DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Winter 2018

Course: B. Tech in Computer Engineering	Sem: III
Subject Name: **Data Structures**	Subject Code: BTCOC303
Max Marks: 60 Date: 5/12/2018	Duration: 3 Hrs.

Instructions to the Students:
1. *Solve **ALL** questions.*
2. *The level question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve Any Three of the following.**		
A)	What is data structure? Why to study data structure? Enlist the five areas of computer science in which data structure is used.	Understand	4
B)	What is garbage collection? Who will run garbage collection program? When it will be run?	Understand	4
C)	Suppose multidimensional arrays A and B are declared using A (0:5, -2:7) and B (0:5, -1:4). Find the length of each dimension and the number of elements in array A and B.	Apply	4
D)	What is primitive data structure? Enlist the differences between primitive and non-primitive data structures.	Understand	4
Q.2	**Solve Any Two of the following.**		
A)	What is circular queue? Let the following circular queue can accommodate maximum six elements with the following data, front = 2, rear = 4 and initial queue content is queue = ----, L, M, N, ----, --- Show the queue content with front and rear value after the following operations. i) Insert A ii) Delete iii) Insert B iv) Delete	Apply	6
B)	What is singly linked list? Write algorithm to find the number of times a given ITEM occurs in the singly linked list.	Creating	6
C)	Let the keys: 46, 34, 42, 23, 52, 33 are inserted into an empty hash tableusing function h (key) = key mod 10. Give hash table content after every insertion, if open addressing with linear probing is used to deal with collision.	Creating	6
Q. 3	**Solve Any Two of the following.**		
A)	What is selection sort? Sort the number following numbers in ascending order and also show the worst case time complexity of selection sort is O (n^2).	Analyzing	6
B)	Consider the stack of size 6 memory cells. Suppose initially stack contains **a, b, c, d, e** (Top of stack). Then the following operations are executed	Evaluating	6

in order. Show the stack top and any other situation raised while doing each of the operation.
i) Push(f) ii) Pop(top) iii) Push(g) iv) Push(h) v) Pop(top) vi) Push(i)

|			
C)	Explain how to implement two stacks in one array A[1 . . N] in such a way that neither stack overflow unless the total number of elements in both the stacks together is N. Note that, Push() and Pop() operations should be run in O (1) time.	Apply	6
Q.4	**Solve Any Two of the following.**		
A)	What are the different types of the linked list? Give advantages and disadvantages each of the linked list over another.	Remember	6
B)	Assume, the following letters are inserted into an empty binary search tree in given order. J, B, D, F, N, K, O. Construct binary search tree and also give height of the tree.	Apply	6
C)	What is threaded binary trees? Give the threaded binary tree of the following binary tree.	Apply	6
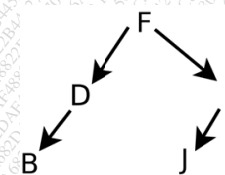
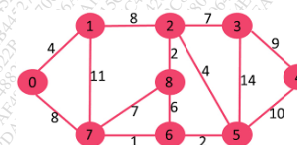|			
Q. 5	**Solve the following.**		
A)	What is graph? Find the shortest path using Dijkstra algorithm. Assume starting node is 0.	Evaluating	6

B)	Explain the in brief the following i) red black tree ii) m-way search tree iii) b tree iv) b+ tree v) sparse matrix vi) AVL tree	Understand	6

*** End ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103
Winter Semester Examination – December - 2019

Branch: B. Tech in Computer Engineering   Sem.:- III
Subject (Subject Code):- Data Structures (BTCOC303)   Marks: 60
Date:-14/12/2019   Time:- 3 Hrs.

==

Instructions to the Students
1. Each question carries 12 marks.
2. Attempt any **FIVE** questions
3. Illustrate your answers with neat sketches, diagrams etc., wherever necessary
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

Q1. Solve any THREE of the following questions.   (3x4 = 12)

a) Why to study data structures? What are the major data structures used in the RDBMS, Network and Hierarchical data model.

b) Consider the following specification of a graph G = (V, E).
     V = {1, 2, 3, 4}
     E = {(1, 2), (1, 3), (3, 3), (3, 4), (4, 1)}
     i) Draw an undirected graph.
     ii) Represent graph G using adjacency matrix.
     iii) Represent graph G using adjacency linked list.

c) Suppose the numbers: **50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24** are inserted in order into an initially empty binary search tree. What is preorder, inorder and postorder traversal sequence of the tree?

d) What is garbage collection? Who will run garbage collection program? When it will be run?

Q2. Solve all the following questions.   (4x3 = 12)

a) What is sparse matrix ? Convert the following sparse matrix into non-sparse matrix.

     1   0   0   0

```
0    -2    11    0

0     0     0    0

0     6     0    5
```

b) Suppose multidimensional arrays A and B are declared using **A (-1:3, 2:6) and B (1:5, -3:1).** Find the length of each dimension and the number of elements in A and B.

c) What is header linked list? Use header linked list to store the following polynomial.

$$p(x) = 2x^8 - 5x^7 + 3x^2 + 4$$

d) What is hash data structure? The keys: **32, 18, 23, 2, 3, 44, 5 and 15** are inserted into an initially empty hash table of length 10 with hash function H (key) = key mod 10 and linear probing is used to resolve collision. What is hash table content after every key insertion?

Q3. Solve any THREE of the following questions.   (3x4 = 12)

a) Give an algorithm to implement binary search with its advantages and disadvantages.

b) Explain the concept of skip list with an example. Give its advantages and disadvantages.

c) Sort the following list using radix sort sort. Show all the passes neatly.
3   45   7 18   9   4   89   103   11   21

d) Suppose we are sorting an array of eight integers using quick-sort, and   we have just finished the first partitioning with the array looking like   this: **2, 5, 1, 7, 9, 12, 21, 30**. What was the pivot element in the first partition? Also complete the rest of the partitions so that all numbers   will be in the ascending order.

Q4. Solve any TWO of the following questions   (2x6 = 12)

a) Write an algorithm to insert a new node at the beginning of the singly linked list.

b) What is singly circular linked list? Write an algorithm to traverse the list and also enlist different operations performed on it and

c) Write a short note on dynamic storage management. Explain how it is done in C.

Q5. Solve any TWO of the following questions   (2x6 = 12)

a) Consider the stack, where N = 6 memory cells allocated. Suppose initially stack contains **A, D, E, F, G** (Top of stack). Then the following operations called in order. Show the stack top and any other situation raised while doing each of the operations.

    i) Push(stack, K)   ii) Pop(stack, Item)   iii) Push(stack, L)
   iv) Push(stack, S)   v) Pop(stack, Item)   vi) Push(stack, T)

b) What is queue? Write an algorithm to implement insert item into queue using singly linked list.

c) Write an algorithm to evaluate postfix expression using stack and execute your algorithm with postfix expression **10, 5, 6, *, +, 8, /.** Show intermediate stack content after each operation.

Q6. Solve all of the following questions.   (4x3 = 12)
a) Give the characteristics of good algorithm. Also explain how do we analyze the algorithm.

b) Store elements of the given below binary tree using

    i) One dimensional array
    ii) Linked list
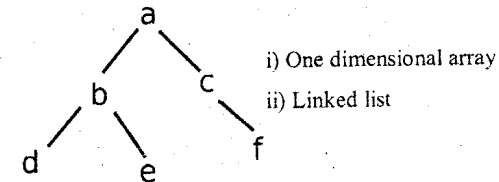
c) What is an Abstract Data type (ADT)? Explain, why queue is called ADT?

d) Explain the following graph terminology with figure
    i) Undirected graph   ii) Total degree of vertex
   iii) Simple path   iv) Cycle

---------------------------------Paper End------------------------------------

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Summer 2019

Course: B. Tech in Computer Engineering　　　　　　　　　　　　　**Sem: III**

Subject Name: Data Structures　　　　　　　　　　　　**Subject Code: BTCOC303**

Max Marks:60　　　　　　　**Date: 30/05/2019**　　　　　　　**Duration: 3 Hr.**

Instructions to the Students:
1. *Solve **ANY FIVE** questions out of the following.*
2. *The level question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks

Q. 1　Solve Any Two of the following.

A)　What is Data Structure? Explain the various characteristics of an algorithm　　　**6**

B)　What is time complexity? Compute the frequency count for :　　　**6**

```
for    i : = 1    to  n
for    j : = i + 1 to n
for    k : = j + 1 to  n
for    l : = k + 1    to    n
       x = x + 1;
```

C)　What is an algorithm? Write an algorithm to find Greatest common divisor (GCD).　　　**6**

Q.2　Solve the following.

A)　Write a "C" code to find the transpose of a sparse matrix stored in this way.　　　**6**

B)　Using linear probing insert the following values in hash table of size 10. Elements are   28, 55,71,67,11,10,90,44.　　　**6**

Q. 3　Solve the following.

A)　Explain sequential search. Write an algorithm for sequential search.　　　**4**

B)　What is skip list? Give its representation .Write an algorithm to insert new item (k,e) in the skip list S.　　　**8**

undefined

Q.4 Solve the following.

A) Write a program in C to create a singly linked list and perform the following operations I) Insert into list II)Search for data III)Delete from list   **6**

B) Construct algorithm for following operations on a Doubly Linked List1) CREATE AT END2) DELETE AT START3) TRAVERSE   **6**
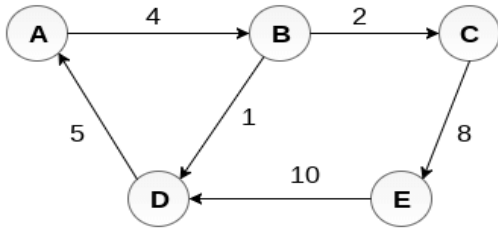
Q. 5 Solve the following.

A) With the help of suitable example, explain following operation, Enqueue and Dequeue and traverse operation of circular queue   **6**

B) Convert the A*B+C/D expression into postfix using stack   **6**

Q.6 Solve the following.

A) Explain breadth first search technique for graph traversal.   **6**

B) What is a Binary Tree.Explain inorder and postorder traversals with example   **6**

.

*** End ***

	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE		
	Winter Examination – 2022		
	Course: B. Tech. **Branch :Computer Engineering** **Semester :III**		
	Subject Code & Name: BTCOC303 Data Structures		
	Max Marks: 60 **Date:** **Duration: 3 Hr.**		
	Instructions to the Students: 1. *All the questions are compulsory.* 2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.* 3. *Write proper Syntax, example and program wherever necessary.* 4. *Assume suitable data wherever necessary and mention it clearly.*		
		(Level/CO)	**Marks**
Q. 1	**Solve Any Two of the following.**		**12**
A)	What is a data structure? Why do we need data structures? Differentiate linear and non-linear data structure.	**Remember**	**6**
B)	Explain the concept of sparse matrices.	**Understanding**	**6**
C)	Explain double hashing in data structure with its advantages and disadvantages.	**Understanding**	**6**
Q.2	**Solve Any Two of the following.**		**12**
A)	What is Queue ADT? Explain representation and implementation of queue using sequential operations.	**Synthesis**	**6**
B)	Explain applications of stack for Expression Evaluation.	**Understanding**	**6**
C)	What is priority queue ? Explain operations of priority queue.	**Analysis**	**6**
Q. 3	**Solve Any Two of the following.**		**12**
A)	Explain circular linked list data structure with its insertion and deletion operations.	**Analysis**	6
B)	Write a C Program to implement following any two operations of doubly linked list. 1.insertion 2.deletion 3.display 4.search	**Apply**	6
C)	Justify a linked list is a data structure that is based on dynamic memory allocation. and List the application of Linked List Dynamic Memory Allocation.	**Understanding**	6
Q.4	**Solve Any Two of the following.**		**12**
A)	What is Binary Search Tree? Write an algorithm to search an element in Binary search tree.	**Remember**	**6**

B)	Explain Adjacency matrix for an undirected graph and what will be the adjacency matrix for the below directed weighted graph? Fig. Directed weighted graph	**Synthesis**	**6**
C)	Explain Threaded Binary Tree and its types? State its advantages and disadvantages.	**Understanding**	**6**
Q. 5	**Solve Any Two of the following.**		**12**
A)	What is a skip list? Write algorithm for basic skip list operations.	**Remember**	**6**
B)	Explain binary search algorithm by suitable example. Discuss the complexity of Binary search algorithm.	**Analysis**	**6**
C)	Explain Insertion sort algorithm with suitable example. Discuss the complexity of insertion sort.	**Understanding**	**6**
	*** End ***		

The grid and the borders of the table will be hidden before final printing.

	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE		
	Supplementary Examination – Summer 2022		
	Course: B. Tech. SE **Branch : CSE** **Semester :III**		
	Subject Code & Name: Data Structure (BTCOC303)		
	Max Marks: 60 **Date:** **Duration: 3 Hr.**		
	Instructions to the Students: 1. *All the questions are compulsory.* 2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.* 3. *Use of non-programmable scientific calculators is allowed.* 4. *Assume suitable data wherever necessary and mention it clearly.*		
		(Level/CO)	**Marks**
Q. 1	**Solve Any Two of the following.** *(This is just a sample instruction)*		
A)	**Define array and show the representation of one-dimensional array is memory.**		**06**
B)	**Explain Abstract data types.**		**06**
C)	**Write a c code to accomplish the following Stack Operations: i] insert ii]delete iii]display iv]peek**		**06**
Q.2	**Solve Any Two of the following.** *(This is just a sample instruction)*		
A)	**Write an algorithm to convert infix expression to postfix expression using stack.**		**06**
B)	**Explain array and linked list representation of Binary tree.**		**06**
C)	**What is queue and explain types of queue.**		**06**
Q. 3	**Solve Any One of the following.** *(This is just a sample instruction)*		
A)	**Explain representation of graph : A] adjacency matrix representation B] adjacency list representation**		**06**
B)	**Explain different file organization in detail.**		**06**
C)	**Define and explain the following terms with an example:** **1]Path and Cycle 2]Connected , Unconnected graph** **3]Complete graph and weighted graph**		**06**
Q.4	**Solve Any Two of the following.** *(This is just a sample instruction)*		
A)	**What is Depth First Traversal ? Write an algorithm for Depth First Traversals.**		**06**

B)	Write an algorithm for binary search tree . Construct binary search tree for the following list of numbers: 18,17,3,5,9,21,26,15,61,6,8,11.			06
C)	What is Hashing and explain construction of a hash table.			06
Q. 5	Solve Any One of the following. *(This is just a sample instruction)*			
A)	Explain different file operations.			06
B)	Explain Indexed sequential file in detail.			06
C)	What is graph ? Explain matrix and linked list representation of a graph.			06
	*** End ***			

The grid and the borders of the table will be hidden before final printing.

Course: B. Tech.   Branch : Computer Engineering and Allied   Semester : III

Subject Code & Name: Data Structures [BTCOC303]

Max Marks: 60   **Date:** 14/08/2023   **Duration: 03:00 Hrs.**

Instructions to the Students:
1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks

Q. 1 **Solve Any Two of the following.**   **[12]**

A) Define the following terms: *Remember*
i) Classification of Data Structure   ii) Abstract Data Types
iii) Transpose of Matrix

B) What is the Sparse Matrix. Write a C program to convert a sparse matrix, an   *Understand*
input provided by a user into its triplet representation.

C) Consider the following 4-digit employee numbers: 3205 and 7148. Find 2-digit   *Application*
hash address of each number using a) division method (m = 97); b) midsquare
method; c) folding method without reversing.

Q.2 **Attempt the following questions.**   **[12]**

A) Define Queue. Write an algorithm to perform an Enqueue and Dequeue   *Understand*
operations on the Queue.

B) Write an algorithm to convert Infix expression to Postfix expression. Consider   *Application*
the following Infix expression Q and translate Q into its equivalent Postfix
expression P.
Q: A + (B * C – (D / E ↑ F) * G) * H

Q. 3 **Solve Any Two of the following.**   **[12]**

A) Explain the following concepts: *Understand*
a) Garbage Collection   b) Dynamic Memory Allocation

B) Write a pseudo code for the performing following operations in the Single Link   *Understand*
List:
a) Insert the elements at the end
b) Delete the element from the beginning

C) Write a pseudo code for the performing following operations in the Circular Link   *Understand*
List:
a) Insert the elements at the beginning
b) Delete the element from the end

Q.4 **Attempt the following questions.**   **[12]**

A) Consider the following weighted graph G. Find the shortest path between the   Application
nodes using Warshall's Algorithm.
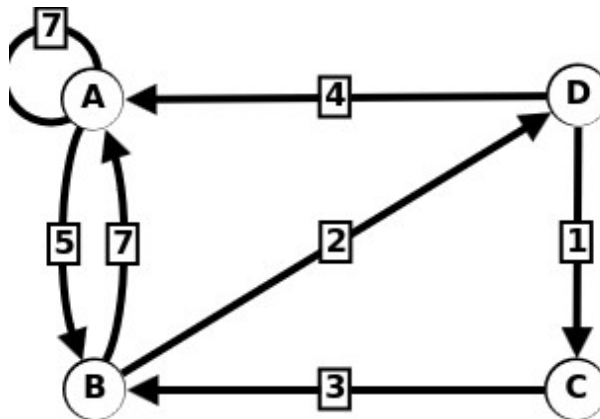
B) Define the the following terms: Application
i) Siblings   ii) Leaf Node   iii) Ancestor of Node

Following numbers are inserted into an empty binary search tree. Find the final
tree **T.**

25, 20, 10, 36, 22, 5, 1, 8, 30, 12, 15, 40, 28, 38, 48, 45, 50

Q. 5 **Attempt the following questions.**   **[12]**

A) Write a pseudo code for Linear Searching.   Understand

B) Consider the following array consisting of 8 elements. Use insertion sort to   Application
arrange the elements in the Ascending order.

77, 33, 44, 11, 88, 22, 66, 55

*** End ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular & Supplementary Winter Examination-2023

Course: B. Tech.   **Branch : Computer Engineering / Computer Science Engineering / Computer Science & Engineering (Artificial Intelligence) / Computer Science & Design / Computer Science & Engineering (Artificial Intelligence & Machine Learning)**   **Semester : III**

Subject Code & Name: Data Structure (BTCOC303)

Max Marks: 60   **Date:06-01-24**   **Duration: 3 Hr.**

Instructions to the Students:
1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve Any Two of the following.**		**12**
A)	What is Data Structure? Explain the various characteristics of an algorithm.	Understand	**6**
B)	What is sparse matrix? Explain the representation of it.	Understand	**6**
C)	What is primitive data structure? Enlist the differences between primitive and non-primitive data structures.	Analyze	**6**
Q.2	**Solve Any Two of the following.**		**12**
A)	Explain various stack operations with example.	Understand	**6**
B)	Write Algorithms for enqueue and dequeue operations on queue with example.	Evaluate	**6**
C)	Convert the following infix expression to postfix expression. $A / B \wedge C + D * E - A * C$	Create	**6**
Q. 3	**Solve Any Two of the following.**		**12**
A)	What are advantages and disadvantages of linked list?	Understand	**6**
B)	Write differences between array and linked list.	Analyze	**6**
C)	Describe doubly link list (DLL) operations.	Evaluate	**6**
Q.4	**Solve Any Two of the following.**		**12**
A)	What are the properties of binary search tree?	Knowledge	**6**
B)	Illustrate the binary tree traversal with example.	Analyze	**6**
C)	Explain Heap in binary tree with basic operations on binary heap.	Understand	**6**

Q. 5 **Solve Any Two of the following.** 12

A) What is skip list? Explain the representation of it in detail. Understand 6

B) What is radix sort? Explain in detail with example. Analyze 6

C) Apply the insertion sort on following list. Create 6

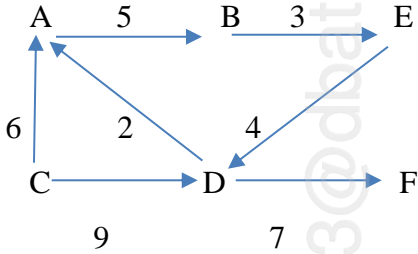| 25	79	41	9	34	60

*** End ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Supplementary Summer Examination – 2024

Course: B. Tech   Branch: Computer Engineering/Computer Science and Engineering   Sem: III

Subject Name: Data Structures   **Subject Code: BTCOC303**

Max Marks: 60   **Date: - 04/07/2024**   **Duration: - 3 Hrs.**

Instructions to the Students:
1. All the questions are compulsory.
2. The level of question / answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.
3. Assume data wherever necessary and mention it clearly.

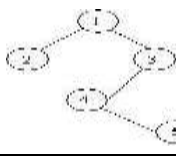|		(Level / CO)	Marks
Q. 1	**Solve any Two of the following**		
1.	What is primitive data structure? Differentiate between primitive and non-primitive data structures.	Understand	**6**

2.	Define space complexity of an algorithm. Determine the space complexity of the following program segment:
	
	int sum(int a[ ], int n)
	{
	int x = 0;
	for (int i=0; i<n; i++)
	{
	x = x + a[i];
	}
	return x;
	}
	Note: Assume integer variable takes 4 bytes of memory space.
		Analyze	**6**

3.	Define collision. Consider a hash table of size 13 and the hash function given is h(x) = x mod 13. Demonstrate how Linear probing handles collision while inserting keys 18, 41, 22, 44, 59, 32, 31, 73, in this order.	Apply	**6**
Q.2	**Solve any Two of the following**		
1.	Consider the stack of size 5 memory cells. Suppose initially stack contains A, B, C, D (Top of stack). Then the following operations are executed in order. Show the stack top and any other situation raised while doing each of the operations. i) Push(E) ii) Pop(top) iii) Push(F) iv) Push(G) v) Pop(top) vi) Push(H)	Apply	**6**

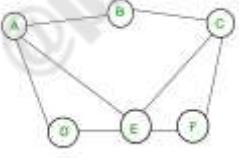| 2.	Write algorithms for enqueue and dequeue operations on circular queue with example.	Evaluate	**6**
3.	Explain with suitable example concept of binary recursion.	Apply	**6**
Q.3	**Solve any Two of the following**		
1.	Describe circular linked list operations in detail.	Evaluate	**6**
2.	What is garbage collection? Who will run garbage collection program?	Remember	**6**
3.	Justify a linked list is a data structure that is based on dynamic memory allocation. List the advantages of linked list dynamic memory allocation.	Understand	**6**
Q.4	**Solve any Two of the following**		
1.	Explain different binary search tree traversal methods.	Understand	**6**
2.	How does graph can be represented using adjacency matrix? What will be the adjacency matrix for the below given directed weighted graph?	Apply	**6**
3.	Write short note on balanced trees.	Understand	**6**
Q.5	**Solve any Two of the following**		
1.	Describe how dictionaries can be implemented using skip lists.	Evaluate	**6**
2.	What is selection sort? Explain in detail with suitable example.	Apply	**6**
3.	Write short note on file handling.	Understand	**6**

*** End ***

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular/Supplementary Winter Examination – 2024

Course: B. Tech   Branch: Computer Engineering/Computer Science and Engg(AI & ML) & Allied

Subject Code & Name: Data Structures (BTCOC303)   Semester : III

Max Marks: 60   Date:10/02/2025   Duration: 3 Hrs.

Instructions to the Students:
1. *Each question carries 12 marks.*
2. *Question No. 1 will be compulsory and include objective-type questions.*
3. *Candidates are required to attempt any four questions from Question No. 2 to Question No. 6.*
4. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
5. *Use of non-programmable scientific calculators is allowed.*
6. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/ CO)	Marks
Q. 1	**Objective type questions. (Compulsory Question)**		**12**
1	Linked list is not suitable data structure for which one of the following problems? a) Insertion sort b) Binary search c) Radix sort d) Polynomial manipulation		1
2	A program *P* reads in *500* integers in the range *[0..100]* representing the scores of *500* students. It then prints the frequency of each score above *50*. What would be the best way for P to store the frequencies? a) An array of 50 numbers b) An array of 100 numbers c) An array of 500 numbers d) A dynamically allocated array of 550 numbers		1
3	You have to sort a list *L* consisting of a sorted list followed by a few random elements. Which of the following sorting methods would be especially suitable for such a task? a) Bubble sort b) Selection sort c) Quick sort d) Insertion sort		1
4	The number of interchanges required to sort *10, 6, 11, 7,*		1

	9 in ascending order using bubble sort is			
	a) 7 b) 5 c) 6 d) 8			
5	The number of element in an array *A[l1:u1, l2:u2]* is given by a) (u1-l1-1)(u2-l2-1) b) (u1 x u2) c) (u1-l1)(u2-l2) d) (u1-l1+1)(u2-l2+1)			1
6	A situation where one wants to delete data from from a data structure that is empty. a) Free storage b) Underflow c) Overflow d) Compaction			1
7	Which of the following is/are application(s) of linked list? a) To implement file systems b) For separate chaining in hash-table c) To implement non-binary trees d) All of the mentioned			1
8	The matrix contains *m* rows and *n* columns. The matrix is called sparse matrix if a) Total number of Zero elements > (m*n)/2 b) Total number of Zero elements = m+n c) Total number of Zero elements = m/n d) Total number of Zero elements = m–n			1
9	A binary tree with *n* nodes has *null* childrens? a) n b) n+1 c) n/2 d) n^2			1
10	The maximum number of edges in an undirected graph with *n* vertices is a) n(n-1)/2 b) 2^n c) n! d) (n-1)/2			1
11	How many distinct binary search trees can be constructed with *3* distinct keys? a) 4 b) 5 c) 6 d) 9			1
12	The best data structure to check whether an arithmetic expression has balanced parenthesis is. a) Queue b) Stack c) Tree d) Linked list			1
Q. 2	**Solve the following.**			**12**
A)	Why *queue* is called abstract data type (ADT). Write an			6

	algorithm to implement *enque* and *deque* operations using array as data structure.			
B)	What is binary search tree (bst)? Construct *bst* for the following data items and show tree after each insert operation. *85, 40, 7, 55, 91, 89, 24*			**6**
Q.3	**Solve the following.**			**12**
A)	Convert the infix expression ((A + B) * C – (D – E) ^ (F + G)) to equivalent *Prefix* and *Postfix* notations using stack.			**6**
B)	Explain how to implement two stacks using one array *A[1..n]* in such way that neither stack overflows unless the total number of elements in both stacks together is *n*. The *PUSH()* and *POP()* operations should run in *O(1)* time.			**6**
Q. 4	**Solve Any Two of the following.**			**12**
A)	What is hash data structure? Consider the *Keys (k) = {25, 38, 41, 52, 3, 13, 56}* are inserted into an empty hash table using hash function $h(k) = (k \bmod 7)$ and linear probing is used for collision resolution. Give content of the hash table after every key insertion.			**6**
B)	Consider insertion of characters into empty circular linked list *A, B, C, D, E, F*. Assume these elements are stored using *10* memory locations. Find the sequence of characters in the list. Suppose *F* and then *C* are deleted and *G* is inserted at the beginning of list. Find the final structure.			**6**
C)	What is linked list? Let *List* be a linked list in memory. Write a separate procedure for each of the following which: i) Finds the how many times a given *Item* occurs in the *List*. ii) Add a given value *K* to each Item in the List.			**6**

Q.5	Solve Any Two of the following.		12
A)	The inorder and preorder traversals of T yield the following: i) Inorder traversal: *E, A, C, K, F, H, D, B, G* ii) Preorder traversal: *F, A, E, K, C, D, H, G, B* Construct the original binary tree T using above two sequences.		6
B)	A scheme for storing binary trees in an array X is as follows. Indexing of *an array* start with *1*. The root is stored at *X[1]*. For a node stored at *X[i]*, the left child is stored in *X[2i]* and the right child is stored in *X[2i+1]*. Give the array representation of the below given tree. Also, in worst case to store any binary tree of n number of vertices, how many places do you need in array? 		6
C)	Write and explain bubble sort algorithm. Also, prove that the complexity of bubble sort is $O(n^2)$.		6
Q. 6	Solve Any Two of the following.		12
A)	An array *A[1…5][1…5]* is stored in the memory with each element requiring 4 bytes of storage. If the base address of array is 300, then determine the location of *A[3][4]*, if the array elements are stored (i) Row wise and (ii) Column wise.		6

B)	Enlist properties of the follwoing trees.
	     i) Red black tree
	     iii) AVL tree
	     iv) m-way search tree
	     vi) b+ tree
			6

C)	Consider the simple graph given below. Describe G formally in terms of its set V of nodes and its set E of edges. Also find the indegree, outdegree and total degree of each node.		6

*** End ***