Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2024

INFORMATION TECHNOLOGY
Fourth Semester
IT5401- Object Oriented Programming and Advanced Data Structures
(Regulation 2019)

Time:3 hrs Max. Marks: 100

CO1	Understand the problem specifications as per the requirements.
CO2	Design practical applications using OOP concepts.
CO3	Solve the given problem using object oriented programming concepts.
CO4	Implement advanced data structures through ADTs using OOP.
CO5	Apply graph data structures for a real world problem.
CO6	Understand and apply the advanced data structures for solving real world applications.

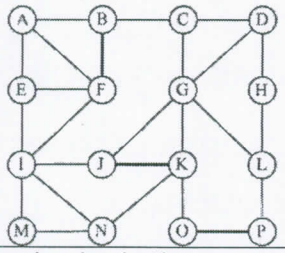
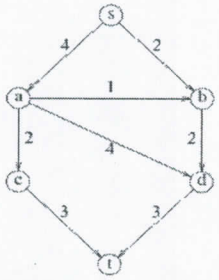
BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10x2=20Marks)
(Answer all Questions)

Q. No.	Questions	Marks	CO	BL

1	Find the error in the following class and correct it.
	class Example
	{ private:
	int data;
	static int count;
	public:
	Example(int y = 10) : data(y) { }
	int getIncrementedData() const
	{
	return data++;
	} // end
	} ; //end class Example
		2	1	L1

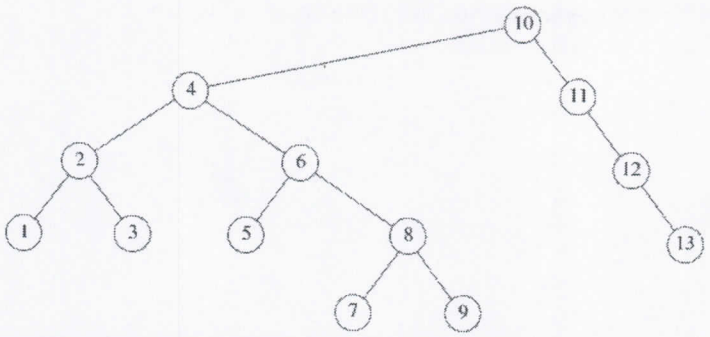
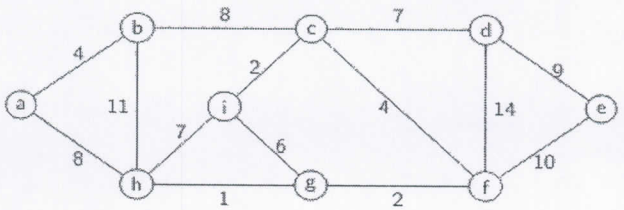
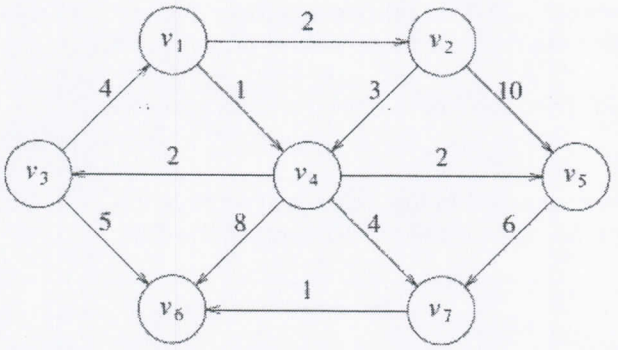
2	What difference can be observed from the following statements with reference to initialization/assignment? MyClass t1, t2; MyClass t3 (t1); t2 = t1;	2	1	L1
3	Write a function template to swap two elements.	2	2	L2
4	Using STL, Create a list of 10 elements and print the elements after sorting the list.	2	2	L2
5	State the properties of B-trees.	2	3	L2
6	Insert the following nodes into a Binomial heap in the given order: 23,51,42,12,10,15,70.	2	3	L3
7	Give the sequence of vertices of the below graph ,visited using a DFS traversal starting at vertex A. Assume chronological order for the traversal.	2	4	L4

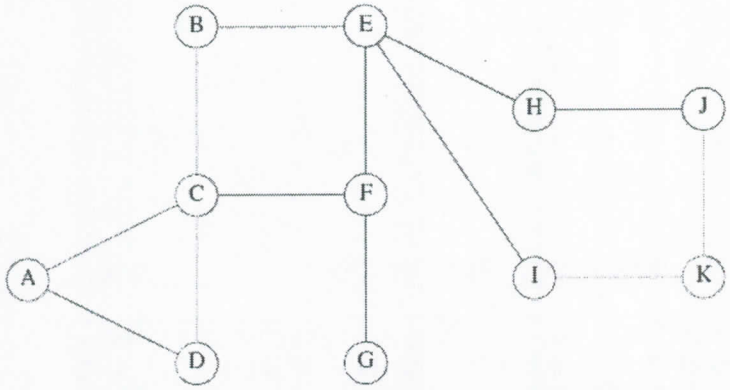
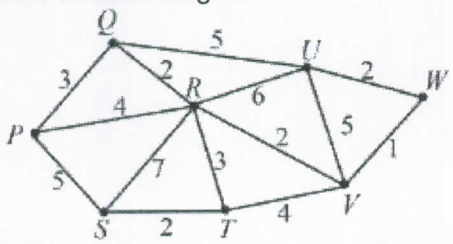
				
8	How will you check whether a graph is bi-connected or not?	**2**	4	L4
9	For a give Graph G , Determine the maximum amount of flow that can pass from *s* to *t* 	**2**	5	L5
10	How will you determine whether a graph contains cycle or not?	**2**	5	L5

PART- B (5x 13=65Marks)

(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a)	i. Create a class IntegerSet , where each object hold integers in the range 0 through 100. Represent the set internally as a vector of bool values. Element a[i] is true if integer *i* is in the set otherwise false. ii. Write a C++ program with the above class definition. Overload + , - and ouput stream operators for performing union, intersection operations on the set and to Print the elements in the list.	**5** **8**	1 1	L1 L1
	OR			
11 (b)	i. Create a class called Rational for performing arithmetic operations with fractions. Represent the rational numbers internally as vector of bool values. Element a[i] is true if there exists a highest common factor for the rational number otherwise false. ii. Write a C++ program to test your class. Overload +,- and output stream operators for performing addition and multiplication operations and to Print the resultant value.	**5** **8**	1 1	L1 L1
12 (a)	Define a class template for fixed length stack with the standard basic operations. Create two stack objects. Write a generic exchange function that replaces the contents of the two stack objects retaining their order Print the contents of the stack before and after exchange.	**13**	2	L2
	OR			
12 (b)	Design a class hierarchy for estimating the construction cost of a building with respect to the following departments: Civil (cost per sq.ft.), Plumbing (pipes,taps,..) and Electrical works (wires, switches,..). Use pure virtual function to estimate the cost of the items in the respective departments. Print the estimated cost for each department and the overall construction cost.	**13**	2	L2

13 (a)	i.Show the result of accessing the keys 3, 9, 1, 5 in order in the splay tree in the following Figure. Specify the possible rotations in each cases  ii. Write the pseudocode for splaying the keys.	**5** **8**	3 3	L3 L3
	OR			
13 (b)	i.State the properties of Red-Black tree. Show the result of inserting the following keys into an initially empty Red-Black tree: 85, 15, 70, 60, 30, 50, 110, 40. Draw the figures depicting your tree immediately after each insertion and identify the rebalancing rotation or color change (if any). ii.Write the pseudocode for the appropriate cases of rotation.	**5** **8**	3 3	L3 L3
14 (a)	i. Compute the Minimum spanning tree using the two greedy approaches. Generate the intermediate stages.  ii. Explain the time bound in both of the above approaches.	**10** **3**	4 4	L4 L4
	OR			
14 (b)	i.Assume that the vertices are cities, edges are the path between the cities . A person wishes to take the shortest path from city v_1 to all other cities. Solve the single source shortest path problem starting from vertex v_1 using a greedy approach.  For each iteration, Detail the vertex that are declared known at each stage with the associated table construction. ii. Explain why Dijkstra's algorithm does not work for negative edge costs.	**10**	4	L4

		3	4	L4
15 (a)	Find all the articulation points in the following graph which represents a partial network. Show the depth-first spanning tree and the values of *Num* and *Low* for each vertex. Identify the back, cross, or forward edge. Simulate the tree and validate the computation of Low and Num values .  	13	5	L5
	OR			
15 (b)	In the following graph, vertices P, Q, R, S, T, U, V & W represent cities . The time to travel from one city to another represented as edges. Find the all pair shortest path using a dynamic-programming formulation. Tabulate the weighted and predecessor matrix at each stage.  	13	5	L5

PART- C (1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	i. Write the Abstract Data Type (ADT) which reads a list of names and telephone numbers from a text file and inserts them into a tree that always maintains the balance factor based upon height.	8	1,2,3	L2,L6
	ii. How does the above defined ADT differs form a Binary Search Tree ADT?	2		
	iii. Search the element with respect to the name and retrieve the corresponding telephone number. Print the contents in the file .	5		