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NATIONAL INSTITUTE OF TECHNOLOGY GOA

Farmagudi, Ponda, Goa, 403401

Programme Name: B.Tech.

End Semester Examinations, December-2021

Course Name: Data Structures | Course Code: CS201

Date: 13/12/2020 | Time: 9:30 AM-12:30 AM

Duration: 3 Hours | Max. Marks: 100

ANSWER ALL QUESTIONS

1. Consider an undirected graph with 5 vertices A, B, C, D and E. Let there is depth first search. Let y(u) denotes the time at which the vertex u is first visited , and let z(u) denotes the time at which the vertex u is last visited.
   Given that
   y(A)=7 y(B)=8 y(C)=16 y(D)=23 y(E)=24 z(A)=14 z(B)=12
   z(C)=20 z(E)=25 z(D)=26
   How many connected components are there? What are the vertices connected?
   (10 Marks)

2. Consider the following sample graph shown in Fig. 1. (10 Marks)
   Write inorder, preorder and postorder traversal for the tree shown in Fig. 1.

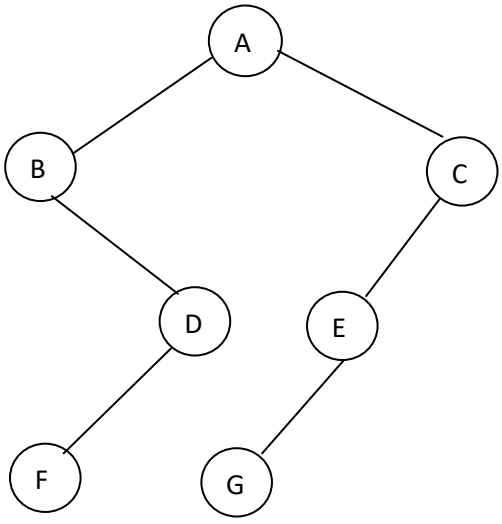

Fig1: Sample Binary Tree

3. Which data structure is used for Depth First Traversal of a graph?
   Write Algorithm for Depth First Traversal? Explain its time and space
   Complexity with respect to both adjacency list and adjacency matrix with proof.
   (10 Marks)

4. Apply the following code segment on the tree shown in Fig.1. Assume t is a pointer points to node A. (Assume there is no syntax error) (10 Marks)

```
Do(t)
{
if(t)
{
printf(t->data) //prints the data value
Do(t->left)
printf(t->data)
printf(t->data)
Do(t->right)
}}
```

5. Consider the following be adjacency Matrix shown in Table1 of an undirected graph. Which of the following DFS order is not possible. (10 Marks)
   1. pqtusvr
   2. pqturvs
   3. psvtqru
   4. psqrvtu

Table1: Adjacency matrix representation

	p	q	r	s	t	u	v
p		1		1			
q	1		1	1	1		
r		1			1	1	
s	1	1			1		1
t		1	1	1		1	1
u			1		1		1
v				1	1	1	

6. Insert the following elements in a Binary Search Tree and Balance it whenever it is required.(Construct an AVL Tree) 56, 26, 66, 16, 14, 21, 38, 52, 17, 54 (10 Marks)

7. What is the space complexity for the following code segment? Also, find the depth of the stack used. (10 Marks)

```
star(n)
{
 if(n>0)
{
star(n-1);
printf(n);
star(n-1);
}
}
```

8. Apply the following code segment on the tree shown in Fig.2. Write its output. (10 Marks)

```
void star(struct node *t)
{
if(t)
{
printf("%d", t->data);
star(t->leftchild);
printf("%d", t->data);
star(t->rightchild);
printf("%d", t->data);
}
}
```

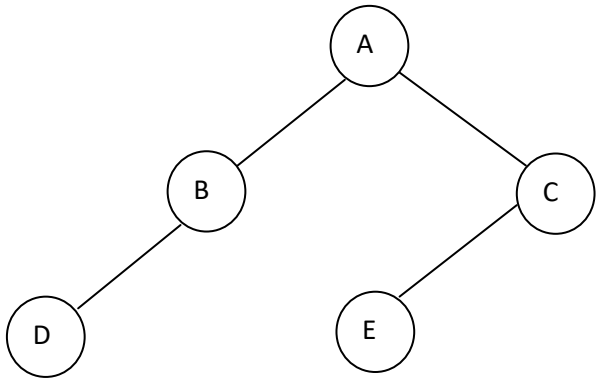

Fig 2: Sample Binary Tree

9. a) Given $(logn)^2$ sorted lists each of size $\frac{n}{(logn)^2}$. What is the total time required to merge them into one single list. (7 Marks)
   b) Write an algorithm for checking balanced parenthesis in an expression. (3 Marks)

10. What does the following code do in a heap represented by array A? What is the time complexity and space complexity of the following algorithm? (10 Marks)

```
star(A, k, key)
 {
 if(key<A[k])
 Error;
A[k] = key;
while(k>1 and A[k/2] <A[k])
Exchange A[k] and A[k/2];
k = k/2;
}
```