SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)
SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF
COMPUTER SCIENCE ANDENGINEERING

QUESTION BANK

V SEMESTER

1904007- DATA STRUCTURES

Regulation – 2019

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Prepared by

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QUESTION BANK

SUBJECT :**1904007- DATA STRUCTURES**
SEM/YEAR: V/III

UNIT I - LINEAR DATA STRUCTURES - LIST

Introduction to structure-Abstract Data Types (ADTs) - List ADT - array-based implementation - linked list implementation - singly linked lists- circularly linked lists - applications of lists –Polynomial Manipulation.

PART – A

Q.No	Questions	BT Level	Competence
1	**What** is Circular list? Give an example with diagram.	BTL-1	Remember
2	**Differentiate** linear and nonlinear data structures.	BTL-2	Understand
3	**Compare** calloc () and realloc () function and mention its application in linked list.	BTL-4	Analyze
4	**Define** ADT. Give any two examples.	BTL-1	Remember
5	**List** out the areas in which data structures are applied extensively.	BTL-1	Remember
6	Define iterators. Give example.	BTL-1	Remember
7	**Compare** singly linked list with circular linked list.	BTL-5	Evaluate
8	**State** the advantage of ADT.	BTL-1	Remember
9	**List** out the advantage of circular linked list.	BTL-1	Remember
10	Binary search cannot be performed on a linked list. **Examine**.	BTL-3	Apply
11	**Discuss** the advantages and disadvantages of linked lists and arrays.	BTL-2	Understand
12	**Give** an example for linked list application.	BTL-2	Understand
13	**Specify** the use of Header node in a linked list.	BTL-6	Create
14	**Illustrate** the use of linked list with an example.	BTL-3	Apply
15	**Show** the ways in which list ADT can be implemented.	BTL-3	Apply
16	**Differentiate** arrays and linked lists.	BTL-2	Understand
17	**Analyze** and write a find routine in array implementation.	BTL-4	Analyze
18	**Analyze** and write the array representation of a polynomial: $p(x) = 4x^3+6x^2+7x+9$	BTL-4	Analyze

19	Should arrays or linked lists be used for the following types of applications? Support your **justification**. 1. Many search operations in sortedlist. 2. Many search operations in Unsortedlist.	BTL-5	Evaluate
20	**Develop** an algorithm for insertion operation in a singly linked list.	BTL-6	Create
	PART – B		
1	**Describe** the following: i. Polynomial manipulation(7) ii. Applications of lists.(6)	BTL-1	Remember
2	What is a linked list? **Describe** the suitable routine segments for any four operations in a linked list. (13)	BTL-1	Remember
3	**List** an algorithm to perform the following operations in a doubly linked list. i. Insert a node at the end of thelist.(7) ii. Delete the last node in the list.(6)	BTL-1	Remember
4	i. **Discuss**theinsertionanddeletionproceduresforcursorbasedlinkedlists.(7) ii. Give an algorithm for the deletion and reverse operations on doubly linked list. (6)	BTL-2	Understand
5	i. **Give** the algorithm to perform insertion on a doubly linkedlist.(7) ii. Give the algorithm to perform deletion on a doubly linkedlist.(6)	BTL-2	Understand
6	Write an algorithm to **demonstrate** a polynomial using a linked list for i.Addition and Subtraction. (7) iii. Multiplication operations. (6)	BTL-3	Analyze
7	**Analyze** and write algorithm for Circular Linked list for the following operations using structure pointer. i. Create & Insert.(6) ii. Delete &Display.(7)	BTL-4	Analyze
8	**Explain** the application of linked list in detail. i. Radix sort. (7) ii. Multi list.(6)	BTL-4	Apply
9	Consider an array A[1: n] Given a position, write an algorithm to insert an element in the Array. If the position is empty, the element is inserted easily. If the position is already occupied the element should be inserted with the minimum number of shifts. (Note: The elements can shift to the left or to the right to make the minimum number of moves). (13)	BTL-5	Evaluate
10	**Develop** a program to add the values of the nodes of a linked list and then calculate the mean. (13)	BTL-6	Create
11	**Describe** the various operations of the list ADT with examples. (13)	BTL-1	Remember

12	i. **Illustrate**thepolynomialrepresentationfor6x3+9x2+7x+1usinglinkedlist. Writeproceduretoaddandmultiplytwopolynomialsandexplainwithsuitable example.(7) ii. What are the ways to insert a node in linked list? Write an algorithm for inserting a node before a given node in a linked list.(6)	BTL-3	Analyze
13	**Explain** the steps involved in the following insertion operations in a singly linked list. i. Insert the node in the start and End.(7) ii. Insert the node in the middle of the List(6)	BTL-4	Apply
14	**Discuss** an algorithm for linked list implementation of list. (13)	BTL-2	Understand

PART – C

1	**Create** an algorithm to add two polynomials using linked list. (15)	BTL-6	Create
2	**Explain** an algorithm to split a linked list into two sub lists containing odd and even ordered elements in them respectively. (15)	BTL-5	Evaluate
3	**Analyze how** to merge two sorted linked lists into a single sorted list. (15)	BTL-4	Analyze
4	**Design** algorithm for various operations performed on circular linked list. Extend the algorithm defined in the previous question for the doubly linked circular list. (15)	BTL-6	Create

UNIT II - LINEAR DATA STRUCTURES – STACKS, QUEUES

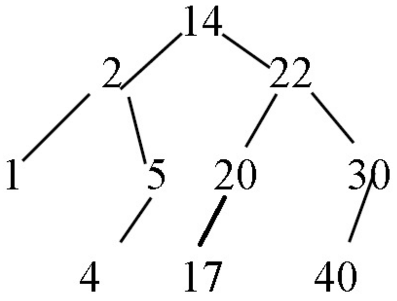
Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – applications of queues.

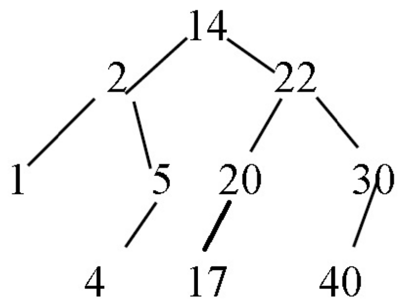
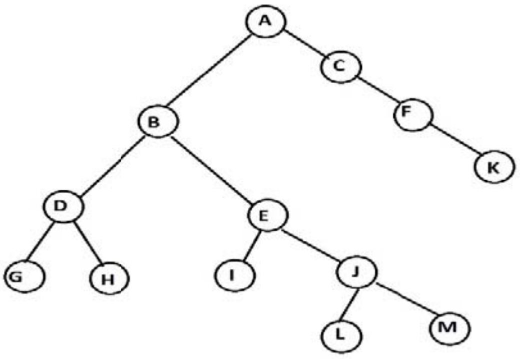
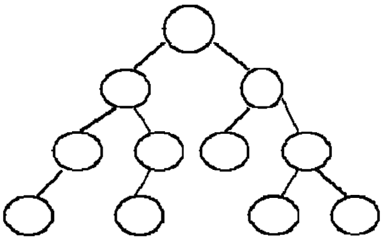
PART – A

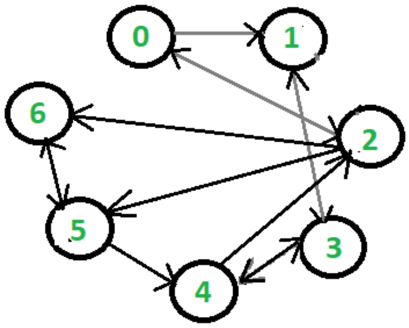
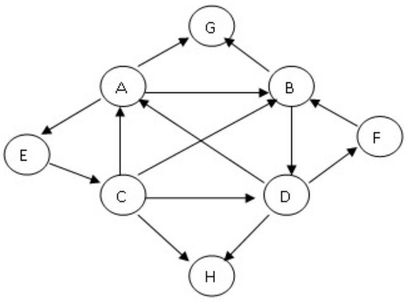
Q.No	Questions	BT Level	Competence
1	**Point out** the advantage of representing stack using a linked list than array.	BTL-4	Analyze
2	**Point out** the rules followed during the infix to postfix conversions.	BTL-4	Analyze
3	**Compare** the working of stack and queue data structure.	BTL-5	Evaluate
4	**Develop** an algorithm for inserting a new element into the stack.	BTL-6	Create
5	**What** are priority queues? What are the ways to implement priority queue?	BTL-1	Remember
6	**List** any four applications of stack.	BTL-1	Remember
7	Given the prefix for an expression, write its postfix: -*-+abc/ef-g/hi	BTL-2	Understand
8	**Describe** how the following "infix" expression is evaluated with the help of stack : 5 * (6 + 2) - 12 / 4	BTL-2	Understand
9	**Give** the postfix and prefix forms of the expression: A + B* (C – D) / (P – R)	BTL-2	Understand
10	**Define** double ended queue.	BTL-1	Remember
11	**List** the applications of a queue.	BTL-1	Remember

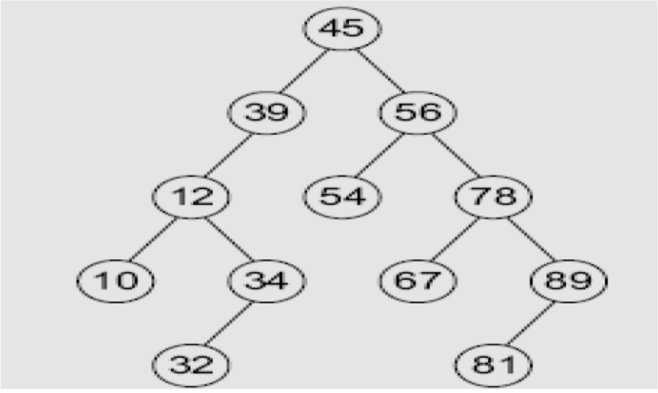
12	**What** are the applications of priority queue?	BTL-1	Remember
13	**What** is circular queue?	BTL-1	Remember
14	Circular queue is better than standard linear queue, **Why?**	BTL-2	Understand
15	**Classify** the different types of queues.	BTL-3	Apply
16	**Illustrate** the difference between a queues and linked lists with an example.	BTL-3	Apply
17	**Complete** a routine to display the contents of queue.	BTL-3	Apply
18	**Analyze** and write a routine to check whether the queue is full or empty.	BTL-4	Analyze
19	For railway reservation the queue data structure is preferred –**Justify.**	BTL-5	Evaluate
20	**Develop** an algorithm for deleting an element in a double ended queue.	BTL-6	Create
	PART – B		
1	**Describe**withanexamplehowtoevaluatearithmeticexpressionsusingstacks. (13)	BTL-1	Remember
2	**Explain** array based implementation of stacks. (7) Explain linked list implementation of stacks. (6)	BTL-3	Apply
3	i. **Describe** about stack ADT in detail.(7) ii. Explain any one application ofstack.(6)	BTL-1	Remember
4	**Explain** the infix, prefix and postfix expressions with an example. (13)	BTL-3	Apply
5	i. Write an algorithm to convert an infix expression to a postfix expression. Tracethealgorithmtoconverttheinfixexpression‘(a+b)*c/d+e/f’toapostfix expression.(8) ii. **Justify** the need for Infix and Postfix expression.(5)	BTL-5	Evaluate
6	i. **Give**analgorithmforoperationsonstackusingalinkedlist.(7) ii. Discuss about addition and deletion operations performed on a circular queue with necessary algorithms.(6)	BTL-2	Understand
7	i. **Describe**theprocessofpostfixexpressionevaluationwithanexample.(7) ii. Describe the process of conversion from infix expression to postfix expression using stack.(6)	BTL-2	Understand
8	i. Writeanalgorithmthat**checks**ifexpressioniscorrectlyparenthesizedusing stack and illustrate with an example.(7) ii. Write the function to examine whether the stack is full () or empty ().(6)	BTL-4	Analyze
9	i. **Describe** about queue ADT in detail.(7) ii. Explain any one application of queue with suitable example.(6)	BTL-1	Remember
10	Briefly **describe** the operations of queue with examples. (13)	BTL-1	Remember
11	**Analyze** and write an algorithm to implement queue functions using arrays. (13)	BTL-4	Analyze
12	**Develop** an algorithm to perform the four operations in a double endedqueue that is implemented as an array. (13)	BTL-6	Create
13	**Discuss** in detail about the circular queue and its implementation. (13)	BTL-2	Understand
14	**Illustrate** the enqueue and dequeue operations on double ended queues.	BTL-4	Analyze

	(13)		
	PART – C		
1	**Develop** the simulation using stack for the following expression conversion: 12 + 3 * 14 – (5 * 16) +7. (15)	BTL-6	Create
2	**Analyze** the algorithm which implements the stack ADT. Explain any one applicationof stack. (15)	BTL-4	Analyze
3	**Assess** the difference between double ended queue and circular queue. Show the simulation using stack for the following expression to convert infix to postfix: p * q - (r-s/ t). (15)	BTL-5	Evaluate
4	**Develop** an algorithm to explain Priority Queue, deQueue and theapplications ofqueues. (15)	BTL-6	Create

UNIT-III: NON LINEAR DATA STRUCTURES TREES- GRAPHS			
Binary Trees – Binary tree representation and traversals – Application of trees: – Graph and its representations – Graph Traversals – Connected components.			
Q.No	**Questions**	**BT Level**	**Competence**
	PART – A		
1	If the depth of the binary tree is k, the maximum number of nodes in the binary tree is 2^k-1.**Justify**	BTL 5	Evaluate
2	For the given binary search tree, if we remove the root and replace it with something from left subtree. What will be the value of the new root? **Justify** your answer. 	BTL5	Evaluate
3	**Define** a fully binary tree.Give an example.	BTL 1	Remember
4	**Create**a binary tree with four nodes	BTL 6	Create
5	**How**binary search tree differ from binary tree?	BTL 4	Analyze
6	**What**are the rules to be followed to construct a binary search tree?	BTL 1	Understand
7	**List** the applications of trees.	BTL 1	Remember
8	**What**isa complete binary tree?**Give**example with diagram.	BTL 2	Understand
9	**Define**height of a tree	BTL 1	Remember
10	**How**to calculate the maximum number of nodes in a binary tree with depth k?	BTL 2	Understand
11	**Simulate**preorder tree traversal for the following tree	BTL 6	Create

	 		
12	**Discuss** with respect to following tree: a) List the siblings for node E. b) Compute the height  A C B F K D E G H I J L M	BTL 2	Understand
13	Number the following binary tree to traverse it in i.Preorder ii.Inorder 	BTL 2	Understand
14	**Explain** why binary search cannot be performed on a linked list.	BTL 4	Analyze
15	**How** do you calculatethe in-degree and out-degree of each node in the given graph?	BTL 3	Apply

			
16	**List out various types of graph.**	BTL 1	Remember
17	**List out two applications of graph**	BTL 1	Remember
18	**Illustrate the steps in the construction of adjacency matrix for the following graph** 	BTL 3	Apply
19	**Differentiate** cyclic and acyclic graph	BTL 4	Analyze
20	**Show** that the number of edges in a complete graph of n vertices inn(n-1)/2	BTL 3	Apply
	PART – B		
1	**Write** an algorithm for preorder, inorder and postorder traversal of a binarytree. (13)	BTL 1	Remember
2	**Explain** the following operations on a binary search tree with suitablealgorithms i. Find a node (6) ii. Find the minimum and maximum elements of binary search tree (7)	BTL 4	Analyze
3	**Describe** representation of binary tree using arrays and linked list.	BTL 1	Remember
4	**Write** an algorithm for inserting and deleting a node in a binary search tree.(13)	BTL 1	Remember
5	**Discuss** in detail the various methods in which a binary tree can berepresented. Discuss the advantage and disadvantage of each method (13)	BTL 2	Understand
6	Construct the binary search tree using following elements: 35,15,40,7,10,100,28,82,53,25,3. **Show** diagrammatically each step of construction of BST. (13)	BTL 5	Evaluate
7	**Discuss** the different traversal technique inbinary tree with suitablealgorithms and examples? (13)	BTL 2	Understand
8	**Develop** an algorithm to compute the shortest path using Dijkstra's algorithm. Validate the algorithm with suitable example. (13)	BTL 6	Create
9	**Describe** in detail about the following representations of a graph. i. Adjacency Matrix (7)	BTL 1	Remember

	ii. Adjacency List (6)		
10	**Differentiate** depth-first search and breadth-first search traversal of a graph with suitable examples. (13)	BTL 4	Analyze
11	i. **Write** short notes on Bi-connectivity. (7) ii. Express different types of graphs with example. (6)	BTL 2	Remember
12	**Explain** the depth first approach of finding articulation points in a connected graph with necessary algorithm.(13)	BTL 4	Analyze
13	**Illustrate** depth-first search and breadth-first search traversal of a graph with suitable examples. (13)	BTL 3	Apply
14	**i. Show** that the maximum number of edges in a simple graph with n vertices is n(n-1)/2. (7) **ii. Prove** that if a graph has exactly two vertices of odd degree, there must be path joining these two vertices (6)	BTL 3	Apply
PART – C			
1	Consider the binary search tree given below. Find the result of in-order, pre-order, and post-order traversals. Show the deletion of the root node Insert 11, 22, 33, 44, 55, 66, and 77 in the tree (15)  45 39 56 12 54 78 10 34 67 89 32 81	BTL 5	Evaluate
2	Create a binary search tree and Find the position of element 29 using binary search method in an array 'A' given below : A = {11, 5, 21, 3, 29, 17, 2, 43} (15)	BTL 6	Create
3	Given the adjacency matrix of a graph, write an algorithm to **calculate** the in-degree and the out-degree of a node N in the graph. (15)	BTL 4	Analyze

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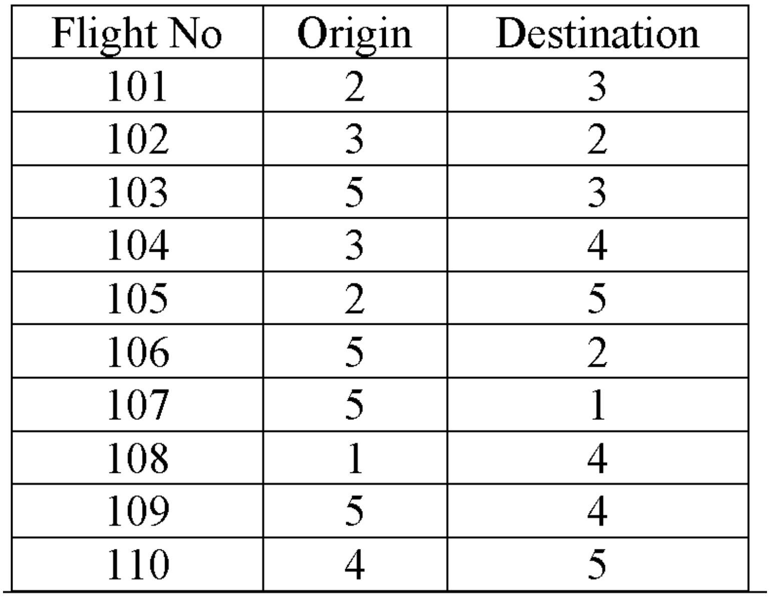
<td>Consider five cities: (1) New Delhi, (2) Mumbai, (3) Chennai, (4) Bangalore, and (5) Kolkata, and a list of flights that connect these cities as shown in the following table.Use the given information to <b>construct</b> a graph.(15)

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UNIT-IV: SORTING			
Selection sort-Insertion sort – Merge sort – Quick sort – Heap sort – Bubble sort- Shell sort – Radix sort.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1	**What** is sorting**?**	BTL1	Remember
2	**Define**radix sort.	BTL1	Remember
3	**Give** the fast sorting algorithm.	BTL2	Understand
4	**What** is meant by internal and external sorting? Give any two examples for each type.	BTL1	Remember
5	**Give** the time complexities of bubble sort and quick sort.	BTL2	Understand
6	**List**any four sorting techniques.	BTL1	Remember
7	**Describe** the complexity of bubble sort.	BTL1	Remember
8	**Predict** the fastest sorting algorithm, justify.	BTL2	Understand
9	**Compare** internal and external sorting.	BTL4	Analyze
10	**Distinguish** which sorting technique are in-place sort and which are not.	BTL2	Understand
11	**Classify** the different sorting methods.	BTL3	Apply

12	**Develop** an algorithm for a quick sort.	BTL6	Create
13	**Which sorting** technique is best and illustrate with an example?	BTL3	Apply
14	**Summarize** the shell sort.	BTL5	Evaluate
15	**Point out** the advantages of using quick sort.	BTL4	Analyze
16	**Compare** the internal and external sorting techniques.	BTL4	Analyze
17	**Select** the best sorting method out of the following - insertion sort, quick sort and merge sort and give justification.	BTL5	Evaluate
18	**Illustrate** the time complexity of insertion sort with an example.	BTL3	Apply
19	**Identify** the advantage of shell sort over insertion sort.	BTL1	Remember
20	**Develop** a simple algorithm for bubble sort.	BTL6	Create
PART – B			
1	**Describe**howtheisimplemented (13)	BTL1	Remember
2	**Describe** the algorithm to sort the following array: 77, 33, 44, 11, 88, 22, 66, 55 i. Insertion sort(7) ii. Shell Sort(6)	BTL1	Remember
3	i. **List** the different types of sorting techniques?(7) ii. Explain any one sorting technique in detail with an Example.(6)	BTL1	Remember
4	i. Write algorithm for merge sort. (7) ii. Discuss the running time of Divide-and-Conquer Merge sort algorithm.(6)	BTL2	Understand
5	i. Sort the sequence 3, 1, 4, 1, 5, 9, 2, 6, 5 usingInsertion sort. (7) ii. **Describe** the routine for insertion sort.(6)	BTL2	Understand
6	Writeanalgorithmtosortasetof'N'numbersusingquicksort.**Demonstrate** quick sort for the followingdata:88,11,22,44,66,99,32,67,54,10. (13)	BTL3	Apply
7	**Explain** Quicksort in detail with an example. (13)	BTL4	Analyze
8	**Compare** the below different Sorting methods and discuss about each method in a very detailed Manner. i. Bucket Sort.(7) ii. Selection Sort.(6)	BTL4	Analyze
9	i. Sort the given integers and Explain the intermediate results using shell sort: 35,12,14,9,15,45,32,95,40,5. (7) ii. Write and **explain**aalgorithm to sort an integer array.(6)	BTL5	Evaluate
10	i. **Create** a algorithm to perform a insertion sort.(7) ii. Develop an algorithm for Merge sort with anexample.(6)	BTL6	Create
11	i. Write short notes on BubbleSort.(5) ii. **Illustrate** an algorithm to sort the elements using bubble sort.(8)	BTL4	Analyze

12	**Describe** the following sorting techniques in detail with an example. i. Shell sort. (7) ii.Radix sort. (6)	BTL1	Remember
13	i. **Explain** bubble sort. Sort the following numbers using bubble sort 35,12,14,9,15,45,32,95,40,5(9) ii. Explain the radix sort.(4)	BTL3	Apply
14	**Describe** quick sort with algorithm. Explain thetime complexity of quicksort (13)	BTL2	Understand
PART – C			
1	**Develop** an algorithm for quick sort and explain with suitable example Give its worst case, average case and best case time complexities.(15)	BTL6	Create
2	**Analyze** how to sort an integer array using Selection Sort and Radix Sort.(15)	BTL4	Analyze
3	**Explain** an algorithm for Shell Sort and Merge Sort and explain withexample.(15)	BTL5	Evaluate
4	**Prepare** a quick sort algorithm and explain with suitable example Give its worst case, average case and best case time complexities.(15)	BTL6	Create

UNIT-V: SEARCHING AND INDEXING

Linear Search – Binary Search - Hash tables – Overflow handling – Hash Index – B-Tree Indexing.

PART – A

Q.No	Questions	BT Level	Competence
1	**What** is hashing?	BTL1	Remember
2	**Define** extendible hashing.	BTL1	Remember
3	**Give** the fastest searching algorithm.	BTL2	Understand
4	**What** is hash function?	BTL1	Remember
5	**Give** example for hash function.	BTL2	Understand
6	**Name** the applications of linear each technique.	BTL1	Remember
7	**Name** the applications of binary search techniques.	BTL1	Remember
8	**Predict** the fastest, justify.	BTL2	Understand
9	**Point** out the procedure for select good hash function.	BTL4	Analyze
10	**Distinguish** between linear and binary search technique.	BTL2	Understand
11	**Classify** the different hashing techniques.	BTL3	Apply
12	**Develop** an algorithm linear search.	BTL6	Create
13	**Which** hashing technique is best and illustrate with an example?	BTL3	Apply
14	**Summarize** the open addressing hashing method with an example.	BTL5	Evaluate
15	**Point out** the advantages of using binary search.	BTL4	Analyze
16	**Compare** the working of linear and binary search techniques.	BTL4	Analyze

17	Does a B tree have disadvantage? **Justify**.	BTL5	Evaluate
18	**How** do you **calculate** the depth of a B-Tree?	BTL3	Apply
19	**List** out the various operations that can be performed on B-trees	BTL1	Remember
20	**Develop** a simple algorithm for a binary search.	BTL6	Create
	PART – B		
1	**Describe**how the divide and conquer technique is implemented in binary search. (13)	BTL1	Remember
2	**Describe** the following search algorithms to searchthe number 88 from the following array: 77, 33, 44, 11, 88, 22, 66, 55 i. Linear Search (7) ii. Binary Search (6)	BTL1	Remember
3	**i, List** the different types of hashing techniques**?** (7) **ii,** Explain them in detail with an Example**.** (6)	BTL1	Remember
4	**i, Interpret** the result of inserting the keys 2, 3, 5, 7, 11, 13, 15, 6, 4 into an initially empty extendible hashing data structure with M = 3. (7) **ii. Discuss** the points to be followed in selecting a hash function**.** (6)	BTL2	Understand
5	**i. Search** the element 2 from the sequence 3, 1, 4, 1, 5, 9, 2, 6, 5 using Binary search.(7) **ii. Describe** hash tables**.** (6)	BTL2	Understand
6	**Write** a hash function to index a set of 'N' numbers and **demonstrate**hashingfor the following data: 88,11,22,44,66,99,32,67,54,10. (13)	BTL3	Apply
7	**Explain** various collision resolution techniques in detail with an example. (13)	BTL4	Analyze
8	**Compare** the below different Hashing methods and discuss about each method in a very detailed Manner. i.Static Hashing. (7) ii. Dynamic Hashing .(6)	BTL4	Analyze
9	**i. Index** the following keys using B Tree Indexing: 35,12,14,9,15,45,32,95,40,5. **(7)** **ii.Write**themethod to find the element 45 using the B Tree**.** (6)	BTL5	Evaluate
10	**i. Create** an algorithm to perform a binary Search. (7) **ii. Develop** a hash function and demonstrate hashing.(6)	BTL6	Create
11	**i. Write** short notes on Hash Tables.(5) **ii. Illustrate** rehashing**.** (8)	BTL4	Analyze
12	**Describe** the following collision resolution techniques in detail with an example. i.Separate chaining. (7) ii.Rehashing. (6)	BTL1	Remember
13	**i. Explain** different hashing technique. (5) **ii. Explain** the rehashing technique with suitable example. (8)	BTL3	Apply
14	**Describe** the open addressing and chaining methods of collusion resolution techniques in hashing. (13)	BTL2	Understand
	PART – C		

1	**Develop** an algorithm to search a number in a given set of numbers using binary search. Develop and algorithm to explain Extendible Hashing.(15)	BTL6	Create
2	**Explaining** the following with example i. Hashing (3) ii. Hash function (4) iii. Hash Table (3) iv. Bucket overflow (5)	BTL5	Evaluate
3	**Explain** B Tree with example. Analyze the advantages and disadvantages of B Tree. (15)	BTL5	Evaluate
4	**i. Develop** an index using a B Tree and explain the index can be used to search an element. (8) **ii. Explain** various collision resolution techniques. (7)	BTL6	Create