Question Paper

Exam Date & Time: 02-Jun-2023 (02:30 PM - 05:30 PM)

DEPARTMENT OF INFORMATION & COMMUNICATION TECHNOLOGY, MIT, MANIPAL

FOURTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAY-JUNE 2023

FUNDAMENTALS OF DATA STRUCTURES AND ALGORITHMS [ICT 4303]

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1)		Consider a 2D integer matrix, named MAT, of order mXn. Read the values of m, n and matrix MAT from user. Write complete code to sort each row of the matrix seperately using insertion sort technique. The result of sorting must be saved in same matrix MAT. Example: if MAT is {{4,3,2,6,1},{314,30,212,61,11},{24,23,21,6,12},{141,3,99,26,1}} then MAT should become {{1,2,3,4,6},{11,30,61,212,314},{6,12,21,23,24},{1,3,26,99,141}}	(5)
	B)	Consider an array A[] = "Manipal institute of technology". Write user defined function to reverse the last word and store it in the same array. [Hint: The given string should be displayed as Manipal Institute of ygolonhcet]	(3)
	C)	Answer the following: 1. A single array A[1..MAXSIZE] is used to implement two stacks, The two stacks grow from opposite ends of the array. Variables top1 and top2 (top1 < top2) point to the location of the topmost element in each of the stacks. If the space is to be used efficiently, what is the condition for "stack full" ? 2. An n×n array v is defined as follows v[i, j] = i - j for all i, j⤍1≤i≤n,1≤j≤n. What is the sum of the elements of the array v?	(2)
2)		Write a complete C++ program to check whether a given string is a palindrome or not using stack.	(5)
	A)		
	B)	Write a C++ program to perform following operations on Doubly Linked List (DLL). i. Create a DLL by adding node at the beginning of the list ii. Display the created DLL.	(3)
	C)	Are Linked lists suitable data structures for binary search problems? Justify your answer	(2)
3)		The Employee details of an organization is stored as a singly linked list. The details are employeeID, name, section/unit {Development/Maintenance/Testing/Architecing} and salary. Create	(5)

A) the node structure for this.

Write two functions one to create a master singly linked list(SLL) of employees and the other to create a linked list containing the employees whose unit is "Architecting" from the master SLL (The master SLL containing the details of all the employees is passed as the parameter to the function).

B) Consider the following C++ code snippet that attempts to locate an element x in an array Y[ ] using binary search. The program is erroneous.Identify and write the correction needed in the program to make it work properly. (3)

```
1. f(int Y[10], int x) {
2. int i, j, k;
3. i = 0; j = 9;
4. do {
5. k = (i + j) /2;
6. if( Y[k] < x) {i = k;} else{ j = k;}
7. } while(Y[k] != x && i < j);
8. if(Y[k] == x) cout< < "x is in the array " ;
9. else cout< < " x is not in the array ";
10. }
```

C) Define time complexity of a program. Determine the time complexity of the function given below: (2)

```
1. void someWork(int a[],int n) {
2. int i,j,temp;
3. for(i=0;i< n;i++){
4. for(j=i+1;j< n;j++) {
5. if(a[j]< a[i]){
6. temp=a[i];
7. a[i]=a[j];
8. a[j]=temp; } } } }
```

4) Construct a tree with the list representation (A (B (E (K, L), F), C (G), D (H (M), I, J))). What is the degree and depth of the constructed tree? Write the inorder, preorder & postorder traversal paths for the constructed tree. (5)

A)

B) Write the prefix and postfix expressions for the expression **a*b^c-d/e-f/g .** Show all the conversion steps**.** (3)

C) Consider the graph given in Figure Q.5C and perform Breadth First Search. Trace the same considering node A as start node. (2)

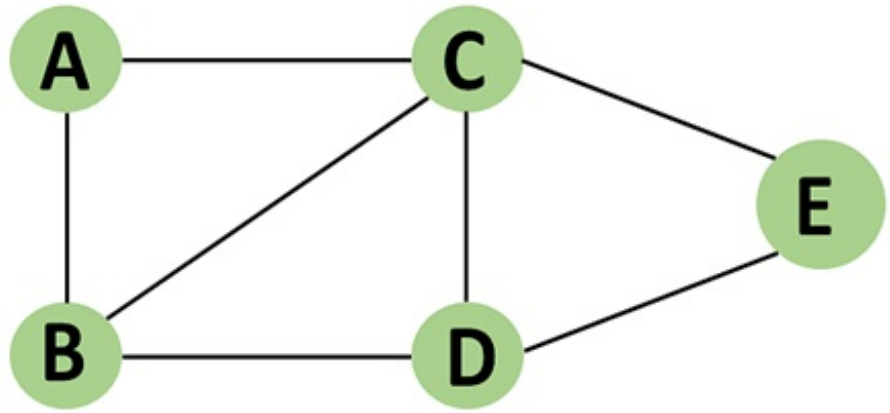

Figure Q.4C

5) Evaluate the following expression using stack : **M Q P A B + C * E ^ *+ F * *.** (5)

A) Show each step of conversion, with proper stack contents, input, and operation performed. Assume the following values:

M = 1 ,Q=2 , P= 3 , A= 1 ,B= 1 ,C=1 , E=1, F=1 .

B) Suggest a suitable data structure for the following applications with proper justification: (3)

1. A movie recommendation system: There are millions of users and thousands of movies, but not all users watch and rate all movies.
2. Traffic system- a computer-controlled traffic system
3. Undo and Redo operations in Microsoft word application

C) The following function takes a single-linked list of integers as a parameter and rearranges the elements of the list. The function is called with the list containing the integers 1,2,3,4,5,6,7 in the given order. What will be the contents of the list after the function completes execution? (2)

```
struct node {

int value;

struct node *next;

};

Void rearrange (struct node *list ){

struct node *p, * q;

int temp;

if( !list || !list-> next) return;

p = list; q = list->next;

while (q) {

temp = p->value;

p-> value = q ->value;

q-> value = temp;

p = q-> next;
```

```
q = p ? p->next : 0; }
```

-----End-----