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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

LAB MANUAL

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SUBJECT CODE/NAME: CSS8381-DATA STRUCTURES LABORATORY

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LIST OF EXERCISES

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues.
9. Graph representation and Traversal algorithms
10. Applications of Graphs
11. Implementation of searching and sorting algorithms
12. Hashing – any two collision techniques

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Ex.No.-1a STACK – ARRAY IMPLEMENTATION

AIM:

To write a C program to implement the stack using arrays.

ALGORITHM:

(i) Push Operation:

- To push an element into the stack, check whether the top of the stack is greater than or equal to the maximum size of the stack.
- If so, then return stack is full and element cannot be pushed into the stack.
- Else, increment the top by one and push the new element in the new position of top.

(ii) Pop Operation:

- To pop an element from the stack, check whether the top of the stack is equal to -1.
- If so, then return stack is empty and element cannot be popped from the stack. o Else, decrement the top by one.

PROGRAM:

/*Stack Implementation using arrays*/

```
# include <stdio.h>
# include <conio.h>
# include <stdlib.h>
# define size 5
struct stack
{
        int s[size];
        int top;
}st;

int stfull()
{
   if(st.top>=size-1)
          return 1;
   else return 0;
}

void push(int item)
{
          st.top++;
          st.s[st.top] =item;
}
int stempty( )
```

```
{
 if(st.top==-1)
   return 1;
 else return 0;
}

int pop()
{
        int item;
        item=st.s[st.top];
        st.top--;
        return(item);
 }

void display()
{
   int i;
   if(stempty())
        printf("Stack Is Empty!\n");
   else
  {
        for(i=st.top;i>=0;i--)
             printf("\n%d",st.s[i]);
  }
}
void main(void)
{
        int item,ch;
        char ans;
        st.top = -1;
        clrscr();
        printf("<-----Stack using Array ---- >\n");
        while(1)
        {
            printf("\n1.Push\n2.Pop\n3.Display\n4.exit\n");
            printf("Enter Your Choice:\n");
            scanf("%d",&ch); switch(ch)
            {
                case 1:
                    printf("Enter The item to be pushed:\n");
                    scanf("%d",&item);
                    if(stfull())
                        printf("Stack is Full!\n");
                    else
                        push(item);
                    break;
```

```
                        case 2:
                                if(stempty())
                                        printf("Empty stack!\n");
                                else
                                {
                                        item=pop();
                                        printf("The popped element is %d\n",item);
                                }
                                break;
                         case 3:
                                display();
                                break;
                         case 4:
                                exit(0);
                }
        }
        getch();
}
```

OUTPUT:

<-----Stack using Array ---->

1.Push
2.Pop
3.Display
4.exit
Enter Your Choice:
1
Enter The item to be pushed: 10

1.Push
2.Pop
3.Display
4.exit
Enter Your Choice:
1
Enter The item to be pushed: 20

1.Push
2.Pop
3.Display
4.exit
Enter Your Choice: 3

20

10

1.Push
2.Pop
3.Display
4.exit
Enter Your Choice: 2
The popped element is 20

1.Push
2.Pop
3.Display
4.exit
Enter Your Choice: 4

RESULT:

Thus a C program to implement the stack using arrays is written and executed successfully.

Ex.No.-1b QUEUE – ARRAY IMPLEMENTATION

AIM:

To write a C program to implement the queue using arrays.

ALGORITHM:

Enqueue:

1. Check if queue is not full.
2. If it is full then return queue overflow and item cannot be inserted.
3. If not, check if rear value is -1, if so then increment rear and by 1; if not increment front by 1.
4. Store the item in the new value of front.

Dequeue:

1. Check if queue is not empty.
2. If it is empty, return queue underflow and dequeue operation cannot be done.
3. If queue is not empty , check if rear and front are equal.
   - If so assign -1 to front and rear.
   - If not decrement front by 1.

PROGRAM:

```
/*Queue using Array*/
# include <stdio.h>
# include <conio.h>
# define MAX 10
int queue[MAX],front = -1,rear = -1;

void insert_element( );
void delete_element( );
void display_queue( );

int main( )
{
        int option;
        printf(">>> c program to implement queue operations <<<");
        do
        {
                printf("\n\n 1.Enqueue an element");
                printf("\n 2.Dequeue an element");
                printf("\n 3.Display queue");
                printf("\n 4.Exit");
```

```
                printf("\n Enter your choice: ");
                scanf("%d",&option);
                switch(option)
                {
                  case 1:
                        insert_element();
                        break;
                  case 2:
                        delete_element();
                        break;
                  case 3:
                        display_queue();
                        break;
                  case 4:
                        return 0;
                }
        }while(option!=4);
}

void insert_element( )
{
        int num;
        printf("\n Enter the number to be Enqueued: ");
        scanf("%d",&num);
        if(front==0 && rear==MAX-1)
                printf("\n Queue OverFlow Occured");
        else if(front==-1&&rear==-1)
        {
                front=rear=0;
                queue[rear]=num;
        }
        else if(rear==MAX-1 && front!=0)
        {
                rear=0;
                queue[rear]=num;
        }
        else
        {
                rear++;
                queue[rear]=num;
        }
}

void delete_element( )
{
        int element;
        if(front==-1)
```

```
        {
                printf("\n Underflow");
        }
        element=queue[front];
        if(front==rear)
                front=rear=-1;
        else
        {
                if(front==MAX-1)
                        front=0;
                else front++;
                printf("\n The dequeued element is: %d",element);
        }

}

void display_queue( )
{
        int i;
        if(front==-1)
              printf("\n No elements to display");
        else
        {
             printf("\n The queue elements are:\n ");
             for(i=front;i<=rear;i++)
             {
                  printf("\t %d",queue[i]);
             }
        }
}
```

OUTPUT:

```
>>> c program to implement queue operations <<<

 1.Enqueue an element
 2.Dequeue an element
 3.Display queue
 4.Exit
 Enter your choice: 1

 Enter the number to be Enqueued: 10


 1.Enqueue an element
 2.Dequeue an element
```

3.Display queue
4.Exit
Enter your choice: 1

Enter the number to be Enqueued: 20

1.Enqueue an element
2.Dequeue an element
3.Display queue
4.Exit
Enter your choice: 3

The queue elements are: 10 20

1.Enqueue an element
2.Dequeue an element
3.Display queue
4.Exit
Enter your choice: 2

The dequeued element is: 10

1.Enqueue an element
2.Dequeue an element
3.Display queue
4.Exit
Enter your choice: 4

RESULT:

Thus a C program to implement the queue using arrays is written and executed successfully.

Ex.No.-2 LIST – ARRAY IMPLEMENTATION

AIM:

To write a C program to implement the List using arrays.

ALGORITHM:

1. Start the program.
2. Read the number of elements in the list and create the list.
3. Read the position and element to be inserted.
4. Adjust the position and insert the element.
5. Read the position and element to be deleted.
6. Remove the element from the list and adjust the position.
7. Read the element to be searched.
8. Compare the elements in the list with searching element.
9. If element is found, display it else display element is not found.
10. Display all the elements in the list.
11. Stop the program.

PROGRAM:

```
#include<stdio.h>
#include<conio.h>
#define MAX 10

void create( );
void insert( );
void deletion( );
void search( );
void display ();
int a,b[20], n, p, e, f, i, pos;

void main( )
{
        int ch;
        char g='y';
        do
        {
```

```
printf("\n Main Menu");
printf("\n 1.Create \n 2.Delete \n 3.Search \n 4.Insert \n 5.Display\n 6.Exit \n");
printf("\n Enter your Choice:");
scanf("%d", &ch);
switch(ch)
{
        case 1:
                create();
                break;
        case 2:
                deletion();
                break;
        case 3:
                search();
                break;
        case 4:
                insert();
                break;
        case 5:
                display();
                break;
        case 6:
        exit();
        break;

        default:
        printf("\n Enter the correct choice:");
        }
        printf("\n Do u want to continue:");
        scanf("\n%c", &g);
        }
        while(g=='y'||g=='Y');
        getch();
        }


        void create( )
        {
        printf("\n Enter the number of nodes:");
        scanf("%d", &n);
        for(i=0;i<n;i++)
        {
        printf("\n Enter the Element:",i+1);
        scanf("%d", &b[i]);
        }

        }
```

```
void deletion( )
{
printf("\n Enter the position u want to delete:");
scanf("%d", &pos);
if(pos>=n)
{
printf("\n Invalid Location:");
}
else
{
for(i=pos+1;i<n;i++)
{
b[i-1]=b[i];
}
n--;
}
printf("\n The Elements after deletion:");
for(i=0;i<n;i++)
{
printf("\t%d", b[i]);
}
}


void search()
{
printf("\n Enter the Element to be searched:");
scanf("%d", &e);

for(i=0;i<n;i++)
{
if(b[i]==e)
{
printf("Value is in the %d Position", i);
}
else
{
printf("Value %d is not in the list:", e);
continue;
}
}
}


void insert()
{
```

```
printf("\n Enter the position u need to insert:");
scanf("%d", &pos);

if(pos>=n)
 {
 printf("\n invalid Location:");
 }
 else
 {
 for(i=MAX-1;i>=pos-1;i--)
 {
 b[i+1]=b[i];
 }
 printf("\n Enter the element to insert:");
 scanf("%d",&p);
 b[pos]=p;
 n++;
 }
 printf("\n The list after insertion:");

display();
}


void display()
{
printf("\n The Elements of The list ADT are:");
for(i=0;i<n;i++)
{
printf("\n\n%d", b[i]);
}
}
```

OUTPUT:

```
 Main Menu
1.Create
2.Delete
3.Search
4.Insert
5.Display
6.Exit
Enter your Choice:1

Enter the number of nodes:4
Enter the Element: 11
Enter the Element: 22
```

```
Enter the  Element: 33
Enter the  Element: 44

Do u want to continue:y

Main Menu
1.Create
2.Delete
3.Search
4.Insert
5.Display
6.Exit
Enter your Choice:2
Enter the position u want to delete:2
Elements after deletion: 11       33       44

Do u want to continue:y
Main Menu
1.Create
2.Delete
3.Search
4.Insert
5.Display
6.Exit
Enter your Choice:3

Enter the Element to be searched:44
Value is in the 3 Position

Do u want to continue:y

Main Menu
1.Create
2.Delete
3.Search
4.Insert
5.Display
6.Exit
Enter your Choice:4
Enter the position u need to insert:2
Enter the element to insert:25
The list after insertion: 11       25       33      44

Do u want to continue:y

Main Menu
1.Create
```

2.Delete
3.Search
4.Insert
5.Display
6.Exit
Enter your Choice:5

The Elements of The list ADT are: 11 25 33 44

Do u want to continue:y

Main Menu
1.Create
2.Delete
3.Search
4.Insert
5.Display
6.Exit
Enter your Choice:6

RESULT:

Thus a C program to implement the List using array is written and executed successfully.

Ex.No.-3a LIST – LINKED LIST IMPLEMENTATION

AIM:

To write a C program to implement the List ADT using linked list.

ALGORITHM:

1. Start the program.
2. Create a node using structure
3. Dynamically allocate memory to node
4. Create and add nodes to linked list.
5. Read the element to be inserted.
6. Insert the elements into the list.
7. Read the element to be deleted.
8. Remove that element and node from the list.
9. Adjust the pointers.
10. Display the elements in the list.
11. Stop the program.

PROGRAM:

```
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
#include<math.h>
/*declaring a structure to create a node*/
struct node
{
        int data;
        struct node *next;
};
struct node *start;
/* inserting nodes into the list*/
/*function to insert values from beginning of the the single linked
list*/ void insertbeg(void)
{
        struct node *nn;
        int a;
        /*allocating implicit memory to the node*/
        nn=(struct node *)malloc(sizeof(struct node));
```

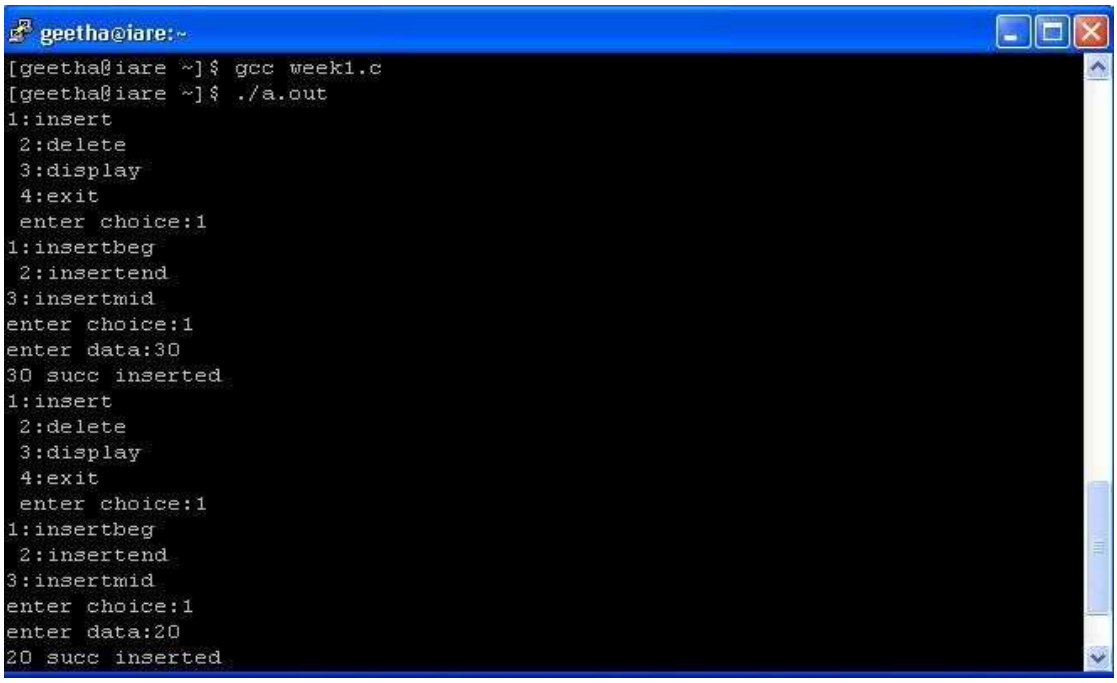
```
        printf("enter data:");
        scanf("%d",&nn->data);
        a=nn->data;
        if(start==NULL)
        /*checking if List is empty*/
        {
                nn->next=NULL;
               start=nn;
        }
        else
        {
                nn->next=start;
               start=nn;
        }
         printf("%d succ. inserted\n",a);
        return;
}
/*function to insert values from the end of the linked list*/
void insertend(void)
{
        struct node *nn,*lp;
        int b;
        nn=(struct node *)malloc(sizeof(struct node));
        printf("enter data:");
        scanf("%d",&nn->data);
        b=nn->data;
        if(start==NULL)
        {
                nn->next=NULL;
                start=nn;
        }
         else
        {
                lp=start;
                while(lp->next!=NULL)
                {
                        lp=lp->next;
                }
                lp->next=nn;
                nn->next=NULL;
        }
         printf("%d is succ. inserted\n",b);
         return;
 }
 /*function to insert values from the middle of the linked list*/
void insertmid(void)
 {
```

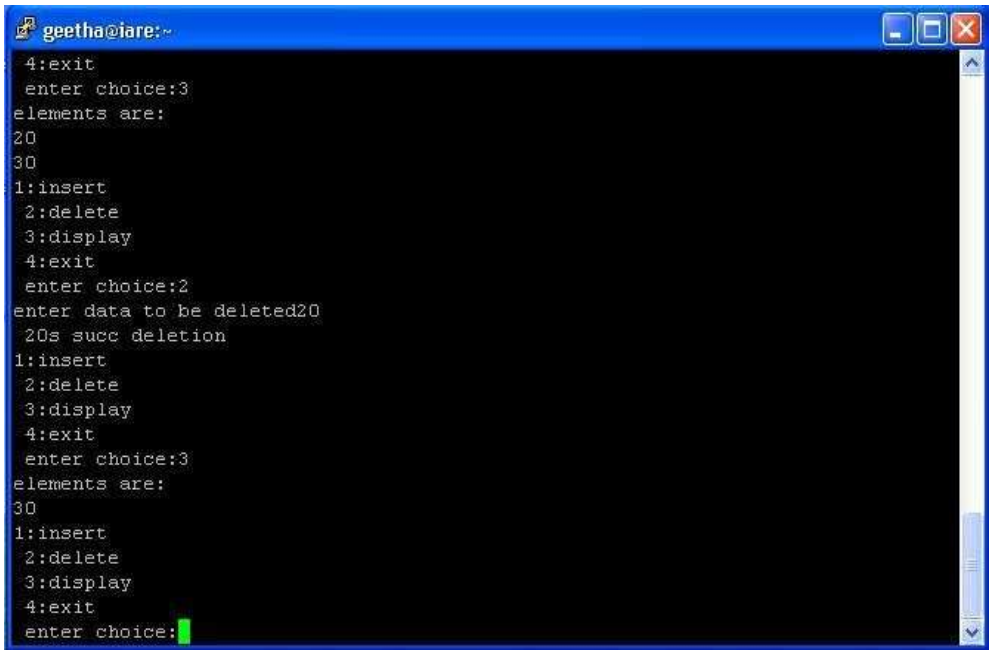
```
        struct node *nn,*temp,*ptemp;
        int x,v;
        nn=(struct node *)malloc(sizeof(struct node));
        if(start==NULL)
        {
                printf("sll is empty\n");
                return;
        }
        printf("enter data before which no. is to be inserted:\n");
        scanf("%d",&x);
        if(x==start->data)
        {
                insertbeg();
                return;
        }
        ptemp=start;
        temp=start->next;
        while(temp!=NULL&&temp->data!=x)
        {
                ptemp=temp;
                temp=temp->next;
        }
        if(temp==NULL)
        {
                printf("%d data does not exist\n",x);
        }
        else
        {
                printf("enter data:");
                scanf("%d",&nn->data);
                v=nn->data;
                ptemp->next=nn;
                nn->next=temp;
                printf("%d succ. inserted\n",v);
        }
        return;
}
void deletion(void)
{
        struct node *pt,*t;
        int x;
        if(start==NULL)
        {
                printf("sll is empty\n");
                return;
        }
        printf("enter data to be deleted:");
```

```
        scanf("%d",&x);
        if(x==start->data)
        {
                t=start;
                /* assigning first node pointer to next node pointer to delete a
                data from the starting of the node*/
                start=start->next;
                free(t);
                printf("%d is succ. deleted\n",x);
                return;
        }
        pt=start;
        t=start->next;
        while(t!=NULL&&t->data!=x)
        {
                 pt=t;t=t->next;
        }
        if(t==NULL)
        {
                printf("%d does not exist\n",x);
                return;
         }
        else
        {
                pt->next=t->next;
        }
        printf("%d is succ. deleted\n",x);
        free(t);
        return;
}
void display(void)
{
        struct node *temp;
        if(start==NULL)
        {
                printf("sll is empty\n");
                return;
        }
        printf("elements are:\n");
        temp=start;
        while(temp!=NULL)
        {
                 printf("%d\n",temp->data);
                 temp=temp->next;
        }
        return;
 }
```

```
/* main program*/
int main( )
{
        int c,a;
        start=NULL;
        do
        {
                printf("1:insert\n2:delete\n3:display\n4:exit\nenter choice:");
                scanf("%d",&c);
                switch(c)
                {
                        case 1:
                                printf("1:insertbeg\n2:insert end\n3:insert mid\nenter choice:");
                                scanf("%d",&a);
                                switch(a)
                                {
                                        case 1:insertbeg(); break;
                                        case 2:insertend(); break;
                                        case 3:insertmid(); break;
                                } break;
                        case 2:deletion(); break;
                        case 3:display(); break;
                        case 4:printf("program ends\n");break;
                        default:printf("wrong choice\n"); break;
                 }
         }while(c!=4);
        return 0;
 }
```

OUTPUT:





RESULT:

Thus a C program to implement the List ADT using linked list is written and executed successfully.

Ex.No.-3b STACK – LINKED LIST IMPLEMENTATION

AIM:

To write a C program to implement the stack using linked list.

ALGORITHM:

A) Push Operation:

1. To push an element into the stack, copy the element to be inserted in the data field of the new node.
2. Assign the reference field of the new node as NULL.
3. Check if top is not NULL, if so, then assign the value of top in the reference field of new node.
4. Assign the address of the new node to the top.

B) Pop Operation:

1. To pop an element from the stack, check whether the top of the stack is NULL.
2. If so, then return stack is empty and element cannot be popped from the stack.
3. Else, assign the top value to a temporary node.
4. Now assign the value in the reference field of the node pointed by top to the top value.
5. Return the value in the data field of the temporary node as the element deleted and delete the temporary node.

PROGRAM:

/*Stack Implementation using Linked List*/

```
# include <stdio.h>
void push( );
void pop( );
void display( );
main( )
{
        int n;
        printf("STACK USING LINKED LIST\n1.PUSH\n 2.POP\n 3.DISPLAY\n 4.
                EXIT \n");
        do
        {
                printf("\nEnter your choice\n");
                scanf("%d",&n);
                switch(n)
                {
                        case 1:
                           push();
                           break;
```

```
                        case 2:
                          pop();
                          break;
                        case 3:
                          display( );
                          break;
                        case 4:
                          break;
                        default:
                          printf("Invalid choice\n");
                          break;
                }
        }while(n!=4);
}

typedef struct node
{
        int data;
        struct node *link;
}n;
n *top=NULL;

void push()
{
        int item; n *temp;
        printf("Enter the item\n");
        scanf("%d",&item);
        temp=(n*)malloc(sizeof(n));
        temp->data=item;
        temp->link=top;
        top=temp;
}

void pop()
{
        n *temp;
        if(top==NULL)
                printf("Stack is empty\n");
        else
        {
                temp=top;
                printf("The element deleted = %d\n",temp->data);
                free(temp);
                top=top->link;
        }
}
void display()
```

```
{
        n *save;
        if(top==NULL)
                printf("Stack is empty\n");
        else
        {
                save=top;
                printf("The elements of the stack are :");
                while(save!=NULL)
                {
                        printf("%d\t",save->data);
                        save=save->link;
                }
                printf("\nTopmost element = %d\n",top->data);
        }
}
```

OUTPUT:

```
STACK USING LINKED LIST
1.PUSH
2.POP
3.DISPLAY
4.EXIT

Enter your choice 1
Enter the item 10

Enter your choice 1
Enter the item 20

Enter your choice 3
The elements of the stack are :20 10
Topmost element = 20

Enter your choice 2
The element deleted = 20

Enter your choice 4
```

RESULT:

Thus a C program to implement the stack using linked list is written and executed successfully.

Ex.No.-3c QUEUE – LINKED LIST IMPLEMENTATION

AIM:

To write a C program to implement the queue using linked list.

ALGORITHM:

Enqueue:

1. Create a new node and allocate memory space for the new node.
2. Assign the element to be inserted in the data field of the new node.
3. Assign NULL to the address field of the new node.
4. Check if rear and front pointers are NULL.
5. If so, then make the front and rear pointers to point to new node.
6. If not, then assign address of the new node as the rear pointer

value. Dequeue:

1. Check if queue is not empty.
2. If it is empty, return queue underflow and dequeue operation cannot be done.
3. If not, assign the front->next value as the new front pointer and free the deleted node.

PROGRAM:

```
//Queue using linked list
#include<stdio.h>
#include<conio.h>
#include<stdlib.h>
 struct node
 {
       int data;
       struct node* next;
 }*rear, *front;

void dequeue()
{
      struct node *temp, *var=rear;
      if(var==rear)
     {
           rear = rear->next;
           free(var);
     }
     else
```

```
        printf("\nQueue Empty");
}


void enqueue(int value)
{
    struct node *temp;
    temp=(struct node *)malloc(sizeof(struct
    node)); temp->data=value;
    if (front == NULL)
    {
        front=temp; front-
        >next=NULL;
        rear=front;
    }
    else
    {
        front->next=temp; front=temp;
        front->next=NULL;
    }
}

void display()
{
    struct node *var=rear;
    if(var!=NULL)
    {
        printf("\nElements in Queue: ");
        while(var!=NULL)
        {
            printf("\t%d",var->data);
            var=var->next;
        }
        printf("\n");
    }
    else
         printf("\nQueue is Empty");
}

int main( )
{
    int ch;
    clrscr();
    front=NULL;
    printf("<-----Queue using Linked List ---->\n");
    printf(" \n1. Enqueue an element");
    printf(" \n2. Dequeue an element");
```

```
    printf(" \n3. Display Queue");
    printf(" \n4. Exit\n");
    while(1)
    {
        printf(" \nEnter your choice: ");
        scanf("%d",&ch);
        switch(ch)
        {
            case 1:
            {
                int value;
                printf("\nEnter a value to Enqueue: ");
                scanf("%d",&value);
                enqueue(value);
                display( );
                break;
            }
            case 2:
            {
                dequeue( );
                display( );
                break;
            }
            case 3:
            {
                display( );
                break;
            }
            case 4:
            {
                exit(0);
            }
            default:
            {
                printf("\nwrong choice for operation");
            }
        }
    }
}
```

OUTPUT:

<-----Queue using Linked List ---- >

1. Enqueue an element
2. Dequeue an element
3. Display Queue

4. Exit

Enter your choice: 1

Enter a value to Enqueue: 10

Elements in Queue: 10

Enter your choice: 1

Enter a value to Enqueue: 20

Elements in Queue: 10 20

Enter your choice: 1

Enter a value to Enqueue: 30

Elements in Queue: 10 20 30

Enter your choice: 2

Elements in Queue: 20 30

Enter your choice: 4

RESULT:

Thus a C program to implement the queue using linked list is written and executed successfully.

Ex.No.-4a POLYNOMIAL ADDITION

AIM:

To write a C program to perform polynomial addition using linked list.

ALGORITHM:

1. Start the program.
2. Declare the node as link.
3. Allocate memory space for pol1, pol2 and poly.
4. Read pol1 and pol2.
5. Call the function polyadd.
6. Add the co-efficients of poly1 and poly2 having the equal power and store it in poly.
7. If there is no co-efficient having equal power in poly1 and poly2, then add it to poly.
8. Display the poly1, poly2 and poly.
9. Stop the program.

PROGRAM:

```
# include <stdio.h>
# include <malloc.h>
# include <conio.h>

struct link
{
        int coeff,pow;
        struct link *next;
}*poly1=NULL, *poly2=NULL,*poly=NULL;

void create(struct link *node)
{
        char ch;
        do
        {
                        printf("\n Enter Coeff:");
                        scanf("%d",&node->coeff);
                        printf("\n Enter Power:");
                        scanf("%d",&node->pow);
                        node->next=(struct link *) malloc(sizeof(struct link));
                        node=node->next;
                        node->next=NULL;
```

```
                printf("\n\n Continue(y/n):");
                ch=getch();
        }while(ch=="y" || ch =="Y");
}

void display(struct link *node)
{
                while(node->next!=NULL)
                {
                    printf("%dx^%d",node->coeff,node->pow);
                    node=node->next;
                    if(node->next!=NULL)
                            printf("+");
                }
}

void polyadd(struct link *poly1, struct link *poly2, struct link *poly)
{
                while(poly1->next && poly2->next)
                {
                    if(poly1->pow > poly2->pow)
                    {
                            poly->pow=poly1->pow;
                            poly->coeff=poly1->coeff;
                            poly1=poly1->next;
                            }
                    else if(poly1->pow < poly2->pow)
                    {
                            poly->pow=poly1->pow;
                            poly->coeff=poly1->coeff;
                            poly2=poly2->next;
                    }
                    else
                    {
                            poly->pow=poly1->pow;
                            poly->coeff=poly1->coeff + poly2->coeff;
                            poly1=poly1->next;
                            poly2=poly2->next;

                    }
                    poly->next=(struct link *) malloc(sizeof(struct link));
                    poly=poly->next;
                    poly->next=NULL;
}
                while(poly1->next || poly2->next)
                {
                    if(poly1->next)
```

```
                {
                        poly->pow=poly1->pow;
                        poly->coeff=poly1->coeff;
                        poly1=poly1->next;
                }
                if(poly2->next)
                {
                        poly->pow=poly2->pow;
                        poly->coeff=poly2->coeff;
                        poly2=poly2->next;
                }
                poly->next=(struct link *) malloc(sizeof(struct link));
                poly=poly->next;
                poly->next=NULL;
}
}
void main( )
{
                poly1=(struct link *)malloc(sizeof(struct link));
                poly2=(struct link *)malloc(sizeof(struct link));
                poly=(struct link *)malloc(sizeof(struct link));
                clrscr();
                printf("\n Enter the First Polynomial:");
                create(poly1);
                printf("\n Enter the Second Polynomial:");
                create(poly2);
                polyadd(poly1,poly2,poly);
                printf("\n\t First Polynomial:");
                display(poly1);
                printf("\n\t Second Polynomial:");
                display(poly2);
                printf("\n\t Addition of two Polynomials:");
                display(poly);
                getch();
}
```

OUTPUT:

```
Enter the First Polynomial:
Enter Coeff:3
Enter Power:3
Continue(y/n):y

Enter Coeff:6
Enter Power:2
Continue(y/n):y

Enter Coeff:9
```

Enter Power:1
Continue(y/n):y

Enter Coeff:8
Enter Power:0
Continue(y/n):n

Enter the Second Polynomial:
Enter Coeff:76
Enter Power:3
Continue(y/n):y

Enter Coeff:43
Enter Power:2
Continue(y/n):y

Enter Coeff:23
Enter Power:1
Continue(y/n):y

Enter Coeff:24
Enter Power:0
Continue(y/n):n

First Polynomial: 3x^3+6x^2+9x^1+8x^0
Second Polynomial: 76^3+43x^2+23x^1+24x^0
Addition of two Polynomials: 79^3+49x^2+32x^1+32x^0

RESULT:

Thus a C program to perform polynomial addition using linked list is written and executed successfully.

Ex.No.-4b INFIX TO POSTFIX CONVERSION

AIM:

To write a C program to perform infix to postfix conversion using stack.

ALGORITHM:

1. Define a stack
2. Go through each character in the string
3. If it is between 0 to 9, append it to output string.
4. If it is left brace push to stack
5. If it is operator *+-/ then
    a. If the stack is empty push it to the stack
    b. If the stack is not empty then start a loop:
        i. If the top of the stack has higher precedence
        ii. Then pop and append to output string
        iii. Else break
        iv. Push to the stack
6. If it is right brace then
    a. While stack not empty and top not equal to left brace
    b. Pop from stack and append to output string
    c. Finally pop out the left brace.
7. If there is any input in the stack pop and append to the output string.

PROGRAM:

/*Stack application - Infix to Postfix Conversion*/

```
# define SIZE 50
# include <ctype.h>

char s[SIZE];
int top = -1;
push(char elem)
{
        s[++top] = elem;
```

```
}

char pop()
{
        return (s[top--]);
}

int pr(char elem)
{
        switch (elem)
        {
                case '#':
                        return 0;
                case '(':
                        return 1;
                 case '+':
                 case '-':
                        return 2;
                 case '*':
                 case '/':
                        return 3;
        }
}

main( )
{
        char infx[50], pofx[50], ch, elem;
        int i = 0, k = 0;
        printf("<-----Stack Application: Infix to Postfix Conversion-----
        >\n"); printf("\n\nRead the Infix Expression ? ");
        scanf("%s", infx);
        push('#');
        while ((ch = infx[i++]) != '\0')
        {
               if (ch == '(')
                  push(ch);
                else if (isalnum(ch))
                  pofx[k++] = ch;
                else if (ch == ' )' )
                {
                        while (s[top] != ' ( ' )
                                pofx[k++] = pop( );
                                elem = pop( );
                }
                  else
                  {
                        while (pr(s[top]) >= pr(ch))
```

```
                                pofx[k++] = pop( );
                                push(ch);
                        }
                }
                while (s[top] != '#')
                        pofx[k++] = pop( );
                        pofx[k] = '\0';
                        printf("\n\nGiven Infix Expn: %s Postfix Expn: %s\n", infx, pofx);
}
```

OUTPUT:

<-----Stack Application: Infix to Postfix Conversion----->

Read the Infix Expression ? a+b*c-d

Given Infix Expn: a+b*c-d Postfix Expn: abc*+d-

RESULT:

Thus a C program to convert the expression in infix to postfix is written and executed successfully.

Ex.No.-4c EVALUATING POSTFIX EXPRESSION

AIM:

To write a C program to evaluate postfix expression using stack.

ALGORITHM:

1. Start the program.
2. Scan the Postfix string from left to right.
3. Initialise an empty stack.
4. If the scannned character is an operand, add it to the stack. If the scanned character is an operator, there will be atleast two operands in the stack.
5. If the scanned character is an Operator, then we store the top most element of the stack(topStack) in a variable temp. Pop the stack. Now evaluate topStack(Operator)temp. Pop the stack and Push result into the stack.
6. Repeat this step till all the characters are scanned.
7. After all characters are scanned, we will have only one element in the stack. Return topStack.
8. Stop the program.

PROGRAM:

```
# define SIZE 50
# include <ctype.h>

int s[SIZE];
int top=-1;

push(int elem)
{
        s[++top]=elem;
}

int pop( )
{
        return(s[top--]);
}

 main( )
{
```

```
        char pofx[50],ch;
        int i=0,op1,op2;
        printf("<-----Stack Application: Evaluating Postfix Expression ---- >\n");
        printf("\n\nRead the Postfix Expression ? ");
        scanf("%s",pofx);
        while( (ch=pofx[i++]) != '\0')
        {
                if(isdigit(ch))
                      push(ch-'0');
                else
                {
                        op2=pop( );
                        op1=pop( );
                        switch(ch)
                        {
                                case '+':
                                        push(op1+op2);
                                        break;
                                case '-':
                                        push(op1-op2);
                                        break;
                                case '*':
                                        push(op1*op2);
                                        break;
                                case '/':
                                        push(op1/op2);
                                        break;
                        }
                }
        }
        printf("\n Given Postfix Expn: %s\n",pofx);
        printf("\n Result after Evaluation: %d\n",s[top]);
}
```

OUTPUT:

<-----Stack Application: Evaluating Postfix Expression ---- >

Read the Postfix Expression ? 456*+7-

Given Postfix Expn: 456*+7-

Result after Evaluation: 27

RESULT:

Thus a C program to evaluate the postfix expression is written and executed successfully.

Ex.No.-5 BINARY TREE

AIM:

To write a C program to implement binary tree and its traversals.

ALGORITHM:

1. Start the program.
2. Declare the node.
3. Create the binary tree by inserting elements into it.
4. Traverse the binary tree by inorder and display the nodes.
5. Traverse the binary tree by preorder and display the nodes.
6. Traverse the binary tree by postorder and display the nodes.
7. Stop the program.

PROGRAM:

```
# include <stdio.h>
# include <alloc.h>
# include <conio.h>

typedef struct bin
{
        int data;
        struct bin *left;
        struct bin *right;
}node;

void insert(node *,node *);
void inorder(node *);
void preorder(node *);
void postorder(node *);
node *getnode();

void main( )
{
        int choice;
        char ans='n';
        node *newnode,*root;
        root=NULL;
        clrscr ( ) ;
        do
```

```
{
        printf("\n\t Program for Binary Tree Travesal");
        printf("\n\t 1.Create");
        printf("\n\t 2.Inorder");
        printf("\n\t 3.Preorder");
        printf("\n\t 4.Postorder");
        printf("\n\t 5.Exit");
        printf("\n\t Enter your Choice:");
        scanf("%d",&choice);
        switch(choice)
        {
                case 1:
                        root=NULL;
                        do
                        {
                                newnode=getnode();
                                printf("\n\tEnter the element:");
                                scanf("%d",&newnode->data);
                                if(root==NULL)
                                root=newnode;
                                else
                                insert(root,newnode);
                                printf("\n\tDo u want to enter more elements?(y/n):
                                "); ans=getche();
                        }while(ans=='y' || ans=='Y');
                        clrscr();
                        break;

                case 2:
                        if(root==NULL)
                                printf("\n\t Tree is not created.");
                        else
                                inorder(root);
                        break;

                case 3:
                        if(root==NULL)
                                printf("\n\t Tree is not created.");
                        else
                                preorder(root);
                        break;
                case 4:
                        if(root==NULL)
                                printf("\n\t Tree is not created.");
                        else
                                postorder(root);
                        break;
```

```
                }
        }while(choice!=5);
}

node *getnode()
{
        node *temp;
        temp=(node *)malloc(sizeof(node));
        temp->left=NULL;
        temp->right=NULL;
        return temp;
}

void insert(node *root, node *newnode)
{
        char ch;
        printf("\n\t Where to insert LEFT/RIGHT of %d: ",root->data);
        ch=getche();
        if((ch=='r')||(ch=='R'))
        {
                if(root->right==NULL)
                {
                        root->right=newnode;
                }
                else
                        insert(root->right,newnode);;
        }
        else
        {
                if(root->left==NULL)
                {
                        root->left=newnode;
                }
                else
                        insert(root->left,newnode);
        }
}

void inorder(node *temp)
{
        if(temp!=NULL)
        {
                inorder(temp->left);
                printf(" %d",temp->data);
                inorder(temp->right);
        }
```

```
}

void preorder(node *temp)
{
        if(temp!=NULL)
        {
                printf(" %d",temp->data);
                preorder(temp->left);
                preorder(temp->right);
        }
}

void postorder(node *temp)
{
        if(temp!=NULL)
        {
                postorder(temp->left);
                postorder(temp->right);
                printf(" %d",temp->data);

        }
}
```

OUTPUT:

```
Program for Binary Tree Travesal
1.Create
2.Inorder
3.Preorder
4.Postorder
5.Exit
Enter your Choice:1
Enter the element:10
Do u want to enter more elements?(y/n):y

Enter the element:12
Where to insert LEFT/RIGHT of 10: l
Do u want to enter more elements?(y/n):y

Enter the element:17
Where to insert LEFT/RIGHT of 10: r
Do u want to enter more elements?(y/n):y

Enter the element:8
Where to insert LEFT/RIGHT of 10: l
Where to insert LEFT/RIGHT of 12: r
```

Do u want to enter more elements?(y/n):n

Program for Binary Tree Travesal
1.Create
2.Inorder
3.Preorder
4.Postorder
5.Exit
Enter your Choice:2
12 8 10 17

Program for Binary Tree Travesal
1.Create
2.Inorder
3.Preorder
4.Postorder
5.Exit
Enter your Choice:3
10 12 8 17

Program for Binary Tree Travesal
1.Create
2.Inorder
3.Preorder
4.Postorder
5.Exit
Enter your Choice:4
8 12 17 10

Program for Binary Tree Travesal
1.Create
2.Inorder
3.Preorder
4.Postorder
5.Exit
Enter your Choice:5

RESULT:

Thus a C program to implement the tree and tree traversals is written and executed successfully.

Ex.No.-6 BINARY SEARCH TREE

AIM:

To write a C program to implement binary search tree.

ALGORITHM:

1. Start the program.
2. Declare the node.
3. Read the elements to be inserted.
4. Create the binary search tree.
5. Read the element to be searched.
6. Visit the nodes by inorder.
7. Find the searching node and display if it is present with parent node.
8. Read the element to be removed from BST.
9. Delete that node from BST.
10. Display the binary search tree by inorder.
11. Stop the program.

PROGRAM:

```
# include <stdio.h>
# include <alloc.h>
# include <conio.h>
# include <stdlib.h>

typedef struct bst
{
        int data;
        struct bst *left,*right;
}node;

void insert(node *,node *);
void inorder(node *);
node *search(node *,int,node **);
void del(node *,int);

void main()
{
        int choice;
        char ans='N';
```

```
int key;
node *newnode,*root,*temp,*parent;
node *getnode();
root=NULL;
clrscr();
do
{
        printf("\n\t Program for Binary Search Tree");
        printf("\n\t 1.Create");
        printf("\n\t 2.Search");
        printf("\n\t 3.Delete");
        printf("\n\t 4.Display");
        printf("\n\t 5.Exit");
        printf("\n\t Enter your Choice:");
        scanf("%d",&choice);
        switch(choice)
        {
                case 1:
                        do
                        {
                                newnode=getnode();
                                printf("\n\tEnter the element:");
                                scanf("%d",&newnode->data);
                                if(root==NULL)
                                root=newnode;
                                else
                                insert(root,newnode);
                                printf("\n\tDo u want to enter more elements?(y/n):
                                "); ans=getche();
                        }while(ans=='y' || ans=='Y');
                        break;
                case 2:
                        printf("\n\tEnter the element to be searched:");
                        scanf("%d",&key);
                        temp=search(root,key,&parent);
                        printf("\n\tParent of node %d is %d",temp->data,parent-
                        >data); break;
                case 3:
                        printf("\n\tEnter the element to be deleted:");
                        scanf("%d",&key);
                        del(root,key);
                        break;
                case 4:
                        if(root==NULL)
                                printf("\n\t Tree is not created.");
                        else
                        {
```

```
                                        printf("\n The Tree is:");
                                        inorder(root);
                                }
                                break;
                        }
        }while(choice!=5);
}
node *getnode( )
{
        node *temp;
        temp=(node *)malloc(sizeof(node));
        temp->left=NULL;
        temp->right=NULL;
        return temp;
}
void insert(node *root, node *newnode)
{
        if(newnode->data > root->data)
        {
                if(root->right==NULL)
                {
                        root->right=newnode;
                }
                else
                        insert(root->right,newnode);;
        }
        if(newnode->data < root->data)
        {
                if(root->left==NULL)
                {
                        root->left=newnode;
                }
                else
                        insert(root->left,newnode);
        }
}
void inorder(node *temp)
{
        if(temp!=NULL)
        {
                inorder(temp->left);
                printf(" %d",temp->data);
                inorder(temp->right);
        }
}
node *search(node *root,int key,node **parent)
{
```

```
        node *temp;
        temp=root;
        while(temp!=NULL)
        {
            if(temp->data==key)
            {
                    printf("\n\tThe %d element is present",temp->data);
                    return(temp);
            }
            *parent=temp;
            if(temp->data > key)
                temp=temp->left;
            else
                temp=temp->right;
        }
        return NULL;
}
void del(node *root, int key)
{
        node *temp,*parent,*tempsucc;
        temp=search(root,key,&parent);
        if(temp->left!=NULL&&temp->right!=NULL)
        {
                parent=temp;
                tempsucc=temp->right;
                while(tempsucc->left!=NULL)
                {
                        parent=tempsucc;
                        tempsucc=tempsucc->left;
                }
                temp->data=tempsucc->data;
                parent->right=NULL;
                printf("Now Deleted it!");
                return;
        }
        if(temp->left!=NULL&&temp->right!=NULL)
        {
                if(parent->left==temp)
                        parent->left=temp->left;
                else
                        parent->right=temp->left;
                        temp=NULL;
                        free(temp);
                        printf("Now deleted it!");
                        return;
        }
        if(temp->left!=NULL&&temp->right!=NULL)
```

```
        {
                if(parent->left==temp)
                        parent->left=temp->right;
                else
                        parent->right=temp->right;
                temp=NULL;
                free(temp);
                printf("Now deleted it!");
                return;
        }
        if(temp->left!=NULL&&temp->right!=NULL)
        {
                if(parent->left==temp)
                        parent->left=NULL;
                else
                        parent->right=NULL;
                        printf("Now deleted it!");
                        return;
        }
}
```

OUTPUT:

```
Program for Binary Search Tree
1.Create
2.Search
3.Delete
4.Display
5.Exit
Enter your Choice:1

Enter the element:10
Do u want to enter more elements?(y/n):y

Enter the element:8
Do u want to enter more elements?(y/n):y

Enter the element:9
Do u want to enter more elements?(y/n):y

Enter the element:7
Do u want to enter more elements?(y/n):y

Enter the element:15
Do u want to enter more elements?(y/n):y

Enter the element:13
```

Do u want to enter more elements?(y/n):y

Enter the element:14
Do u want to enter more elements?(y/n):y

Enter the element:12
Do u want to enter more elements?(y/n):y

Enter the element:16
Do u want to enter more elements?(y/n):n

1.Create
2.Search
3.Delete
4.Display
5.Exit
Enter your Choice:4

The Tree is: 7 8 9 10 12 13 14 15 16

1.Create
2.Search
3.Delete
4.Display
5.Exit
Enter your Choice:2

Enter the element to be searched:16
The 16 element is present
Parent of node 16 is 15

1.Create
2.Search
3.Delete
4.Display
5.Exit
Enter your Choice:5

RESULT:

Thus a C program to implement the binary search tree is written and executed successfully.

Ex.No.-7 AVL TREE

AIM:

To write a C program to implement an AVL tree.

ALGORITHM:

1. Start the program.
2. Declare the node.
3. Read the elements and create a tree.

Insert:

4. Insert a new node as new leaf node just as in ordinary binary search tree.
5. Now trace the path from inserted node towards root. For each node, „n" encountered , check if heights of left(n) and right(n) differ by atmost 1.
    a) if yes, move towards parent(n).
    b) Otherwise restructure the by doing either a single rotation or a double rotation.

Delete:

6. Search the node to be deleted.
7. If the node to be deleted is a leaf node, then simply make it NULL to remove.
8. If the node to be deleted is not a leaf node, then the node must be swapped with its inorder successor. Once the node is swapped, then remove the node.
9. Traverse back up the path towards root, check the balance factor of every node along the path.
10. If there is unbalanced in some subtree then balance the subtree using appropriate single or double rotation.

PROGRAM:

```
#include<stdio.h>

typedef struct node
{
   int data;
   struct node *left,*right;
   int ht;
}node;
```

```
node *insert(node *,int);
node *Delete(node *,int);
void preorder(node *);
void inorder(node *);
int height( node *);
node *rotateright(node *);
node *rotateleft(node *);
node *RR(node *);
node *LL(node *);
node *LR(node *);
node *RL(node *);
int BF(node *);

int main( )
{
   node *root=NULL;
   int x,n,i,op;

   do
   {
      printf("\n1)Create:");
      printf("\n2)Insert:");
      printf("\n3)Delete:");
      printf("\n4)Print:");
      printf("\n5)Quit:");
      printf("\n\nEnter Your Choice:");
      scanf("%d",&op);

      switch(op)
      {
         case 1: printf("\nEnter no. of elements:");
                 scanf("%d",&n);
                 printf("\nEnter tree data:");
                 root=NULL;
                 for(i=0;i<n;i++)
                 {
                    scanf("%d",&x);
                    root=insert(root,x);
                 }
                 break;

         case 2: printf("\nEnter a data:");
                 scanf("%d",&x);
                 root=insert(root,x);
                 break;
```

```
            case 3: printf("\nEnter a data:");
                    scanf("%d",&x);
                    root=Delete(root,x);
                    break;

            case 4: printf("\nPreorder sequence:\n");
                    preorder(root);
                    printf("\n\nInorder sequence:\n");
                    inorder(root);
                    printf("\n");
                    break;
        }
    }while(op!=5);

    return 0;
}

node * insert(node *T,int x)
{
    if(T==NULL)
    {
        T=(node*)malloc(sizeof(node));
        T->data=x;
        T->left=NULL;
        T->right=NULL;
    }
    else
        if(x > T->data)       // insert in right subtree
        {
            T->right=insert(T->right,x);
            if(BF(T)==-2)
                if(x>T->right->data)
                    T=RR(T);
                else
                    T=RL(T);
        }
        else
            if(x<T->data)
            {
                T->left=insert(T->left,x);
                if(BF(T)==2)
                    if(x < T->left->data)
                        T=LL(T);
                    else
                        T=LR(T);
            }
```

```
        T->ht=height(T);

        return(T);
}

node * Delete(node *T,int x)
{
   node *p;

   if(T==NULL)
   {
      return NULL;
   }
   else
      if(x > T->data)       // insert in right subtree
      {
         T->right=Delete(T->right,x);
         if(BF(T)==2)
            if(BF(T->left)>=0)
               T=LL(T);
            else
               T=LR(T);
      }
      else
         if(x<T->data)
         {
            T->left=Delete(T->left,x);
            if(BF(T)==-2)    //Rebalance during windup
               if(BF(T->right)<=0)
                  T=RR(T);
               else
                  T=RL(T);
         }
         else
         {
            //data to be deleted is found
            if(T->right!=NULL)
            { //delete its inorder succesor
               p=T->right;

               while(p->left!= NULL)
                  p=p->left;

               T->data=p->data;
               T->right=Delete(T->right,p->data);

               if(BF(T)==2)//Rebalance during windup
```

```
                if(BF(T->left)>=0)
                   T=LL(T);
                else
                   T=LR(T);\
             }
             else
                return(T->left);
          }
   T->ht=height(T);
   return(T);
}

int height(node *T)
{
   int lh,rh;
   if(T==NULL)
      return(0);

   if(T->left==NULL)
      lh=0;
   else
      lh=1+T->left->ht;

   if(T->right==NULL)
      rh=0;
   else
      rh=1+T->right->ht;

   if(lh>rh)
      return(lh);

   return(rh);
}

node * rotateright(node *x)
{
   node *y;
   y=x->left;
   x->left=y->right;
   y->right=x;
   x->ht=height(x);
   y->ht=height(y);
   return(y);
}

node * rotateleft(node *x)
{
```

```
    node *y;
    y=x->right;
    x->right=y->left;
    y->left=x;
    x->ht=height(x);
    y->ht=height(y);

    return(y);
}

node * RR(node *T)
{
    T=rotateleft(T);
    return(T);
}

node * LL(node *T)
{
    T=rotateright(T);
    return(T);
}

node * LR(node *T)
{
    T->left=rotateleft(T->left);
    T=rotateright(T);

    return(T);
}

node * RL(node *T)
{
    T->right=rotateright(T->right);
    T=rotateleft(T);
    return(T);
}

int BF(node *T)
{
    int lh,rh;
    if(T==NULL)
        return(0);

    if(T->left==NULL)
        lh=0;
    else
        lh=1+T->left->ht;
```

```
    if(T->right==NULL)
       rh=0;
    else
       rh=1+T->right->ht;

    return(lh-rh);
}

void preorder(node *T)
{
    if(T!=NULL)
    {
       printf("%d(Bf=%d)",T->data,BF(T));
       preorder(T->left);
       preorder(T->right);
    }
}

void inorder(node *T)
{
    if(T!=NULL)
    {
       inorder(T->left);
       printf("%d(Bf=%d)",T->data,BF(T));
       inorder(T->right);
    }
}
```

OUTPUT:

```
1)Create:
2)Insert:
3)Delete:
4)Print:
5)Quit:
Enter Your Choice:1
Enter no. of elements:4
Enter tree data:7 12 4 9

1)Create:
2)Insert:
3)Delete:
4)Print:
5)Quit:
Enter Your Choice:4
```

Preorder sequence:
7(Bf=-1)4(Bf=0)12(Bf=1)9(Bf=0)
Inorder sequence:
4(Bf=0)7(Bf=-1)9(Bf=0)12(Bf=1)

1) Create:
2) Insert:
3) Delete:
4) Print:
5) Quit:
Enter Your Choice:3
Enter a data:7

1) Create:
2) Insert:
3) Delete:
4) Print:
5) Quit:
Enter Your Choice:4
Preorder sequence:
9(Bf=0)4(Bf=0)12(Bf=0)
Inorder sequence:
4(Bf=0)9(Bf=0)12(Bf=0)

1) Create:
2) Insert:
3) Delete:
4) Print:
5) Quit:
Enter Your Choice:5

RESULT:

Thus a C program to implement an AVL tree is written and executed successfully.

Ex.No.-8 HEAP USING PRIORITY QUEUE

AIM:

To write a C program to implement heap sort using priority queue.

ALGORITHM:

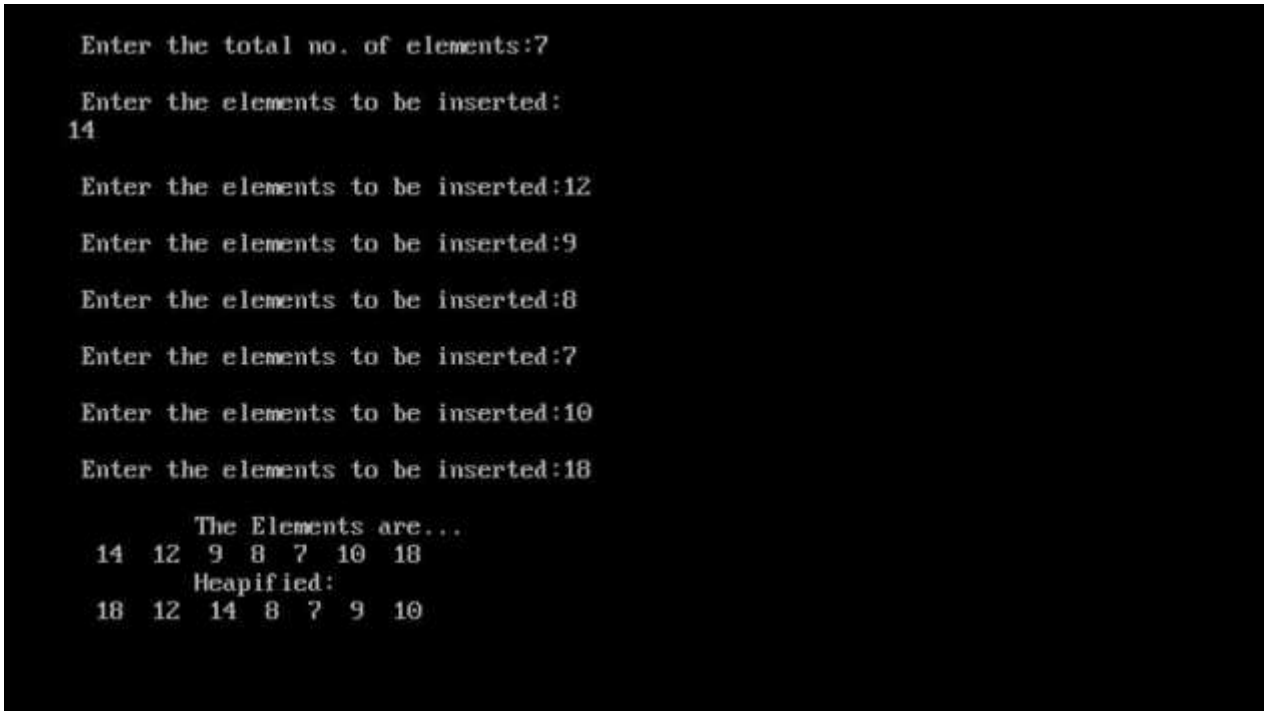
1. Start the program.
2. Read the elements to be inserted in heap.
3. Insert the element one by one.
4. Construct the heap structure to satisfy heap property of maxheap.
5. Display the heapified structure.
6. Stop the program.

PROGRAM:

```
# include <stdio.h>
# include <stdlib.h>
# include <conio.h>

# define MAX 10

int arr[MAX];
int i,item,n;

void insert(int num)
{
        if(i<MAX)
        {
                arr[i]=num;
        }
        else
                printf("\n Array is full");
}

void makeheap()
{
        for(i=0;i<n;i++)
        {
                int val=arr[i];
                int j=i;
                int f=(j-1)/2;
```

```
                while(j>0 && arr[f] < val)
                {
                        arr[j]=arr[f];
                        j=f;
                        f=(j-1)/2;
                }
                arr[j]=val;
        }
}

void display()
{
        printf("\n");
        for(i=0;i<n;i++)
                printf(" %d",arr[i]);
}

int main()
{
        clrscr();
        printf("\n Enter the total no. of elements:");
        scanf("%d",&n);
        for(i=0;i<n;i++)
        {
        printf("\n Enter the elements to be inserted:");
        scanf("%d",&item);
        insert(item);
        }
        printf("\n\t The Elements are...");
        display();
        makeheap();
        printf("\n\t Heapified:");
        display();
        getch();
        return 0;
}
```

OUTPUT:



RESULT:

Thus a C program to implement heap sort using priority queue is written and executed successfully.

Ex.No.-9 GRAPH TRAVERSAL

AIM:

To write a C program to implement graph traversals by Breadth First Search and Depth First Search.

ALGORITHM:

Breadth First Search:

1. Start the program.
2. Read the number of vertices and adjacency matrix.
3. Read the vertex from which to traverse the graph.
4. Initialize the visited array to 1 and insert the visited vertex in the queue.
5. Visit the vertex which is at the front of the queue.
6. Delete it from the queue and place its adjacent nodes in the queue.
7. Repeat the steps 5 & 6 , till the queue is not empty.
8. Display the traversal path.
9. Stop the program.

Depth First Search:

1. Start the program.
2. Read the number of vertices and adjacency matrix.
3. Initialize the visited array to 1.
4. Traverse the path one by one and push the visited vertex in the stack.
5. When there is no vertex further, we traverse back and search for unvisited vertex.
6. Display the traversal path.
7. Stop the program.

a) Breadth First Search

PROGRAM:

```
#include<stdio.h>
                int a[20][20], q[20], visited[20], n, i, j, f = 0, r = -1;
                void bfs(int v) {
```

```
        for(i = 1; i <= n; i++)
                if(a[v][i] && !visited[i])
                        q[++r] = i;
        if(f <= r) {
                visited[q[f]] = 1;
                bfs(q[f++]);
        }
}
void main() {
        int v;
        printf("\n Enter the number of vertices:");
        scanf("%d", &n);

        for(i=1; i <= n; i++) {
                q[i] = 0;
                visited[i] = 0;
        }

        printf("\n Enter graph data in matrix form:\n");
        for(i=1; i<=n; i++) {
                for(j=1;j<=n;j++) {
                        scanf("%d", &a[i][j]);
                }
        }

        printf("\n Enter the starting vertex:");
        scanf("%d", &v);
        bfs(v);
        printf("\n The nodes which are reachable are:\n");

        for(i=1; i <= n; i++) {
                if(visited[i])
                        printf("%d\t", i);
                else {
                        printf("\n Bfs is not possible. Not all nodes are
reachable");
                        break;
                }
        }
}
```

OUTPUT:

Enter the number of vertices : 4

Enter graph data in matrix form:

1 1 1 1

0 1 0 0

0 0 1 0

0 0 0 1

Enter the starting vertex: 1

The nodes which are reachable are:

1 2 3 4

b) Depth First Search

PROGRAM:

```
#include<stdio.h>

void DFS(int);
int G[10][10],visited[10],n;    //n is no of vertices and graph is sorted in array G[10][10]

void main()
{
   int i,j;
   printf("Enter number of vertices:");

   scanf("%d",&n);

   //read the adjacency matrix
   printf("\nEnter adjecency matrix of the graph:");

   for(i=0;i<n;i++)
     for(j=0;j<n;j++)
         scanf("%d",&G[i][j]);

   //visited is initialized to zero
  for(i=0;i<n;i++)
      visited[i]=0;

   DFS(0);
}

void DFS(int i)
```

```
{
   int j;
   printf("\n%d",i);
   visited[i]=1;

   for(j=0;j<n;j++)
     if(!visited[j]&&G[i][j]==1)
         DFS(j);
}
```

OUTPUT:

```
Enter number of vertices : 8
Enter adjacency matrix of the graph :
0       1       1       1       1       0       0       0
1       0       0       0       0       1       0       0
1       0       0       0       0       1       0       0
1       0       0       0       0       0       1       0
1       0       0       0       0       0       1       0
0       1       1       0       0       0       0       1
0       0       0       1       1       0       0       1
0       0       0       0       0       1       1       0
0
1
5
2
7
6
3
4
```

RESULT:

Thus a C program to implement graph traversals by Breadth First Search and Depth First Search is written and executed successfully.

Ex.No.-10 TOPOLOGICAL SORTING

AIM:

To write a C program to perform topological sorting (Application of a graph).

ALGORITHM:

1. Start the program.
2. Read the number of vertices and adjacency matrix of a graph.
3. Find a vertex with no incoming edges.
4. Delete it along with all the edges outgoing from it.
5. If there are more than one such vertices then break the tie randomly.
6. Store the vertices that are deleted.
7. Display these vertices that give topologically sorted list.
8. Stop the program.

PROGRAM:

```
#include <stdio.h>
int main( )
{
   int i,j,k,n,a[10][10],indeg[10],flag[10],count=0;
   printf("Enter the no of vertices:\n");
   scanf("%d",&n);
   printf("Enter the adjacency matrix:\n");
   for(i=0;i<n;i++){
      printf("Enter row %d\n",i+1);
      for(j=0;j<n;j++)
         scanf("%d",&a[i][j]);
 }
for(i=0;i<n;i++)
{
      indeg[i]=0;
      flag[i]=0;
 }
 for(i=0;i<n;i++)
      for(j=0;j<n;j++)
         indeg[i]=indeg[i]+a[j][i];
    printf("\nThe topological order is:");
    while(count<n)
```

```
   {
    for(k=0;k<n;k++)
   {
          if((indeg[k]==0) && (flag[k]==0))
{
              printf("%d ",(k+1));
              flag [k]=1;
    }
    for(i=0;i<n;i++)
       {
              if(a[i][k]==1)
                 indeg[k]--;
       }
   }
        count++;
    }
     return 0;
}
```

OUTPUT :

```
Enter the no of vertices:
4
Enter the adjacency matrix:

Enter row 1
0 1 1 0
Enter row 2
0 0 0 1
Enter row 3
0 0 0 1
Enter row 4
0 0 0 0

The topological order is:1 2 3 4
```

RESULT:

Thus a C program to perform topological sorting is written and executed successfully.

Ex.No.-11a LINEAR & BINARY SEARCH

AIM:

To write a C program to perform linear search and binary search.

ALGORITHM:

Linear Search

1. Read n numbers and search value.
2. If search value is equal to first element then print value is found.
3. Else search with the second element and so on.

Binary Search

1. Read n numbers and search value.
2. If search value is equal to middle element then print value is found.
3. If search value is less than middle element then search left half of list with the same method.
4. Else search right half of list with the same method.

PROGRAM:

/*Searching*/

```
# include <stdio.h>
# include <stdlib.h>
# include <conio.h>

void main()
{
        int a[100],i,n,item,s=0,ch,beg,end,mid; clrscr();
        printf("Enter No. of Elements:");
        scanf("%d",&n);
        printf("\nEnter Elements:\n");
        for(i=1;i<=n;i++)
        {
                scanf("%d",&a[i]);
        }
        while(1)
        {
                printf("\n1.Linear Search\n2.Binary
                Search\n3.Exit\n"); printf("Enter your choice:");
                scanf("%d",&ch);
```

```
        switch(ch)
        {
                case 1:
                printf("<-----LINEAR SEARCH ---- >\n");
                printf("\nEnter Element you want to Search:");
                scanf("%d",&item);
                for(i=1;i<=n;i++)
                {
                        if(a[i]==item)
                        {
                                printf("\nData is Found at Location : %d",i);
                                s=1;
                                break;
                        }
                }
                if(s==0)
                {
                        printf("Data is Not Found");
                }
                break;
                case 2:
                printf("<-----BINARY SEARCH---- >\n");
                printf("\nEnter Item you want to Search:");
                scanf("%d",&item);
                beg=1;
                end=n;
                mid=(beg+end)/2;
                while(beg<=end && a[mid]!=item)
                {
                         if(a[mid]<item)
                             beg=mid+1;
                        else end=mid-1;
                            mid=(beg+end)/2;
                }
                if(a[mid]==item)
                {
                        printf("\nData is Found at Location : %d",mid);
                }
                else
                {
                        printf("Data is Not Found");
                }
                break;
                case 3:
                        default: exit(0);
        }
}
```

```
getch();
}
```

OUTPUT:

```
Enter No. of Elements:
5

Enter Elements:
2 4 3 5 1

1.Linear Search
2.Binary Search
3.Exit
Enter your choice: 1

<-----LINEAR SEARCH ---->

Enter Element you want to Search: 1
Data is Found at Location : 5

1.Linear Search
2.Binary Search
3.Exit
Enter your choice: 2

<-----BINARY SEARCH---- >

Enter Item you want to Search: 3
Data is Found at Location : 3

1.Linear Search
2.Binary Search
3.Exit
Enter your choice: 3
```

RESULT:

Thus a C program to implement the linear search and binary search is written and executed successfully.

Ex.No.-11b SORTING

AIM:

To write a C program to perform insertion sort, quick sort and bubble sort**.**

ALGORITHM:

Insertion Sort

1. Get the n elements to be sorted.
2. The ith element is compared from (i-1)th to 0th element and placed in proper position according to ascending value.
3. Repeat the above step until the last element.

Quick Sort

1. Pick an element, called a pivot, from the list.
2. Reorder the list so that all elements which are less than the pivot come before the pivot and so that all elements greater than the pivot come after it.
3. After this partitioning, the pivot is in its final position. This is called the partition operation.
4. Recursively sort the sub-list of lesser elements and the sub-list of greater elements.

Bubble Sort

1. Get the n elements to be sorted.
2. Compare the first two elements of the array and swap if necessary.
3. Then, again second and third elements are compared and swapped if it is necessary and continue this process until last and second last element is compared and swapped.
4. Repeat the above two steps n-1 times and print the result.

PROGRAM:

```
/*Sorting*/
#include<conio.h>
#include<stdio.h>
#include<process.h>

void quickSort(int numbers[], int array_size);
```

```
void q_sort(int numbers[], int left, int right);
void bubble(int *array,int length);
void insertion(int a[], int n);

void insertion(int a[], int n)
{
  int i,j,temp;
  for(i=1;i<n;i++)
  {
    temp=a[i];
    j=i-1;
    while((temp<a[j])&&(j>=0))
    {
        a[j+1]=a[j];
        j=j-1;
    }
    a[j+1]=temp;
  }
}

void display(int a[],int n)
{
        int i;
        printf("\n\t\t\tSorted List\n");
        for(i=0;i<n;++i)
        printf("\t%d",a[i]);
}

void q_sort(int a[], int left, int right)
{
        int pivot, l_hold, r_hold;
        l_hold = left;
        r_hold = right;
        pivot = a[left];
        while (left < right)
        {
                while ((a[right] >= pivot) && (left < right))
                    right--;
                if (left != right)
                {
                        a[left] = a[right];
                        left++;
                }
                while ((a[left] <= pivot) && (left < right))
```

```
                left++;
                if (left != right)
                {
                        a[right] = a[left];
                        right--;
                }
        }
        a[left] = pivot;
        pivot = left;
        left = l_hold;
        right = r_hold;
        if (left < pivot) q_sort(a, left, pivot-1);
        if (right > pivot) q_sort(a, pivot+1, right);
}

void bubble(int *array,int length)
{
        int i,j; for(i=0;i<length;i++)
        {
                for(j=0;j<i;j++)
                {
                        if(array[i]>array[j])
                        {
                                int     temp=array[i];
                                array[i]=array[j];
                                array[j]=temp;
                        }
                }
        }
}

void main( )
{
        int a[100],n,i,ch;
        clrscr( );
        printf("\nEnter The Number Of Elements\t: ");
        scanf("%d",&n);
        printf("\nEnter Elements\n");
        for(i=0;i< n;++i)
                scanf("%d",&a[i]);
        while(1)
        {
                printf("\n1.Insertion sort\n2.Quick sort\n3.Bubble
                sort\n4.Exit\n"); printf("Enter your choice:");
                scanf("%d",&ch);
                switch(ch)
```

```
                {
                        case 1:
                                printf("<-----Insertion SORT ---- >\n");
                                insertion(a,n);
                                display(a,n);
                                break;
                        case 2:
                                printf("<-----Quick SORT ---->\n");
                                q_sort(a,0,n-1);
                                display(a,n);

                                break;
                        case 3:
                                bubble(a,n);
                                printf("<-----Bubble SORT ---- >\n");
                                printf("\n\t\t\tSorted List\n");
                                for (i=n-1;i>=0;i--)
                                        printf("\t%d",a[i]);
                                break;
                        case 4:
                                exit(0);
                                default:
                        printf("Enter a Valid Choice!");
                }
        }
getch( );
}
```

OUTPUT:

```
Enter The Number Of Elements :
5

Enter
Elements 2 4
1 3 5

1.Insertion
sort 2.Quick
sort 3.Bubble
sort 4.Exit
Enter your choice: 1

<----Insertion SORT ----->
                Sorted List
        1       2       3       4   5
```

```
1.Insertion sort
2.Quick sort
3.Bubble sort
4.Exit
Enter your choice:
2
<-----Quick SORT---- >

                Sorted List
     1      2      3      4     5

1.Insertion sort
2.Quick sort
3.Bubble sort
4.Exit
Enter your choice:
3
<-----Bubble SORT ---->

                Sorted List
     1      2      3      4     5
```

RESULT:

Thus a C program to perform insertion sort, quick sort and bubble sort is written and executed successfully.

Ex.No.-12 LINEAR PROBING

AIM:

To write a c program to create hash table and collision handling by linear probing.

ALGORITHM:

1. Start the program.
2. Read the numbers to be stored in hash table.
3. Create the hash function by generating the hash key.
4. If the location indicated by hash key is empty, then place the number in the hash table.
5. If collision occurs, then search for empty location.
6. If found, place the number at that location.
7. Display the hash table.

PROGRAM:

```
# include <stdio.h>
# include <conio.h>
# include <stdlib.h>
# define MAX 10

void main()
{
        int a[MAX],num,key,i;
        char ans;
        int create(int);
        void linearprob(int[], int,int),display(int[]);
        clrscr();

        printf("\nCOLLISION HANDLING BY LINEAR PROBING");
        for(i=0;i<MAX;i++)
        a[i]=-1;
        do
        {
                printf("\nEnter the number:");
                scanf("%d",&num);
                key=create(num);
                linearprob(a,key,num);
                printf("\n Do U wish to continue? (y/n)");
                ans=getche();
        }
                while(ans=='y');
```

```
                display(a);
                getch();
}

int create(int num)
{
        int key;
        key=num%10;
        return key;
}

void linearprob(int a[MAX],int key,int num)
{
        int flag,i,count=0;
        void display(int a[]);
        flag=0;
        if(a[key]==-1)
                a[key]=num;
        else
        {
                i=0;
                while(i<MAX)
                {
                        if(a[i]!=-1)
                                count++;
                                i++;
                }
                if(count==MAX)
                {
                        printf("\n Hash Table is full");
                        display(a);
                        getch();
                        exit(1);
                }
                for(i=key+1;i<MAX;i++)
                        if(a[i]==-1)
                        {
                                a[i]=num;
                                flag=1;
                                break;
                        }
                for(i=0;i<key&&flag==0;i++)
                        if(a[i]==-1)
                        {
                                a[i]=num;
                                flag=1;
                                break;
                        }
```

```
        }
}

void display(int a[MAX])
{
        int i;
        printf("\n Hash Table is..\n");
        for(i=0;i<MAX;i++)
        printf("\n %d %d ",i,a[i]);
}
```

OUTPUT:

COLLISION HANDLING BY LINEAR PROBING

Enter the number:131

Do U wish to continue? (y/n)y

Enter the number:21

Do U wish to continue? (y/n)y

Enter the number:3

Do U wish to continue? (y/n)y

Enter the number:4

Do U wish to continue? (y/n)y

Enter the number:8

Do U wish to continue? (y/n)y

Enter the number:9

Do U wish to continue? (y/n)y

Enter the number:18

Do U wish to continue? (y/n)n

Hash Table is..

0 18

1 131

2 21

3 3

4 4

5 5

6 -1

7 -1

8 8

9 9

RESULT:

Thus a C program to create hash table and collision handling by linear probing is written and executed successfully.

CSS8381 - DATA STRUCTURES LABORATORY
VIVA QUESTIONS

ARRAY:

Q1. What is an array & how many types of arrays represented in memory?
A1. An array is a structured datatype made up of a finite, fixed size, collection of homogeneous ordered elements. Types of array: One-Dimentional array, Two-Dimentional array, Multi-Dimentional array.

Q2 .How can be declared an array?
A2.data_type var_name[Expression];

Q3 .How can be insert an element in an array?
A3. Insertion of a new element in an array can be done in two ways:
* Insertion at the end of array.
* Insertion at required position.

Q4. How many types of implementation of a two-dimentional array?
A4. * Row-major implementation
* Column-major implementation

Q5. What is array of pointers?
A5. Array of pointer refers to homogeneous collection of pointer that is collection of pointer of same datatype.

Q6. What are limitations of array?
A6. i. These are static structures.
ii. It is very time consuming.

Q7. Where the elements of the array are stored respectively in successive?
A7 .Memory locations.

Q8. How can merge two arrays?
A8. Simplest way of merging two arrays is that first copy all elements of one array into a third empty array and the copy all the elements of other array into third array.

Q9. What is the operations of array?
A9. Insertion, Deletion, Traversing, Merging.

Q10. How can access one-
dimentional aray elements? A10.
array_name[index or subscript];

Q11.What is the traversing of an array?
A11. Traversing means to access all the elements of the array, starting from first element upto the last element in the array one-by-one.

STACK:

Q1. What is Stack ?

A1. Stack is ordered collection of element like arrays out it has a special feature that deletion and insertion of element can be done only from one end called top of stack .It is also called LIFO(last in first out).

Q2. What are the operations performed on stack?

A2 . Push for insertion and pop for deletion.

Q3. What is push operation?

A3. When an element is inserted into the stack is called push operation

Q4 .What is pop operation.

A4. When an element is deleted from the stack is called pop operation.

Q5. How stacks are implemented?

A5. Stacks are implemented in two ways:

- Static implementation –array
- Dynamic implementation –pointers.

Q6. What are the applications of stack?

A6. infix , post fix and prefix notations are the applications of stack.

Q7. What is recursion.

A7. Recursion is defined as function calling itself.

Q8. What are the different types of stack

A8 .Direct: a system calls itself from within itself.
Indirect: two functions mutually calls one another

Q9. Define “Top of stack”

A9. Pointer indicating the top element of the stack.

Q10. Is stack is primitive or non primitive data structure ?

A10. Non primitive data structure.

QUEUE:

Q1. Define queue.

A1.Queue is an homogeneous collection of elements. It is logically a first in first out (FIFO) type of list.Queue means a line.

Q2. In how many ways queue is implemented?

A2. Queues can be implemented in two ways:

1. static implementation (using array)
2. dynamic implementation (using pointers)

Q3. What is the rear end in a queue?
A3. in a queue new elements are added at one end called the rear end .

Q4.What is a front end?
A4. The existing elements in a queue are deleted from an end called the front end.

Q5. What is the value of front and rear end in an empty queue?
A5. Front =-1 and rear =-1.

Q6. What are the different variarions in a queue?
A6. Major variations are: 1. circular queue 2. double ended queue 3. priority queue.

Q7. What is the full form of dequeue?
A7.DEQUEUE : Double ended queue.It is another form of queue in which both insertion and deletion are performed at the either end.

Q8. When an element is added to the dequeue with n memory cells ,what happens to LEFT or RIGHT.
A8. If the element is added an the left , then LEFT is decreases by 1 (mod n) . IF the element is added on the right , then RIGHT is increase by 1 (mod n)

Q9. What are the applications of queue.
A9. Applications are: 1. round robin technique for processor scheduling
2. All types of customer services(eg. RTC)
3. Printer server routines.

Q10. What is Circular Queue?
A10. A Circular Queue is one in which the insertion of a new element is done at the very first variation of the Queue if the last location of the Queue is full.

Q11. Why use of Circular Queue?
A11. A Circular Queue over comes the problem of utilized space in linear Queue implemented as Array.

Q12. Explain Dequeue ?
A12. It is also a homogenous list of element in which insertion deletion of element are perform both the ends we insert element from the rear or from the front end.

Q13. What is Queue ?
A13. It is a non primitive linear data structure. In a Queue new element are added at the one end called rear end and the element are removed from another end called front end.

Q14 .Variation in a Queue ?
A14. i. Circular Queue.ii. Dequeue ,iii. Priority Queue

Q15. What is Priority Queue ?
A15. Priority Queue determines the order in which the exist in the Queue the highest Priority items are removed first.

Q16. Application of Queue ?

A16. 1> Customer service center

2> Ticket counter

3> Queue is used for determine space complexity & time complexity.

Q17. What is Queue implemention?

A17. i. Static implemention(Array)

ii. Dynamic implemention(Pointer)

Q18. Define operations on queue?

A18 .The basic operation that can be performed on queue are :

1. To insert an element in a Queue
2. To delete an element from the Queue

LINKED LIST:

Q1. Define linked list.

A1. Linked list are special list of some data elements linked to one another .The logical ordering is represented by having each element pointing to the next element. Each element is called a node.

Q2. What does a node define?

A2. Node has two parts: INFO – it stores the information and POINTER – which points to the next element.

Q3. What are the different types of linked list?

A3. Linked list are of four types: 1. singly linked list 2. doubly linked list 3. circular linked list 4. circular doubly linked list.

Q4. What are the different operations performed on a linked list?

A4 .Basic operations are: creation, insertion, deletion , traversing, searching , concatenation and display.

Q5. What are the advantages of linked list?

A5. Advantages are:

1. linked lists are dynamic data structures
2. Efficient memory utilizations
3. Insertion and deletions are easier and efficient

Q6. What is null pointer?

A6 .The link field of the last node contains NULL rather than a valid address. It is a null pointer and indicates the end of the list.

Q7. What is external pointer?

A7. It is a pointer to the very first node in the linked list, it enables us to access the entire linked list.

Q8. What are the different notations used in a linked list.

A8. Node(p) : a node pointed to by the pointer p

Data (p) : data of the node pointed by p

Link (p) : address of the next node that follows yhe node pointed to by the pointer p.

Q9. What are advantages of circular linked list.

A9. 1.Nodes can be accessed easily.

2. deletion of node is easier

3. concatenation and splitting of circular list is more efficient.

Q10..A doubly linked list contains how many fields?

A10. Doubly linked list consists of three fields:

Data : contains the information

Next: contains the address of the next node

Prev: contains the address of the previous node

INFIX , POSTFIX, PREFIX EXPRESSION

Q1. Application of Stack ?

A1 . Infix ,Prefix Postfix

Q2. Explain infix in Stack ?

A2. The operator is written in between the operands.

Ex:- A + B

Q3 .Explain Postfix in Stack ?

A3. The operator is written after the operands. It is also called suffix notation.

Ex:- AB+

Q4 Define operations on Stack ?

A4 The basic operation that can be performed on Stack are as follows:

PUSH ,POP

Q5. Give postfix form for (A+B)*C/D

A5. AB+C*D/

Q6. Give postfix form for A+B/C-D

A6 . ABC/+D-

Q7. Give prefix form for A/B^C+D

A7. +/A^BCD

Q8. Give prefix form for A*B+C

A8 . +*ABC

TREE:

Q1. What is a tree?

A1. A tree is a non linear data structure in which items are arranged in a sorted sequence.It is a finite set of one or more data items.

Q2. What is a root in a tree?

A2. A root is the first node in the hierarchical arrangement of data items.

Q3 .What do you mean by degree of a tree?
A3. It is a maximum degree of nodes in a given tree .

Q4. What are non terminal nodes?
A4. Any node(Except the root node) is not zero is called non terminal node. Non terminal nodes are the intermediate nodes in traversing the given tree.

Q5. Who are called siblings in a tree?
A5. The children nodes of a given parent node are called siblings. They are also called brothers.

Q6. Explain the degree of node?
A6. It is the no. of sub tree of a node in a given tree.

Q7. Explain the terminal node & non terminal node?
A7. Terminal node:- a node with degree of 0 is called terminal node.
Non terminal node:- a node without degree of 0 is called non terminal node.

LINEAR AND BINARY SEARCHING

Q1. Define searching process?
A1. searching is the process of finding an element within the list of elements stored in any order or randomly.

Q2. How many types of searching are there?
A2. There is basically two types of searching:-linear search and Binary search.

Q3.Define: linear search?
A3 .In linear search, we access each elements of an array one by one sequentially and see wheather it is desired element or not.

Q4 .Why binary search method is more efficient then liner search?
A4 .It is because less time is taken by linear search to search an element from the sorted list of elements.

Q5. Efficiency of linear search ?
A5. The time taken or the number of comparisons made in searching a record in a search table determines the efficiency of the technique.

Q6. What do you understand by the term “linear search is unsuccessful”?
A6. search will be unsuccessful if all the elements are accessed and the desired elements are not found.

Q7. What is worse case?
A7. In the worse case, the no. of average case we may have to scan half of the size of the array (n/2).

Q8. What is the drawback of linear search?
A8. There is no requisite for the linear Search.

Q9. During linear search, when the record is present in first position then how many comparisons are made ?
A9. Only one comparison.

Q10. During linear search, when the record is present in last position then how many

comparisons are made?
A10. n comparisons have to be made.

Q11 . During linear search, when the record is present somewhere in search table, then how many comparisons are made?
A11 . (n+1)/2.
Q12. What do you understand by binary search?
A12. A binary search algorithm or binary chop is a technique for finding a particular value in a sorted list.

Q13. Define the complexity of binary search?
A13. In worst cause there is log(n+1) in the average causes.

Q14 .Explain the difference between linear search and binary search?
A14

Linear search	binary search
1. linear search can be applied on any list of data.	binary search can be applied on Sorted list of data.
2. It can be applied on linked list.	It can not be applied on linked list

BINARY TREE:

Q1. What do you understand by binary tree?
A1. The binary tree is a collection of finite node or set of data object.

Q2. Explain the application of binary tree?
A2. 1. it is used in game programming.e.g. tic- tac-toe etc.

2 . it is used to solve the problem of mathematical expression.

SORTING:

Q1 .Explain the sorting?
A1. Searching and sorting and merging are three related operations which make the job of retrieval at data from the storage device easier & speeder.

Q2 .What are the different types of sorts in data structures ?
A2. 1> bubble sort 2> selection sort 3> insertion sort 4> quick sort 5> radix sort 6> merge sort 7> heap sort.

Q3. Define the bubble sort?
A3. In bubble sort each element is compared with its adduct element is larger than the second element is than the position at the element are interchanging otherwise it is not change.

Q4. Define the selection sort?
A4.,Selection sort technique is based upon the extension of the minimum maximum technique by means at a next at loop.

Q5. What is a bucket sort?

A5 .The bucket sort is also called radix sort. It is a method that can be used to sort list at name alphabetically or numerically.

Q6. What is insertion sort?

A6. An insertion sort is one that sorts a set of values by inserting values into an existing sorted file.

Q7. How many passes are required in selection sort?

A7. The selection sort makes first pass in n-1 comparisions, the second pass in n-2 comparisons and so on.

Q8. How does quick sort works?

A8 .The quick sort works by partitioning the array to be sorted . And each partition is in turn sorted recursively.

Q9 .How does bucket sort works?

A9. First or all the list of names is sorted according to the first letter of each name in26 buckets. In second pass , names are arranged according to the second letter of each name and so on.

Q10. What is the efficiency of heap sort in worst case?

A10. O(n log n) is the efficiency of heap sort in worst case.