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

II SEMESTER M.C.A
IN-SEMESTER EXAMINATION Date: 08.06.2021
DATA STRUCTURES & ALGORITHMS [MCA 4252]

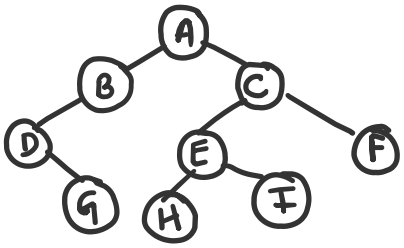
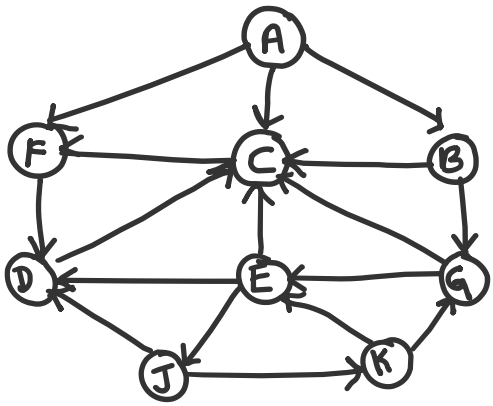
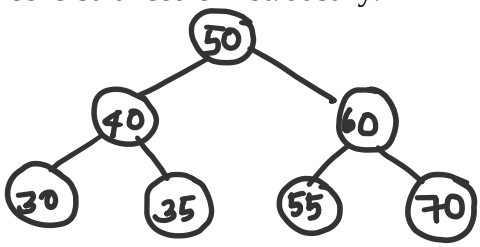
TIME:10.30 am – 12.30 pm MAX. MARKS: 30

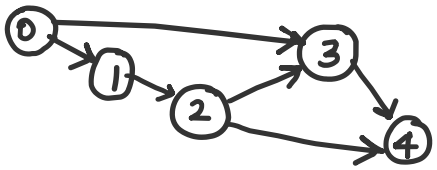
Instructions to Candidates:

- Answer **ALL** the questions. Missing data and proper syntax, may be suitably assumed. **Give appropriate examples.**
- Write your name, registration number, subject name, date of examination on sheet 1.
- Signature on all sheets.

1.	i. For the following mention the type of *algorithmic efficiency* involved and determine the *big-O notation*:
	a. $3n^{5/2} + n^{2/5}$
	b. $2\log(n) + 8n$
	ii. Calculate the run-time efficiency of the following program segment:
	a. `for (var1 = 1; var1 <= count; var1++)`
	`for (var2 = 1; var2 <= count; var2++)`
	`for (var3 = 1; var3 <= count; var3++)`
	`cout<<" i = "<<i<<" j = "<<j<<" k = "<<k;`
		2

2.	i. The following are examples of real-world scenarios. Identify those that are most suited as an example of a stack application. Justify.
	Scenario 1: Movement of a line of people at a counter in a railway station.
	Scenario 2: Printing a given string in the reverse order.
	Scenario 3: Finding number of characters in a given string
	Scenario 4: Locating vowels in a given string.
	ii. Calculate the output of the following recursive function given the value of n=5. Write all intermediate steps.
	`recursive_fn( int n)`
	`{`
	`int x, y;`
	`if (n == 0)`
	`return 0;`
	`x = n -1;`
	`y = recursive_fn(x);`
	`return (n+y);`
	`}`
		2

3.	Convert the following binary tree into its equivalent threaded binary tree. Draw the resultant tree. 	**2**
4.	"*A tree is also a graph".* If true or false, justify with an example.	**2**
5.	i. Write the recursive function for the following: f(n) = 1 if n=1 f(n) = 2*f(n-1) if n>=2 ii. Draw a Binary Search Tree that results from inserting into an initially empty tree records with the keys: "**L I N M K J E D F B S T A C**" and then delete the "**D**" node.	**3**
6.	Consider the following graph G with cities from A to K. Show the adjacency list, adjacency matrix and the incidence matrix for the graph G. 	**3**
7.	i. Check if the given tree is balanced or not. Justify.  ii. Insert a node 52 to the same tree and perform the necessary rotations if the tree is unbalanced. The resultant tree should be an AVL tree.	**3**
8.	i. Explain the Prim's algorithm with the help of an example. ii. Discuss the prerequisites for performing Topological Sort.	**4**

	iii. Illustrate the steps followed to arrange nodes using Topological Sort for ***construction of a house,*** given each node represents an activity of the process. Also draw the precedence of the activities. 0: Laying foundation 1: Building walls, window and door frames. 2: Adding the roof 3: Plumbing work 4: Electrical work 	
9.	Construct a B-Tree of ***order 5***: **10, 70, 60, 20, 110, 40, 80, 130, 100, 50, 190, 90, 180, 240, 30, 120, 140, 200, 210, 160**	**4**
10.	Perform Heapsort in descending order using the following numbers: **20, 12, 35, 15, 10, 80, 30, 17, 2, 1**	**5**

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