PART-A

UNIT:I

1. What is and algorithm? Briefly explain the criteria that an algorithm must satisfy.
2. Define three asymptotic notations and give the asymptotic representation of function 3n + 2 in all the three notations and prove the same from first principle method.
3. Define pointer. With examples, explain pointer declaration, pointer initialization, and use of the pointer in allocating a block of memory dynamically.
4. Differentiate static and dynamic memory allocations. What are the various dynamic memory allocation functions? Explain how memory dynamically allocated using all these functions?
5. What is recursion? What are the various types of recursion? Give two conditions to be followed for successive working of recursive program.
6. Give a recursive implementation of binary search with proper comments.
7. Define pointer. Write a C function to swap two numbers using pointers.
8. Explain performance analysis and performance measurement.
9. Given the following declerations:

```
int a=5;
int b=7;
int *p=&a;
int *q=&b;
```

What is the value of each of the following expressions?

i. ++a
ii. ++(*p)
iii. --(*q)
iv. --b

10. Show the output of the following block:

```
main()
{
    int num [5] = { 3, 4, 6, 2, 1}
    int  *  p = num;
    int  *  q = num+2;
    int   *  r = & num [1];
     printf("\n %d%d", num[2], *(num+2));
    printf("\n%d%d", * p, *(p+1));
    printf("\n%d%d", * q, *(q+1));
   printf("\n%d%d", * r, *(r+1));
}
```

11. Distinguish between the following:
    i) (*m)[5] and * m[5]
    ii) int (*ptr) () and int * ptr ()

12. What is Data Abstraction ? Explain with example. Give the Abstract Data Type (ADT) definition for Natural Number s.
13. Define is Space Complexity & Time Complexity. Explain in detail , with various examples , how Space Complexity and Time complexities can be computed.

UNIT-II

1. What is structure? Give three different ways of defining structure and declaring variables and method of accessing members of structure using a student structure with roll number, name and marks in 3 subjects as members of that structure as example.
2. Develop a structure to represent planets the solar system. Each planet has fields for the planet name, its distance from the sun in miles and number of moons it has. Write a program to read the data for each planet and store. Also print the name of the planet that has the highest number of moons.
3. Give ADT for sparse matrix. For the given sparse matrix and its transpose, give the triplet representation using one dimensional array. '*a*' is the given sparse matrix, '*b*' will be its transpose

$$a = \begin{pmatrix} 15 & 0 & 0 & 22 & 0 & -15 \\ 0 & 11 & 3 & 0 & 0 & 0 \\ 0 & 0 & 0 & -6 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 91 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 28 & 0 & 0 & 0 \end{pmatrix}$$

4. Consider two polynomials $A(x)=2x^{1000}+1$ and $B(x)=x^4+10x^3+3x^2+1$, show diagrammatically how these two polynomials can be stored in a single 1-D array. Also give its C representation.
5. What is the difference between int *a and int a[5] and int *[5]?
6. Write a program in C to read a sparse matrix of integer values and search this matrix for an element specified by the user.
7. How would you represent two sparse polynomials using array of structure and also write a function to add that polynomials and store the result in the same array.
8. Distinguish between structure and union. Explain both with with suitable examples.

   b) Write a c program with an appropriate structure definition and variable declaration to store information about an employee using nested structure. Consider the following fields like Ename, Empid, DOJ(Date,Month, Year) and salary(Basic, DA, HRA).

3

a) Define stack. Give the C implementation of push and pop function. Include check for empty and full conditions of stack.

b) Write the C function to evaluate prefix expression.

C) For the given circular queue shown in the Fig.Q2(c), write the values of front and rear in the table after each specified operation is performed. Queue fully/empty condition s must be considered. 0-7 indicates the array indices.

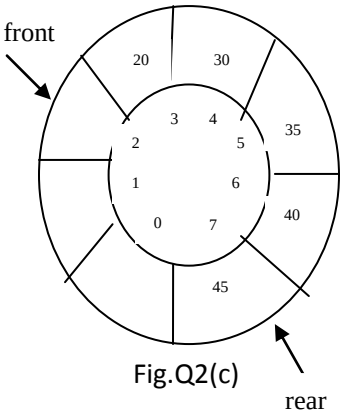


Fig.Q2(c)

Operation	Rear	Front
Insert 0 Insert 10 Insert 15 delete		

a) Define stack. List the operations on stack.
b) Obtain the postfix and prefix expression for (((A+(B-C)*D)E)+F).
c) What is system stack? How the control is transferred to or from the function with the help of activation record?

a) Give ADT stack and with necessary function, explain implementing stack to hold records with different type of fields in stack.
b) Give the disadvantages ordinary queue and how it is solved in circular queue. Explain the same. Explain with suitable example how would you implement circular queue using dynamically allocated arrays.
c) Convert the infix expression a/b-c+d*e-a*c into postfix expression. Write a function to evaluate that postfix expression and trace that for given data a=6, b=3, c=1, d=2, e=4.

a) Write a C program to implement the two prime operations on the stack using dynamic memory allocation.
b) Write an algorithm to convert infix to postfix expression and apply the same to convert the following expression from infix to postfix
i)(a+b)+c/d
ii)(((a/b)-c)+(d*e))-(a*c).

4

a) Explain how a chain can be used to implement a queue. Write a function to insert and delete elements from such a queue.
b) Describe doubly linked list with an advantages and disadvantages. Write C function to delete node from a doubly linked list. ptr is the pointer which points to the nodes to be delete. Assume that there are nodes on either side of the node to be deleted.
c) For the given sparse matrix, give the diagrammatic linked representation.

$$a=\begin{bmatrix}0 & 1 & 2\\ 3 & 0 & 0\\ 0 & 0 & 0\end{bmatrix}$$

a) What is linked list? Explain the different types of linked list with diagram.
b) Write a function to insert a node at front and rear end in a circular linked list. Write down sequence of steps followed.

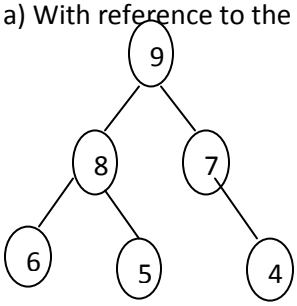
a) Give the node structure to create a linked list of integers and write C function to perform the following:
i)Create a three-node list with data 10,20 and 30.
ii)Insert a node with data value 15 in between the nodes having data values 10 and 20
iii)Delete the node which is followed by a node whose data value is 20.
iv)Display the resulting singly linked list.
b) With node structure show how would you store the polynomials in linked lists? Write a C function to adding two polynomials represented a circular lists.
c) Write a note on:
i) Linked representation of sparse matrix.
ii) Doubly linked list.

a) Define linked list. Write a C program to implement the insert and delete operation on a queue using linked list.
b) Write a C function to add two polynomials using linked list representation. Explain with suitable example.

PART-B

5

a) With reference to the Fig. Q5(a), answer the following:



i) Is it a binary tree?
ii)Is it a complete tree?
iii)Give the preorder traversal.
iv) Give the inorder traversal.
v) Give the postorder traversal.
vi)Give the list notation(using pairs of round brackets.)
vii)Where will be the left child of node 4 pointing to, if it is converted to a threaded b-tree?
viii) Is it a max heap?

Fig. Q5(a).

b) Write the following C functions for
   i)Counting the number of leaf nodes in a b-tree.
   ii)Finding the inorder successor of a node in a threaded b-tree.

c) Show that for any non-empty b-tree T, if n_0 is the number of leaf nodes and n_2 is the number of nodes of degree 2, then $n_0=n_2+1$.

a) What is a tree? Explain: i)root node, ii)child, iii)siblings, iv)ancestors using structure representation.
b) What is binary tree? How it is represented using array and link list?
c) What is heap. Explain the different types of heap?

a) Define a binary tree and with example show array representation and linked representation of binary tree.
b) Write an expression tree for an expression A/B+C*D+E. Give the algorithm for inorder, postorder and preorder traversals and apply that traversal method to the expression tree and give the result of traversals.
c) Define a max Heap. Explain clearly inserting an element that has value 21 for the heap shown in the Fig. Q5(c).given below and show the resulting heap.

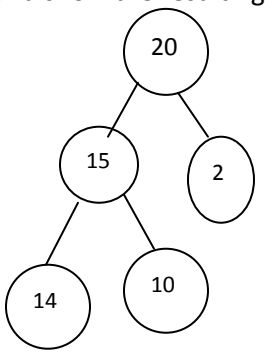


Fig. Q5(c).

a) Define binary trees. For the given tree find the following:
   i)Siblings
   ii)Leaf nodes
   iii)Non-leaf nodes
   iv)Ancestors

v)Level of trees

b)Write the C routines to traverse the given tree using i)inorder ; ii) pre order ; iii) post order.

6

a) Explain the following with an example

i) Forest ii) Graph iii) Winner tree.

b) Describe the binary search tree with an example. Write a iterative function to search for a key value in a binary search tree.

c) Construct the b-tree from the given traversals:

Preorder : ABDCEF

Inorder : BDAEFC

Postorder : DBFECA

a) What is a binary search tree? Draw the binary search tree for the following input:
14, 5, 6, 2, 18, 20, 16, 18, -1, 21

b) What is a forest? Explain the different method of traversing a tree with following tree:

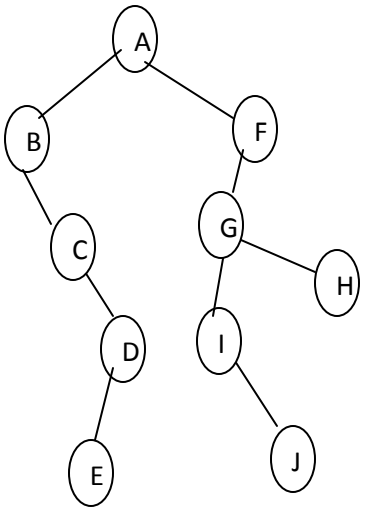


Fig. Q6(b).

a) Define a binary search tree and construct a binary search with elements {22, 28, 20, 25, 22, 15, 18, 10, 14}. Give the recursive search algorithm to search an element in that tree.

b) What is a winner tree? Explain with suitable example a winner tree for k=8.

c) Construct the binary tree having following sequences.

i) Preorder sequence: ABCDEFGHI

ii) Inorder sequence: BCAEDGHFI

Show the steps if constructing binary tree in the above example.

d) Give the adjauncy matrix and adjacinty lists representation for the graph shown in Fig. Q6(d)

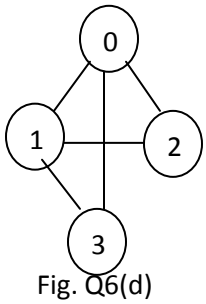


Fig. Q6(d)

a)Define ADT of binary search tree. Write the iterative search function and recursive search function of BST.

b) Construct the binary tree for the given expression:

i)Pre order : /+*1$2345

A B D G C E H I F

ii)In order : 1+2*3$4-5

D G B A H E I C F

c) Define forest with example.

7

a) Briefly explain the following with example:

i) HBLT ii) WBLT

b) What is binomial heap? Explain the steps involved in the deletion of min element from a binomial heap.

c) Define Fibonacci heap? Briefly explain the different types.

a) What is priority queue? Explain the various types of priority queues.

b) Write short note on: i) Binomial heaps ii) Fibonacci heap.

c) What is leftist tree? Explain the different types of leftist trees.

a) Define the following:

i) Single ended priority queues.

ii) Doubly ended priority queues.

iii) Height-based leftist trees.

iv) Weight-based leftist trees.

v) A binomial tree.

vi) Extended binary tree.

b) With suitable example, explain leftist trees and give structure of nodes.

c) What is Fibonacci heap? Give the suitable example and give the steps for deletion of node and decrease key of specified node in F-heap.

a) Define leftist trees. Explain varieties of leftist trees.

b)Write short notes on :

i) Priority queues.

ii) Binomial heaps.

iii)Priority heaps.

iv) Fibonacci heaps.

8

a) Describe the following with an example each:

i)height balanced trees ii)optimal bst

b) Explain the Red-black tree. State its properties.

c) What is splay tree? Briefly explain the different types of splay trees.

a) What is an AVL tree? Write the algorithm to insert an item into AVL tree.
b) Write short note on: i) Red-Black tree, ii) Splay trees.
c) Explain the different types of rotations of an AVL tree.

a) What is an AVL tree? Stating with an empty AVL tree perform the following sequence of insertions, MARCH, MAY, NOVEMBER, AUGUST, APRIL, JANUARY, DECEMBER, JULY, FEBRUARY. Draw the AVL tree following each insertion and state rotation type if any insertion operation.
b) Define Red-black trees and give its additional properties starting with an empty red-black tree insert the following keys in the given order {50, 10, 80, 90, 70, 60, 65, 62}, give color changing and rotation instances.

a) Define AVL trees. Write a C-routine for
i) Inserting into an AVL tree.
ii) LL and LR rotation.
b) Explain the following with example:
i) Red-black trees.
ii) Splay trees.