SRM VALLIAMMAI ENGINEERING COLLEGE
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DEPARTMENT OF
ELECTRONICS AND INSTRUMENTATION ENGINEERING

QUESTION BANK

VI SEMESTER

CS3665–DATA STRUCTURES

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UNIT-I

LINEAR DATA STRUCTURES - LIST

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

PART -A

S.No	Questions	BT level	Competence	COS
1.	Define Abstract data type.	BTL 1	Remember	CO1
2.	Illustrate the advantages of ADT.	BTL 2	Understand	CO1
3.	Give a C routine to deallocate the entire linked list.	BTL 1	Remember	CO1
4.	What are the applications of lists?	BTL 1	Remember	CO1
5.	List the major operations in linear data structure.	BTL 1	Remember	CO1
6.	Write a Pseudo code to create a list of integers using arrays and to search for an element from the list.	BTL 1	Remember	CO1
7.	Express an algorithms to insert an element from a linked list.	BTL 2	Understand	CO1
8.	Point out the four major operations in linear data structures.	BTL 2	Understand	CO1
9.	Compare arrays and linked lists.	BTL 2	Understand	CO1
10.	Write a function to find the position of the given element in the linked list.	BTL 2	Understand	CO1
11.	Summarize the disadvantages of linked list over array?	BTL 2	Understand	CO1
12.	Define linked list.	BTL 1	Remember	CO1
13.	What are the advantages of linked list over array?	BTL 1	Remember	CO1
14.	Differentiate between linear linked list and circular linked list.	BTL 2	Understand	CO1
15.	Assess the use of Header node in a linked list.	BTL 2	Understand	CO1
16.	Discuss the operations can be done with set ADT?	BTL 2	Understand	CO1
17.	List any three applications of linked list.	BTL 1	Remember	CO1
18.	What data structure is used to implement recursion? Why?	BTL 1	Remember	CO1
19.	Demonstrate the differences between singly and doubly linked lists.	BTL 2	Understand	CO1
20.	Analyze and write the array representation of a polynomial: $p(x) = 4x^3+6x^2+7x+9$	BTL 2	Understand	CO1
21.	Explain the term Data structure.	BTL 1	Remember	CO1
22.	What do you meant by linear data structure? Give Examples.	BTL 1	Remember	CO1
23.	State the advantages of abstract data type	BTL 1	Remember	CO1
24.	Why is linked list used for polynomial arithmetic?	BTL 2	Understand	CO1

PART -B

S.No	Questions	BT level	Competence	COS
1.	**(i)** Describe about the classification of Data structures with necessary examples. **(10)** **(ii)** Define the various operations on Data structures. **(6)**	BTL 3	Apply	CO1
2.	**(i)** Recall about the abstract data type. **(8)** **(ii)** Describe the list ADT with examples. **(8)**	BTL 4	Analyze	CO1

3.	**(i)** List the limitations of array based implementation of ADT.**(4)** **(ii)** Describe the advantages of using linked list implementation with examples. **(12)**	BTL 4	Analyze	CO1
4.	Demonstrate about traversal and searching for a value in a linked list with their algorithm.	BTL 3	Apply	CO1
5.	Explain the steps involved in the following insertion operations in a singly linked list **(i)** Insert the node in the start and end. **(8)** **(ii)** The new node is inserted after a given node. **(8)**	BTL 4	Analyze	CO1
6.	Discuss the steps involved in the following deletion operations in a singly linked list **(i)** Delete the node in the start and end. **(8)** **(ii)** The new node is deleted after a given node. **(8)**	BTL 3	Apply	CO1
7.	Summarize all the operation in a singly linked list with necessary algorithm.	BTL 4	Analyze	CO1
8.	Write the program that uses functions to perform the following operation on singly linked list **(i)** Creation (**6)** **(ii)** Insertion **(5)** **(iii)** Deletion **(5)**	BTL 3	Apply	CO1
9.	Demonstrate about the algorithms to insert and delete elements from a circular linked list. Consider all cases.	BTL 3	Apply	CO1
10.	Summarize about the circularly linked list with necessary diagrams.	BTL 4	Analyze	CO1
11.	**(i)** List the various operations on array? Write a procedure to insert an element in the middle of the array. **(8)** **(ii)** Describe procedure to deleting the last node from a circular linked list. **(8)**	BTL 3	Apply	CO1
12.	Demonstrate the steps involved in the following insertion operations in a Doubly linked list **(iii)** Insert the node in the start and end. **(8)** **(iv)** The new node is inserted after a given node. **(8)**	BTL 4	Analyze	CO1
13.	Demonstrate the steps involved in the following deletion operations in a Doubly linked list **(iii)** Delete the node in the start and end. **(8)** **(iv)** The new node is deleted after a given node. **(8)**	BTL 3	Apply	CO1
14.	Analyze about the insertion and deletion operations in a circularly doubly linked list with suitable ADT's and examples.	BTL 4	Analyze	CO1
15.	**(i)** Evaluate the polynomial representation for $6x^3 + 9x^2 + 7x + 1$ using linked list. Write procedure to add and multiply two polynomial and explain with suitable examples. **(8)** **(ii)** Write the program in C to delete a node the minimum value from a singly linked list. **(8)**	BTL 3	Apply	CO1
16.	Demonstrate the addition of Two polynomials using singly linked list with necessary diagram.	BTL 3	Apply	CO1
17.	Develop the implementation of polynomial operation using singly linked list.	BTL 4	Analyze	CO1

UNIT-II

LINEAR DATASTRUCTURES - 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

S.No	Questions	BT level	Competence	COS
1.	Give the applications of stacks.	BTL1	Remember	CO2
2.	Point out the advantage of representing stack using a linked list than array.	BTL1	Remember	CO2
3.	Write an ADT for insertion in stack.	BTL1	Remember	CO2
4.	Develop an algorithm for inserting a new element into the stack.	BTL2	Understand	CO2
5.	Point out the rules followed during the infix to postfix conversions.	BTL2	Understand	CO2
6.	Describe how the following "infix" expression is evaluated with the help of the help of Stack: 5 * (6 + 2) - 12 / 4.	BTL1	Remember	CO2
7.	Write the following infix expression into post fix (A+B)*(C+B)*(E/F).	BTL1	Remember	CO2
8.	Discover the postfix and prefix forms of the expression: A + B* (C – D) / (P – R).	BTL2	Understand	CO2
9.	List the applications of Stack and Queue.	BTL1	Remember	CO2
10.	Compare Stack and an Array.	BTL2	Understand	CO2
11.	Discuss about queue? List its advantages.	BTL2	Understand	CO2
12.	Write a routine to check whether the queue is full or empty.	BTL1	Remember	CO2
13.	What are the applications of queue?	BTL1	Remember	CO2
14.	Write a routine to display the contents of queue.	BTL1	Remember	CO2
15.	Circular queue is better than standard linear queue, Why?	BTL2	Understand	CO2
16.	What is priority queue?	BTL1	Remember	CO2
17.	Define double ended queue.	BTL1	Remember	CO2
18.	What is a deque? What are the two ways in which a deque can be implemented?	BTL2	Understand	CO2
19.	Compare the working of stack and queue data structure.	BTL2	Understand	CO2
20.	Write an algorithm for deleting an element in a double ended queue.	BTL1	Remember	CO2
21.	What do you understand by polish notation?	BTL2	Understand	CO2
22.	Write any two applications of stack.	BTL1	Remember	CO2
23.	List the characteristics of stacks.	BTL1	Remember	CO2
24.	Write the steps to reverse the contents of the list with the help of stack data structure.	BTL1	Remember	CO2

PART -B

S.No	Questions	BT level	Competence	COS
1.	**(i)** Give the ADT operations for array implementations of a stack. **(10)** **(ii)** Summarize about the concept of multiple stacks. **(6)**	BTL 3	Apply	CO2
2.	Explain about the linked representation of stack ADT and its	BTL 4	Analyze	CO2

	operations with necessary example.			
3.	**(i)** Describe algorithm to display to contents of a stack with an example. **(8)** **(ii)** Recall the algorithms for inserting and deleting values from a stack. **(8)**	BTL 4	Analyze	CO2
4.	Describe the Tower of Hanoi implementation of stack application with necessary diagram, algorithm and examples.	BTL 4	Analyze	CO2
5.	Develop a program to implement all the stack operations using linked list implementation of ADT.	BTL 3	Apply	CO2
6.	**(i)** Assess the procedure to convert the infix expression to post fix expression and steps involved in evaluating the postfix expression. **(8)** **(ii)** Deduce the expression A-(B/C+(D%E*F)/G)*H to postfix form and also Evaluate the given post fix expression 934*8+4/-. **(8)**	BTL 3	Apply	CO2
7.	Create a program to perform the conversion of infix expression to post fix expression.	BTL 3	Apply	CO2
8.	**(i)** Demonstrate about the conversion of Infix to post fix expression in stack. **(8)** **(ii)** Illustrate the ADT operations for array implementations of a queue **(8)**	BTL 3	Apply	CO2
9.	**(i)** Describe the operations of queue with example. **(8)** **(ii)** Develop algorithms for inserting and deleting values from a queue **(8)**	BTL 3	Apply	CO2
10.	**(i)** Describe the ADT operations for a linear queue using linked list implementation. **(10)** **(ii)** List the application of stacks. **(6)**	BTL 4	Analyze	CO2
11.	Write a program to implement all the queue operations using array implementation of ADT.	BTL 3	Apply	CO2
12.	Explain about the linked representation of queue ADT and its operations with necessary example.	BTL 4	Analyze	CO2
13.	Write a program to implement all the queue operations using linked implementation of ADT.	BTL 4	Analyze	CO2
14.	**(i)** Point out the advantages of circular queue over linear queue. Write the functions for Insertion in circular queue. **(8)** **(ii)** Explain how to delete an element in a circular queue. **(8)**	BTL 4	Analyze	CO2
15.	Write the program for the implementation of circular queue.	BTL 3	Apply	CO2
16.	Summarize about the priority queue and discuss about the linked representation and linked list representation of priority queue with example.	BTL 4	Analyze	CO2
17.	Explain about the following with necessary examples **(i)** Deques **(8)** **(ii)** Multiple queues **(8)**	BTL 4	Analyze	CO2

UNIT-III

NON LINEAR DATA STRUCTURES -TREES.

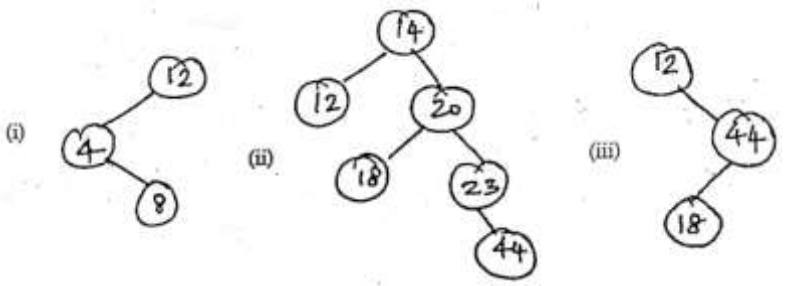
Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree - Heap – Applications of heap.

PART A

S.No	Questions	BT level	Competence	COS
1.	List few applications of tree.	BTL1	Remember	CO3
2.	Deduce the need for tree representation?	BTL2	Understand	CO3
3.	List the three types of tree traversals.	BTL1	Remember	CO3
4.	Define complete binary tree?	BTL 1	Remember	CO3
5.	The depth of complete binary tree is 8 and evaluates the number of nodes in leaf.	BTL 2	Understand	CO3
6.	Give an example for expression tree.	BTL 1	Remember	CO3
7.	Write the expression tree for ((b+c)*a)+((d+e*f)+g).	BTL 1	Remember	CO3
8.	List the applications of trees.	BTL 1	Remember	CO3
9.	What is a threaded binary tree?	BTL1	Remember	CO3
10.	What is a double threaded binary tree?	BTL1	Remember	CO3
11.	Infer the advantages of threaded binary tree?	BTL 2	Understand	CO3
12.	Write the result of inserting 3,1,4,6,2,8,9 into an initially empty AVL tree.	BTL 2	Understand	CO3
13.	Illustrate the height balanced tree:"AVL".	BTL 2	Understand	CO3
14.	How do you calculate the depth of a B-tree?	BTL 2	Understand	CO3
15.	What is meant by B-Tree Indexing	BTL1	Remember	CO3
16.	Why are B-trees used in database indexing?	BTL1	Remember	CO3
17.	What do you mean by splay tree?	BTL1	Remember	CO3
18.	Point out the advantages of B tree indices.	BTL1	Remember	CO3
19.	List the operations performed in splay trees?	BTL 1	Remember	CO3
20.	Illustrate the algorithm for pre-order traversal?	BTL 2	Understand	CO3
21.	Explain Connected components in Data structure	BTL 1	Remember	CO3
22.	How many type of heap are there?	BTL 2	Understand	CO3
23.	Write about heap sort with example	BTL1	Remember	CO3
24.	Mention one application of heap in operating systems.	BTL1	Remember	CO3

PART B

S.No	Questions	BT level	Competence	COS
1.	**(i)** Explain about the basic terminologies used in the tree in data structures. **(8)** **(ii)** Summarize about binary tree and extended binary tree. **(8)**	BTL 4	Analyze	CO3
2.	Explain about the types of tree in data structures with necessary diagrams.	BTL 3	Apply	CO3
3.	**(i)** Demonstrate about the Linked representation of binary trees. **(10)** **(ii)** List the application of trees. **(6)**	BTL 4	Analyze	CO3
4.	**(i)** Describe about tournament trees with an example. **(8)** **(ii)** Examine how binary tree is created from a general tree.	BTL 4	Analyze	CO3

	(8)			
5.	Demonstrate the various tree traversal of a binary tree with algorithm and examples.	BTL 4	Analyze	CO3
6.	**(i)** Explain about the constructing binary tree from traversal results. **(8)** **(ii)** Summarize about Huffman's tree. **(8)**	BTL 3	Apply	CO3
7.	**(i)** Explain how to implement binary search tree. **(10)** **(ii)** Infer about threaded binary tree? Explain its use. **(6)**	BTL 4	Analyze	CO3
8.	**(i)** Explain about binary search tree with necessary diagram. **(8)** **(ii)** Create a binary search tree using the following data elements: 45, 39, 56, 12, 34, 78, 32, 10, 89, 54, 67, 81 **(8)**	BTL 3	Apply	CO3
9.	Explain about the searching an element, insertion and deletion operations on binary search trees.	BTL 4	Analyze	CO3
10.	Demonstrate about the threaded binary tress with example diagram and also explain its traversal operation.	BTL 3	Apply	CO3
11.	Write the program to implement simple right in-threaded binary trees.	BTL 4	Analyze	CO3
12.	Summarize about AVL trees and explain **(i)** Inserting a new node **(8)** **(ii)** Deleting a node **(8)**	BTL 4	Analyze	CO3
13.	**(i)** Estimate the AVL tree for the following after rotation. **(2+3+3)**  **(ii)** Deduce the B tree to insert the following key elements (consider order of the B tree is 3). 55,4,44,3,6,7,9,45,46,56,57 **(8)**	BTL 3	Apply	CO3
14.	Demonstrate about the insertion and deletion operations on B trees.	BTL 4	Analyze	CO3
15.	Explain about the insertion and deletion operations on B+ trees.	BTL 4	Analyze	CO3
16.	With a neat diagram explain about the binary heap and also explain its insertion and deletion algorithm.	BTL 3	Apply	CO3
17.	Explain about the linked representation of Binomial heaps with its algorithms.	BTL 3	Apply	CO3

UNIT-IV

NON LINEAR DATA STRUCTURES - GRAPHS.

Definition – Representation of Graph – Types of graph - Breadth-first traversal -Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits– Applications of graphs

PART A

S.No	Questions	BT level	Competence	COS
1.	What are vertices and edges in a graph?			
2.	Can you define tree in terms of graph? Analyze.	BTL 2	Understand	CO4
3.	Define in degree of Graph.	BTL 1	Remember	CO4
4.	Interpret about undirected graph.	BTL 2	Understand	CO4
5.	Write the two applications of graph.	BTL 1	Remember	CO4
6.	Demonstrate about connected graph.	BTL 2	Understand	CO4
7.	Illustrate about graph traversal	BTL 2	Understand	CO4
8.	How do you represent a graph using linked list? Give example.	BTL 2	Understand	CO4
9.	Differentiate strongly connected and weakly connected graph	BTL 2	Understand	CO4
10.	State advantages of adjacency matrix.	BTL 1	Remember	CO4
11.	Define degree of a vertex.	BTL 1	Remember	CO4
12.	What is meant by weighted graph?	BTL 1	Remember	CO4
13.	Which data structure is used in BFS?	BTL 1	Remember	CO4
14.	State Breadth First Search (BFS) in a graph	BTL 1	Remember	CO4
15.	State the time complexity of DFS.	BTL 1	Remember	CO4
16.	What is topological sorting?	BTL 1	Remember	CO4
17.	On which type of graph is topological sorting possible?	BTL 2	Understand	CO4
18.	Mention the application of topological sorting.	BTL 2	Understand	CO4
19.	What is a bridge in a graph?	BTL 1	Remember	CO4
20.	Discuss about biconnected graph?	BTL 2	Understand	CO4
21.	Define cut vertex (articulation point).	BTL 1	Remember	CO4
22.	State the condition for existence of an Euler circuit.	BTL 2	Understand	CO4
23.	What is an Euler path?	BTL 1	Remember	CO4
24.	Mention any two applications of graphs.	BTL 2	Understand	CO4

PART B

S.No	Questions	BT level	Competence	COS
1.	Define the following graph terminology **(i)** Adjacent node **(ii)** Degree of a node **(iii)** Regular graph **(iv)** Connected graph **(v)** Complete graph **(vi)** Weighted graph **(2+2+3+3+3+3)**	BTL 4	Analyze	CO4
2.	Explain the following representation of graph **(i)** Adjacency Matrix representation **(8)** **(ii)** Adjacency list representation **(8)**	BTL 4	Analyze	CO4
3.	Define a graph. Explain different types of graphs with suitable examples.	BTL 3	Apply	CO4
4.	Write the program for Breadth –First Search algorithm for graph traversal.	BTL 4	Analyze	CO4

5.	Summarize the Breadth –First Search algorithm for graph traversal with an example and give its applications.	BTL 3	Apply	CO4
6.	Write the program for Depth –First Search algorithm for graph traversal.	BTL 4	Analyze	CO4
7.	Discuss different graph traversal techniques and their applications.	BTL 3	Apply	CO4
8.	Demonstrate the Depth –First Search algorithm for graph traversal with an example and give its applications.	BTL 3	Apply	CO4
9.	**(i)** Explain about bi connected graph with an example. **(8)** **(ii)** Summarize the various terminologies used in directed graph. **(8)**	BTL 4	Analyze	CO4
10.	Explain bi-connectivity and articulation points with suitable diagrams.	BTL 3	Apply	CO4
11.	Explain about topological sorting with its algorithm.	BTL 4	Analyze	CO4
12.	Explain Topological Sorting using DFS. Illustrate with an example.	BTL 3	Apply	CO4
13.	Apply Kruskal's algorithm on the graph if F={{A},{B},{C},{D},{E},{F}} MST={} Q={(A,D),(E,F),(C,E),(E,D),(C,D),(D,F)(A,C),(A,B),(B,C)}	BTL 3	Apply	CO4
14.	Summarize about the shortest path algorithm with its example.	BTL 4	Analyze	CO4
15.	Demonstarate about the following with example **(i)** Minimum spanning trees **(8)** **(ii)** Prims's algorithm for graph **(8)**	BTL 4	Analyze	CO4
16.	**(i)** Write the Pseudo code for Dijkstra's shortest path algorithm and also explain with suitable example .	BTL 3	Apply	CO4
17.	Explain about the following with an example **(i)** Cut vertex. **(8)** **(ii)** Euler circuits. **(8)**	BTL 4	Analyze	CO4

UNIT-V

SEARCHING, INDEXING AND HASHING TECHNIQUES

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort -Insertion sort - Shell sort – Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing

PART A

S.No	Questions	BT level	Competence	COS
1.	Discuss about linear search.	BTL 2	Understand	CO5
2.	Write a simple algorithm for a linear search.	BTL 2	Understand	CO5
3.	Analyze the average case complexity of the linear search algorithm.	BTL 2	Understand	CO5
4.	Define binary search.	BTL1	Remember	CO5
5.	Compare linear search and binary search.	BTL 2	Understand	CO5

6.	Illustrate the complexity of binary search.	BTL 2	Understand	CO5
7.	Classify the different sorting methods.	BTL 2	Understand	CO5
8.	How do you solve a bubble sort problem?	BTL 2	Understand	CO5
9.	Summarize about the time complexities of bubble sort and quick sort.	BTL 2	Understand	CO5
10.	Describe the complexity of bubble sort.	BTL 2	Understand	CO5
11.	Discuss about Selection sort algorithm.	BTL 2	Understand	CO5
12.	Demonstrate how do you do a selection sort?	BTL 2	Understand	CO5
13.	Illustrate the time complexity of insertion sort with an example.	BTL 2	Understand	CO5
14.	Illustrate the basic idea of shell sort?	BTL 2	Understand	CO5
15.	What is the other name of shell sort? Why called so?	BTL1	Remember	CO5
16.	Assess the advantage of shell sort over insertion sort.	BTL 2	Understand	CO5
17.	What is meant by Radix sort give example?	BTL1	Remember	CO5
18.	Summarize about Hash index.	BTL 2	Understand	CO5
19.	Define hash table?	BTL1	Remember	CO5
20.	State the advantages of collision resolution strategies.	BTL1	Remember	CO5
21.	What is overflow in hashing?	BTL1	Remember	CO5
22.	Write the major problem in linear probing.	BTL1	Remember	CO5
23.	Summarize briefly about Rehashing.	BTL1	Remember	CO5
24.	Brief about Extendible hashing.	BTL 2	Understand	CO5
	PART B			
S.No	**Questions**	**BT level**	**Competence**	**COS**
1.	Summarize about the linear search with algorithm and an example.	BTL 4	Analyze	CO5
2.	With an algorithm describe about the Binary search and also examine with an example.	BTL 3	Apply	CO5
3.	Write the program to perform the binary search.	BTL 3	Apply	CO5
4.	**(i)** Differentiate linear search and binary search. State and explain the algorithms for both the search with example. **(8)** **(ii)** Explain Rehashing and extendible hashing. **(8)**	BTL 4	Analyze	CO5
5.	Describe about the Bubble sort, its algorithm and also explain with an example.	BTL 4	Analyze	CO5
6.	Sort the following list of numbers using bubble sort technique 52,1,27,85,66,23,13,57	BTL 4	Analyze	CO5
7.	**(i)** Apply Bubble sort algorithm to sort the following numbers. 4,7,2,9,1,8,3,15,12,6,14. **(8)** **(ii)** Apply Selection sort algorithm to sort the following numbers.54,45,72,27,22,9,41, 63,19,7,90 **(8)**	BTL 3	Apply	CO5
8.	Summarize about the selection sort, its algorithm and also explain with an example.	BTL 3	Apply	CO5
9.	**(i)** Develop the program to sort an array using the selection sort algorithm. **(8)** **(ii)** Apply Insertion sort algorithm to sort the following numbers: 63,19,7,90,81,36,54,45,72,27,22,9,41,59,33 **(8)**	BTL 4	Analyze	CO5

10.	**(i)** Give the program to sort an array using insertion sort algorithm. **(10)** **(ii)** Discuss the advantages of Insertion sort. **(6)**	BTL 4	Analyze	CO5
11.	Construct the algorithm and program for selection sort.	BTL 3	Apply	CO5
12.	State and explain the shell sort. State and explain the algorithm for shell sort with an example	BTL 4	Analyze	CO5
13.	Summarize about the Radix sort, its algorithm and also explain with an example.	BTL 4	Analyze	CO5
14.	Explain about the different hash functions with examples.	BTL 3	Apply	CO5
15.	Explain the following collision resolution techniques with example **(i)** Open Addressing **(8)** **(ii)** Chaining **(8)**			CO5
16.	Consider a hash table of size 10. Using quadratic probing, insert the keys 72, 27, 36, 24, 63, 81, and 101 into the table. Take C1= 1 and C2= 3.	BTL 3	Apply	CO5
17.	Consider a hash table of size =10.Using double hashing, insert the keys 72,27,36,24,63,81,92 and 101 into the table. Take h_1=(k mod 10) h_2=(k mod 8).	BTL 3	Apply	CO5