Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH. (COMPUTER SCIENCE & ENGINEERING)
END SEMESTER EXAMINATIONS, APRIL 2018
SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS [CSE 2202]
REVISED CREDIT SYSTEM
(19/04/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Let *A* be the adjacency matrix of an undirected graph. Defining each of the following, explain what property of the matrix indicates that

i) the graph is complete.
ii) the graph has a loop.
iii) the graph has an isolated vertex. **(3)**

1B. The brute-force algorithm for computing the value of a polynomial

$$p(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$$

at a given point x_0 is given below

Algorithm *BruteForcePolynomialEvaluation(P[0..n], x)*
//Input: Array P[0..n] of the coefficients of a polynomial of degree n,
// stored from the lowest to the highest and a number x
//Output: The value of the polynomial at the point x
p ← 0.0
for i ← n downto 0 do
    power ← 1
    for j ← 1 to i do
        *power ← power * x*
    *p ← p + P[i] * power*
return p

i) Analyse the efficiency of this algorithm considering multiplication as the basic operation
ii) Design an algorithm with an efficiency better than this and prove it **(3)**

1C. Solve the following recurrence relations

i) $T(n)=8\,T(n/2)+n^2$ for $n>2$, $T(2)=1$ (solve for $n=2^k$)
ii) $x(n) = x(n-1) + n$ for $n > 0$, $x(0) = 0$

(4)

2A. For the graph shown in Fig. Q.2A, starting at vertex 'a' and resolving ties by the vertex alphabetical order, traverse the graph by breadth-first search and construct the corresponding breadth-first search tree, showing all types of edges. Give the order in which the vertices were reached for the first time.

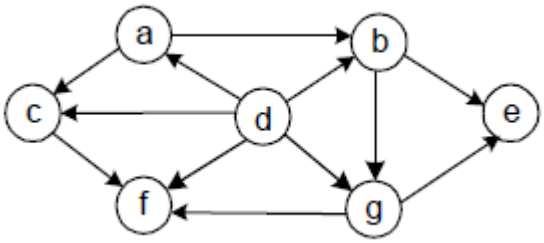

Fig. Q.2A

(3)

2B. Write the algorithm for quicksort and trace the same on the following list to arrange in non-decreasing(ascending) order: ***15, 12, 13, 11, 20, 18, 22, 14.*** Draw the tree of recursive call made.

(4)

2C. Analyse the time complexity of straight insertion sort algorithm **(3)**

3A. What is an AVL tree? Construct AVL tree for the list ***12, 13, 14, 15, 10, 9, 6, 20, 18, 19*** by successive insertion method starting from empty tree. Show all stages.

(3)

3B. Sort the list: ***A, L, G, O, R, I, T, H, M*** in alphabetical order using heapsort by clearly showing bottom-up heap construction and sorting stages.

(4)

3C. Assuming that the set of possible list values is **{a, b, c, d}**, sort the following list in alphabetical order by the distribution counting algorithm:

b, c, d, c, b, a, a, b.

(3)

4A. Write the general procedure of Horspool's string matching algorithm. Trace the same to search for a pattern: ***THIRTHI*** in the text:

KHIRTHI-OF-DHANDATHIRTHA-IS-HI

Also find number of character comparisons made.

(4)

4B. Write Warshall's algorithm and find transitive closure for the digraph shown in Fig.Q.4B using Warshall's algorithm, showing all stages

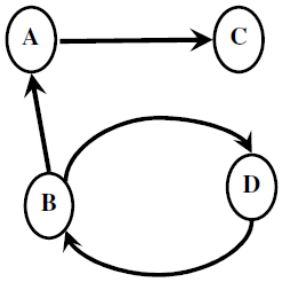

Fig.Q.4B

(3)

4C. Apply the bottom-up dynamic programming algorithm to the following instance of the knapsack problem shown in Table Q.4C with capacity W=5 and find the optimal subset (Neatly show all the steps).

Table Q.4C

Item	Weight	Value
1	2	3
2	3	4
3	4	5
4	5	6

(3)

5A. Apply Dijkstra's algorithm for single-source shortest-paths problem for the graph shown in Fig.Q.5A with vertex '*a'* as the source and find path and distance to all other vertices.

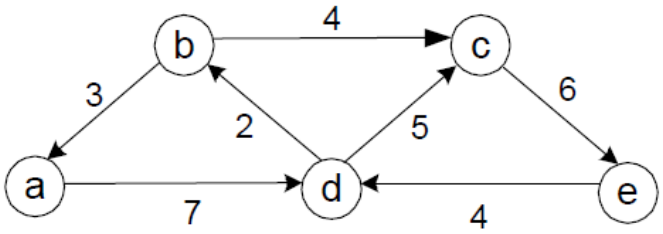

Fig.Q.5A

(4)

5B. Apply the best-first branch-and-bound algorithm to the instance of the assignment problem given in the Table Q.5B, and find the optimal assignment of a person to a job. The table entries represents the assignment costs *C*[i, j] of assigning person '*i'* to job '*j'*. Clearly show the state space tree.

Table Q.5B

	Job *1*	Job *2*	Job *3*	Job *4*
Person *a*	8	1	4	6
Person *b*	3	5	9	4
Person *c*	11	8	2	3
Person *d*	2	4	7	7

(4)

5C. State and explain P and NP problems

(2)