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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: VI**

Branch: Electronics and Communication Engineering **Duration: 3 hrs.**

Course Code: 23EC6PE2DS / 22EC6PE2DS **Max Marks: 100**

Course: Data Structures using C++

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. All codes are to be of generic type. Assume any missing data, suitably and indicate the same in your answer clearly.
3. All codes are to be accompanied with explanatory comments

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Realize a data structure to store data using formula-based representation. Include functions to insert a data at a given position. Include appropriate exception handling.	*1*	*1*	**12**
	b)	Explain with relevant pseudo codes how a linked list is better than formula an array-based data structure.	*1*	*1*	**08**
		OR			
2	a)	Realize a data structure to store data using linked representation. Include functions to insert a data at a given position.	*1*	*1*	**12**
	b)	With codes depict how a data can be searched in a data structure stored using the concept of arrays.	*1*	*1*	**08**
		UNIT - II			

3	a)	Realize a class array1D<T> and include functions for the following main program to compile:
		array1D<int> Arr1(10), Arr2(5),Arr3; // create arrays to hold data as specified in the argument
		Arr3=Arr1 + 20; // Add an offset 20 to all data items of Arr1
			1	*1*	**12**

	b)	Outline how special matrices are different from regular matrices. Demonstrate with an example how the data of a diagonal matrix can be efficiently stored. (No codes)	*2*	*2*	**08**
		OR			
4	a)	In a supermarket that sells 20,000 different types of commodities and which has over 1M customers, a data base is to be maintained of 'who buys what'. Suggest an efficient data structure for the same. Write codes to realize such a data base. Suppose the superstore has 2 outlets and wants to get the total number of customers for each item from the 2 outlets, how would you facilitate the same? (Only algorithm)	*2*	*2*	**12**

		b)	Give the mapping function that can be used to store the contents of a 3D matrix in row major and column major order. Trace the mapping functions.	*1*	*1*	**08**
			UNIT - III			
	5	a)	Write codes to realize a stack using formula-based representation.	*1*	*1*	**10**
		b)	Outline any one application of a queue. Start with problem definition and explain the algorithm with a sample input.	*3*	*3*	**10**
			OR			
	6	a)	Outline how a circular queue overcomes the disadvantages of a linear queue. Give the equations that are used to facilitate enqueue and dequeue operations. (No codes)	*1*	*1*	**10**
		b)	Outline any one application of a stack. Start with problem definition and explain the algorithm with a sample input.	*3*	*3*	**10**
			UNIT - IV			
	7	a)	Derive an expression to calculate the height of the tree given the number of nodes.	*1*	*1*	**08**
		b)	Construct an expression tree for the expression ((a+b)>(c-e)) || (a<f && (x<y || y>z)). Mention the number of levels of the tree and the leaf nodes. Write prefix form of the expression.	*1*	*1*	**12**
			OR			
	8	a)	Construct a BST given the data: 50,43,12,8,32,21,56. Comment on the time complexity of search operation. Give the height of the tree. (No codes)	*1*	*1*	**08**
		b)	Write the prefix and postfix expressions for the equation: ((a+b-(c/2)^2) – (3-x). (No codes)	*1*	*1*	**12**
			UNIT - V			
	9	a)	In a certain system, priorities are pre-assigned to the tasks of the system. The priorities are numbered 1-24, with number 1 being the highest and number 24 being the lowest. Tasks with priorities 12,8,14,5,3,7,11 get ready in that order. Demonstrate how a heap can be used to store this information. Construct a heap. (No codes)	*2*	*2*	**10**
		b)	Construct an AVL tree for the data 23, 45, 51,72, 83, 31, 27. Show all steps of construction. (No codes)	*1*	*1*	**10**
			OR			
	10	a)	Give the algorithm for creating a min heap. Demonstrate the same with a sample data. Where would this data structure be useful.	*2*	*2*	**10**
		b)	Describe the four rotations in case of an AVL tree. With your own examples demonstrate the same.	*1*	*1*	**10**

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