b) Garbage collection  
          c) 4- Queen problem