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MCS-021

MCA (Revised) / BCA (Revised)

Term-End Examination

09152 **June, 2019**

MCS-021 : DATA AND FILE STRUCTURES

Time : 3 hours *Maximum Marks : 100*

(Weightage : 75%)

Note : *Question number **1** is **compulsory**. Attempt any **three** questions from the rest. All algorithms should be written nearer to 'C' language.*

1. (a) Order the following functions by their complexity in increasing order : 3

(i) n!

(ii) 3^n

(iii) $\sqrt{n}$

(iv) $\log_2 (n!)$

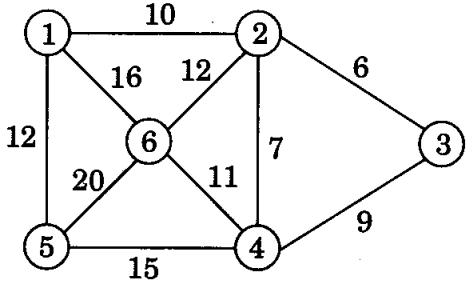
(b) For the function defined by $f(x) = 2x^3 + 4x + 1$, show that $f(x) = O(x^3)$ using the definition of O (big Oh). 4

(c) Convert the following prefix notation into infix notation : 3

+ – * ** ABCD/E/F + GH

(d) Write an algorithm to reverse a string using a stack. Illustrate all the intermediate steps of your algorithm on the string "IGNOU". 6

(e) Use Kruskal's algorithm to construct a minimum cost spanning tree of the following graph : 6



(f) Apply 2-way mergesort for sorting the following numbers and show all the intermediate steps : 6

4 6 3 7 1 9 2 8 5

(g) Insert the following data items into a B-Tree of order 5 : 6

a b e h p c k d m l n u t x y

(h) Explain how a polynomial can be represented using an array. Write an algorithm to add two polynomials. *6*

2. (a) Write an algorithm to do insertion sort and analyze its run-time complexity. *10*

(b) Write a program that accepts a set of integers and creates a singly linked list of these integers. Then it should prompt for input of an integer and delete the node consisting of that integer from the singly linked list. *10*

3. (a) Write a recursive algorithm of preorder and inorder traversal of a binary tree and explain it. *10*

(b) What is a strongly connected component of a graph ? Write an algorithm for finding strongly connected components of a graph. *10*

4. (a) Explain Floyd-Warshall's all pair shortest path algorithm. How is it different from single source shortest path ? *10*

(b) Given the input file
(5, 10, 15, 8, 20, 16, 28, 35, 55, 40, 30),
construct

(i) A binary tree *3*

(ii) Heap *4*

(c) Draw the graph corresponding to the following adjacency matrix : *3*

	a	b	c	d
a	0	1	1	0
b	1	0	0	1
c	1	0	0	1
d	0	1	1	0

5. (a) Construct an AA-tree using the following numbers (nodes). Show all the intermediate steps and balancing of tree. *10*

7 14 21 80 4 50 30 40

(b) Write important properties of : *10*

(i) Binary search tree

(ii) Red black tree