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No. of Printed Pages : 6

MCS-021

MASTER OF COMPUTER APPLICATION (MCA)

Term-End Examination

December, 2019

MCS-021 : DATA AND FILE STRUCTURES

Time : 3 Hours *Maximum Marks : 100*

Weightage : 75%

Note : *Question No. 1 is* ***compulsory*** *Attempt any* ***three*** *questions from the rest. All algorithms should be written nearer to C-language.*

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

   (i) $n \log n$

   (ii) $(\log n)^2$

   (iii) $3n^2 + 7n$

   (iv) 4^n

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

(c) A recursive function is given below : 6

```
f(int x)
{
if (x < 2) return 1
 else
return f (x – 1) + f (x – 2)
}
```

What is the value of f (5)! Show a complete recursion tree.

(d) Evaluate the postfix expression : 3

623 + – 382 | + * 2 * * 3 +

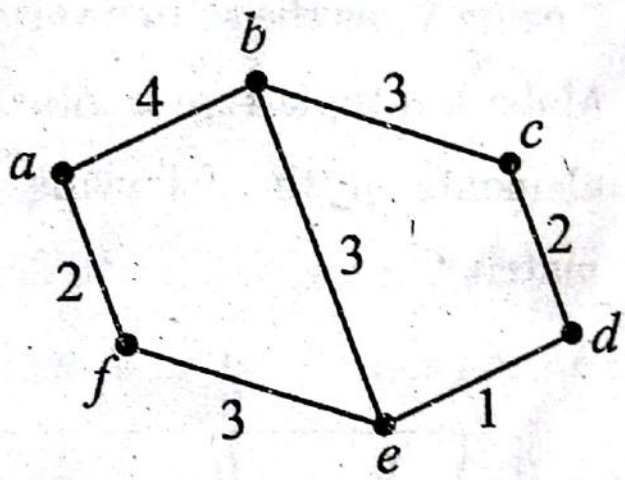
(e) How do you define balance of a subtree ? Construct an AVL-tree (height balanced tree) for the following sequences of input : 8

j a d n o s m f j k l

(f) Apply the Bubble sort algorithm to sort the following list. What is the time complexity of bubble sort ? 8

35 30 10 40 25 28 15 9

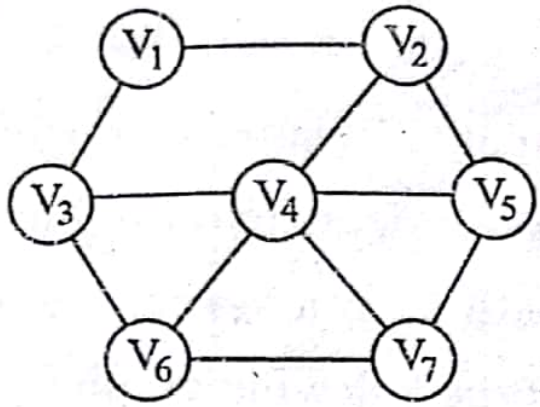
(g) Apply Dijkstra's single source shortest path algorithm to find out the shortest path from a vertex a to every other vertex of the following graph : 8



2. (a) Write an algorithm for Greatest Common Divisor (GCD) of the two integers m and n. Also calculate best case and the worst case time complexity of the algorithm. 10

(b) Write an algorithm to implement a stack through a linked list and delete an item from it. 10

3. (a) Write an algorithm to implement a Depth First Search method. Write the order of node sequences it will visit in the following graph * using this technique : 10



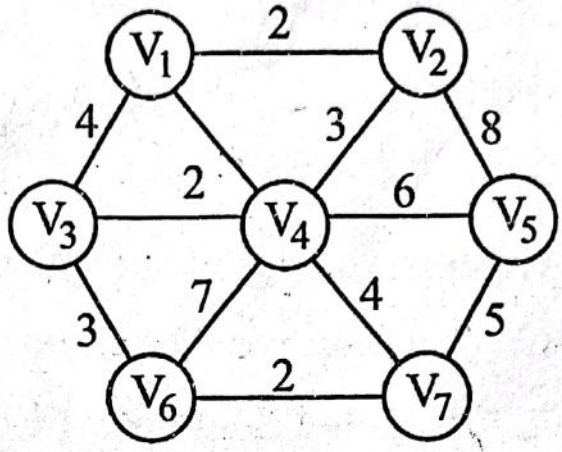
* using V_1 as the source vertex.

(b) Make a 3-tuple representation of non-zero elements of the following 6 × 5 sparse matrix : 3

	0	1	2	3	4
0	0	0	4	0	0
1	0	3	0	0	1
2	0	0	0	5	0
3	0	0	2	1	0
4	0	0	6	0	0
5	0	0	5	4	0

(c) Write an algorithm to implement a circular array and explain the logic. 7

4. (a) What is a minimum spanning tree ? Apply Prim's algorithm to find minimum spanning tree of the following graph : 10



(b) What is a min-heap ? Build a min-heap of the following sequences using top-down approach : 10

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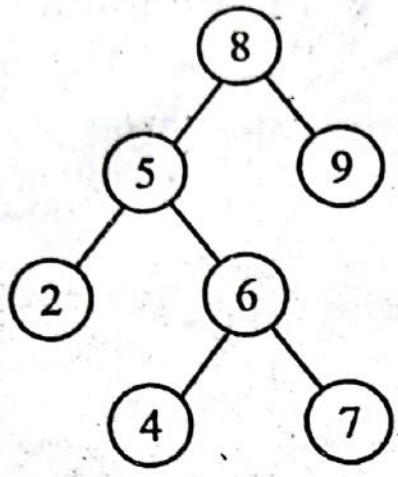
5. (a) What are the properties of a RBT (Red-Black Tree) ? Explain the process of inserting a node into RBT through an example. 10

(b) Given the following BST (Binary Search Tree). Write down its preorder and postorder traversal schemes : 6



(c) Explain the following terms : 4

(i) Asymptotic Analysis

(ii) Indexed Sequential File