Registration No:

Total Number of Pages: 03 **MCA**
MCA301

3rd Semester Regular/Back Examination- 2017-18
DESIGN ANALYSIS AND ALGORITHMS
BRANCH: MCA
Time: 3 Hours
Max Marks: 100
Q.CODE: B786
Answer Question No.1 and Question number 2 which are compulsory and any four from the rest. The figures in the right hand margin indicate marks.

Q1 **(Multiple type Questions. Answer all questions)** (2X10)

a) O- Notation provides an asymptotic _____.
A. Upper bound B. Lower bound
C. Tight bound D. None of these.

b) Which of following arrangement is correct?
A. $n^4 < n! < n^n < 2^n < logn$ B. $n^4 < logn < 2^n < n^n < n!$
C. $logn < n^4 < 2^n < n! < n^n$ D. $logn < n^4 < 2^n < n^n < n!$

c) To sort an array with n items, how many times you should merge two sorted the sub array into one.
A. n B. n-1
C. nlogn D. n+1

d) Which of the following statement is false?

A. Best case running time of linear search is $O(1)$
B. Worst case running time of linear search is $O(n)$
C. Best case running time of Binary is $O(n)$
D. Worst case running time of Binary is $O(logn)$

e) Let N is the number of items, and M is the knapsack capacity. Then Running time to solve knapsack problem using dynamic approach is ___
A. $O(N^2)$ B. $O(N+M)$
C. $O(N×M)$ D. $O(N\,logM)$

f) The time complexity of Floyd's algorithm to find all pair shortest path of a Graph with V vertices and E edges is.
A. $O(V^3)$ B. $O(E^3)$
C. $O(V^2)$ D. $O(VE)$

g) The correct match for the following pairs is
I) Quick Sort 1. Greedy
II) Minimum Spanning Tree 2. Divide and conquer
III) All pair shortest path problem 3. Dynamic Programming
A. I - 3 , II -1, III - 2 B. I - 2 , II -1, III – 3
C. I - 1 , II -3, III – 2 D. I - 3 , II -2, III – 1

h) Which of the following algorithm solve single source shortest path problem where all edge weights are positive?
A. Dijkstra's Algorithm B. Floyd's Algorithm
C. Warshall's Algorithm D. Bellman-Ford Algorithm

i) A problem Q can be solved using an algorithm A. If the running time of the

algorithm A is $O(n^{80})$, Then the problem Q belongs to _____.
   A.   class P   B. Class NP
   C.   class NPC   D. None of these

j) The type of algorithm used to solve 8-Queen problem is

   A. Greedy   B. Dynamic
   C. Backtracking   D. None of these

Q2   **Answer the following questions:**   **(2 x 10)**

a) What is the need of analyzing an algorithm?

b) Let $f(n) = 3n^3 + 5n + 90$. Then prove that $f(n) = O(n^3)$

c) Does the running time of merge sort depend on values of the keys in the array to be sorted? Explain your answer.

d) Differentiate between Greedy approach and Dynamic Programming.

e) Differentiate 0/1 knapsack and Fractional Knapsack problem.

f) What will be running time of knapsack problem if it will be solved using exhaustive search technique?

g) What do you mean by edge relaxation in shortest path problem?

h) Explain capacity constraint in maximum flow problem.

i) Explain 3-CNF SAT problem with example.

j) What is the need of solving a problem using approximation algorithm.

Q3 **a)** Using recurrence tree, solve the recurrence $T(n) = T(n-1) + O(n)$ **(5)**

     b) Write a recursive algorithm to return n[th] number in the Fibonacci series. Derive the recurrence for this algorithm and then find the running time.   **(10)**

Q4 **a)** Explain Big Oh, Big Omega, Theta notations with graph.   **(5)**

     b) Write the cases, where Brute Force approach is preferred over divide and conquer approach. Write a Brute Force algorithm to find closest pair of points among a set of points.   **(10)**

Q5 **a)** Explain Quick sort algorithm with example. Analyze its best case and worst case running time.   **(10)**

     b) Step wise Heapify following items.   **(5)**
   5, 9, 3, 7, 2, 6, 4, 8

Q6 **a)** What do you mean by Optimal Binary Search Tree? Construct the cost table and root table with following keys {k1, k2, k3, k4} with their probabilities of searching {0.1, 0.2, 0.4, 0.3}.   **(10)**

     b) Design the Huffman code for the following symbols and their frequency of occurring in a text.   **(5)**
        Symbols   : a,   b,   c,   d,   e,   f,   g
        Frequency : 24, 8,   14, 10, 20, 15, 9

Q7 **a)** Write the Prim's Minimum Cost of Spanning Tree Algorithm. Find a Minimum **(10)**
Spanning Tree from following graph.
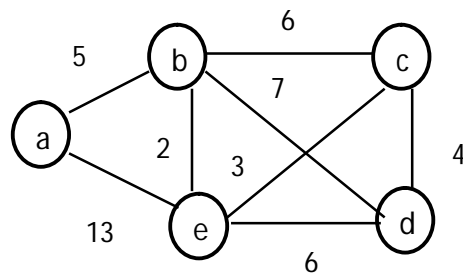
b) Write the ford-Fulkerson algorithm to solve maximum flow problem. Find the **(5)**
running time.

Q8 **a)** Define the class NP and NPC. List out some NP Complete problems. Explain **(10)**
how you can prove that a problem is NP Complete.

b) What do mean by approximation algorithm? Write an approximation algorithm **(5)**
for travelling salesman problem.