C. U. SHAH UNIVERSITY
Summer Examination-2019

Subject Name: Design and Analysis of Algorithms
Subject Code: 4TE05DAA1   **Branch:B.Tech (CE)**
Semester: 5   **Date: 19/03/2019**   **Time: 10:30 To 01:30**   **Marks: 70**

Instructions:
(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1   **Attempt the following questions:**   **(14)**
a) Explain equivalence relation.
b) Is insertion sort stable? Justify your answer.
c) What is edge relaxation in Graph.
d) Define: DFA
e) Define: Spanning Tree
f) Which of these is the Worst-case time complexity of Quick Sort - and cannot be expressed in lower order terms?
    a) $O(n)$
    b) $O(n^2)$
    c) $O(n\log n)$
    d) $O(n^3)$
g) Which of the following is incorrect? Algorithms can be represented:
    a) as pseudo codes
    b) as syntax
    c) as programs
    d) as flowcharts
h) From the following sorting algorithms which algorithm needs the minimum number of swaps:
    a) Insertion
    b) Bubble
    c) Selection
    d) Quick
i) Arrange following rate of growth in increasing order:
2^N, $n\log n$, n^2,1, n, $\log n$, $n!$, n^3
j) What is optimal sub structure?
k) Define: Directed acyclic graph.
l) When is a problem said to be NP-Hard?
m) Define: Dense Graph
n) Define: Sparse Graph

Attempt any four questions from Q-2 to Q-8

Q-2   **Attempt all questions**   **(14)**
a)   Explain why analysis of algorithms is important? Explain worst case,   **(7)**

best case and average case complexity?

b) Differentiate: Divide and conquer strategy, Greedy algorithms and dynamic programming strategy. **(7)**

Q-3 **Attempt all questions** **(14)**
a) State and prove master theorem for solving recurrences. **(5)**
b) Explain Amortized analysis, **(5)**
c) List three problems that have polynomial time algorithms. Justify your answer. **(4)**

Q-4 **Attempt all questions** **(14)**
a) Solve the following 0/1 knapsack problem with knapsack capacity=8. **(7)**
$I = (I^1, I^2, I^3, I^4)$
$V = (15,10,9,5)$
$W = (1,5,3,4)$
b) Write an algorithm for merge sort and prove it's time complexity nlogn in all three cases. **(7)**

Q-5 **Attempt all questions** **(14)**
a) Explain prim's minimum spanning tree algorithm with an example. **(7)**
b) Answer the following: **(7)**
   1) Is $2^{n+1} = O(2^n)$? Explain.
   2) Solve the following recurrence relation:
      $T(n) = 1$ if n=1
      $T(n) = 2T(n/2)$ if n>1

Q-6 **Attempt all questions** **(14)**
a) What is the time complexity of finding longest common subsequence? Find LCS for the following problem: **(7)**
S_1: (A,B,A,Z,D,C)
S_2: (B,A,C,B,A,D)
b) Explain Floyd Warshall algorithm with example. **(7)**

Q-7 **Attempt all questions** **(14)**
a) Solve the following matrix chain multiplication problem in optimal way. **(7)**
M1: 5 x 4, M2: 4 x 6, M3: 6 x 2, M4: 2 x 7
b) Explain the 8 queen problem with example. **(7)**

Q-8 **Attempt all questions** **(14)**
a) Answer the following: **(7)**
   1) Prove that $(n+a)^b = \Theta(n^b)$ for b>0
   2) Explain exponential problem.
b) Explain naive string matching algorithm with example. Also discuss its time complexity. **(7)**