Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

IV SEMESTER B.TECH. (COMPUTER SCIENCE & ENGINEERING)

MAKEUP EXAMINATIONS JUNE 2017

SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS [CSE 2202]

REVISED CREDIT SYSTEM
(14/06/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Which is the asymptotic notation used to represent a function $t(n)$ if it is bounded below by some positive constant multiple of $g(n)$ for all large n? Illustrate the definition of the same with the help of a neat graph. Show that $t(n) = 6 * 2^n + n^2 \in \theta(2^n)$ by clearly stating the values of c_1, c_2, n_0 and $g(n)$ respectively. **3**

1B. Show the complete trace of the brute force string matching algorithm for the text string ***FUN_UNCLE*** and pattern string ***UNCLE***. What is the basic operation of this algorithm? What happens to the analysis of this algorithm if the pattern string is present at the end of the text string or if the pattern string is not present in the text string? Give the proof for the same. **4**

1C. Tabulate the differences between the two types of graph traversal techniques in terms of data structures used, vertex ordering and types of edges involved. **3**

Consider the graph in Fig. Q.1C, starting at vertex 'A' and resolving ties by visiting the vertex in alphabetical order, traverse the graph by breadth-first search and construct the corresponding breadth-first search forest. Give the order in which the vertices were visited i.e., added to (or removed from) the queue.

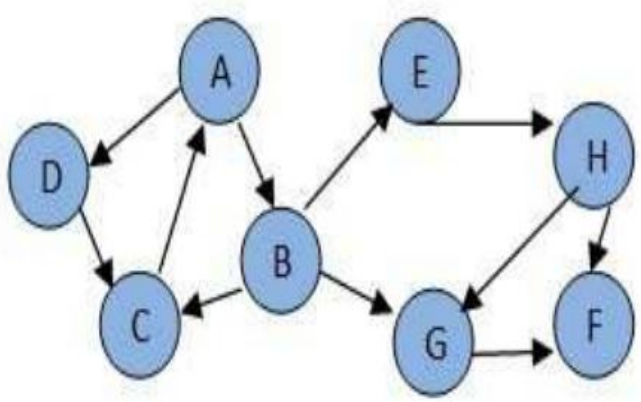

Fig.Q.1C

2A. Consider the following recursive algorithm for computing the sum of the first n cubes. **4**

Sum (n) = $1^3 + 2^3 + 3^3 + \ldots + n^3$

Algorithm Sum (n)

If (n = 1) return 1

else return (Sum (n -1) + n * n *n)

P.T.O.

Set up and solve the recurrence relation for the number of times the basic operation of the algorithm is executed.

2B. State the theorem which is used to simplify the efficiency analysis of many divide and conquer algorithms. Sort the list M, A, N, G, O, F, R, U, I, T in alphabetical order using merge sort algorithm. **4**

2C. Apply the DFS-based algorithm to solve the topological sorting problem for the digraph in Fig. Q.2C. **2**

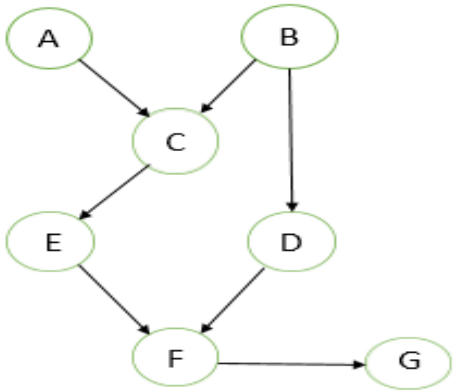

Fig. Q.2C

3A. What is an AVL tree? Construct an AVL tree for the list 8, 9, 11, 6, 5, 7, 10 by successive insertions. Clearly show all the steps by specifying rotation type and balance factors. **3**

3B. Sort the list 18, 19, 18, 23, 23, 23, 19, 18 using the input enhancement distribution counting technique. Show all steps neatly. **2**

3C. A hash table of length m=15 is to be constructed by closed hashing. Show the hash table after inserting the keys LIKE, A, TREE, YOU, FIRST, FIND, A, PLACE, TO, GROW, AND, THEN, BRANCH, OUT into the empty hash table using the hash function h(K) = K mod 15 ,where K is the sum of the positions of the letters of the word in alphabet. Show the procedure involved in searching for the key 'BRANCH' in the hash table constructed. **5**

4A. Solve the all pairs shortest path problem for the graph indicated by the weight matrix in Fig. Q.4A. **5**

0	2	∞	1	8
6	0	3	2	∞
∞	∞	0	4	∞
∞	∞	2	0	3
3	∞	∞	∞	0

Fig. Q.4A

4B. Find the minimum spanning tree for the graph in Fig.Q.4B using Kruskal's algorithm. Show all steps clearly in a tabular format by mentioning the tree vertices, sorted edges and illustration for every step. **2**

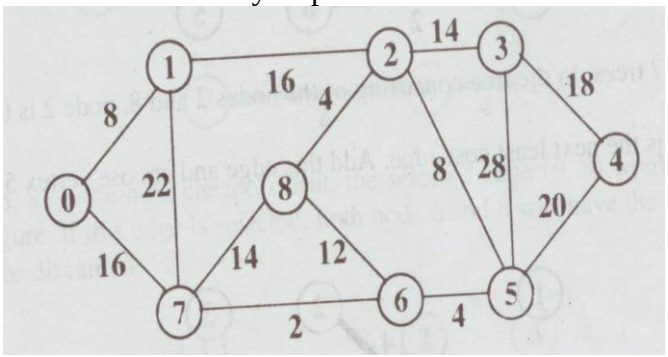

Fig. Q.4B

4C. Apply the dynamic programming algorithm using memory functions to the instance of the Knapsack problem with capacity W=6 shown in Table. Q.4C **3**

Table. Q.4C

Item	Weight	Value
1	3	$25
2	2	$20
3	1	$15
4	4	$40
5	5	$50

5A. Solve the following instance of the subset-sum problem by backtracking method: S= {7, 11, 13, 24} and d=31. Show the state space tree. **4**

5B. Define the NP-complete problem along with a pictorial representation. **2**

5C. Construct a Huffman code for the data in Table. Q.5C by drawing a Huffman coding tree. Clearly show all the steps of tree construction. **4**

Table. Q.5C

Character	A	B	C	D	E
Probability	0.4	0.1	0.2	0.15	0.15

Decode the text whose encoding is 100010111001010 using the generated Huffman code.