BANGALORE UNIVERSITY

CA-C5P: DATA STRUCTURES LAB

1. **Given {4,7,3,2,1,7,9,0} find the location of 7 using Linear and Binary search and also display its first occurrence**

```
//Given {4,7,3,2,1,7,9,0} find the location of 7 using
// Linear search and Binary search  and also display its
// first occurance

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

void LINEAR_SEARCH(int a[10], int n, int key)
{
    int i,found=0;
    for(i=0;i<n;i++)
    {
          if(key==a[i])
          {
            printf("\n %d found at a[%d]",key,i);
            found=1;
            break;
          }
     }
     if(found==0)
     printf("\n Element not found in the list");
}

void BINARY_SEARCH(int a[10], int key, int first, int last)
{
   int mid;
   mid=(first+last)/2;

   if(key < a[mid])
              BINARY_SEARCH(a,key,first,mid-1);
   else if(key > a[mid])
              BINARY_SEARCH(a,key,mid+1,last);
   else
              printf("\n %d found at a[%d]",key,mid);
}
void DISPLAY_ARRAY(int a[10],int n)
{
  int i;
  printf("\n Given array : ");
  for(i=0;i<n;i++)
  {
        printf("%3d",a[i]);
  }
}
```

```
void main()
{
   int a[8] = {4,7,3,2,1,7,9,0};
   int sa[8] = {0,1,2,3,4,7,7,9};
   int n=8;
   int key=7;
   int choice;
   clrscr();
   printf("\n 1. Linear Search");
   printf("\n 2. Binary Search");
   printf("\n Enter your choice :");
   scanf("%d",&choice);
   switch(choice)
   {
        case 1 :  {
                  DISPLAY_ARRAY(a,n);
                  LINEAR_SEARCH(a,n,key);
                  break;
                  }

        case 2 :  {
                  DISPLAY_ARRAY(sa,n);
                  BINARY_SEARCH(sa,key,0,n-1);
                  break;
                  }
         default : printf("\n Invalid choice ");
   }
   getch();
}
```

OUTPUT :

LINEAR SEARCH :

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

Given array :   4  7  3  2  1  7  9  0
7 found at a[1]
```

BINARY SEARCH

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

Given array :   0  1  2  3  4  7  7  9
7 found at a[5]
```

2. **Given {5,3,1,6,0,2,4} order the numbers in ascending order using Bubble Sort Algorithm**

```
// C program to perform Bubble Sort
# include<stdio.h>
# include<conio.h>
void BUBBLE_SORT(int a[], int n)
{
   int pass,temp,j,i;
   for(pass=1;pass<=n-1;pass++)
   {
          for(j=0;j<=n-pass-1;j++)
          {
             if(a[j] > a[j+1])
             {

                   temp=a[j];
                   a[j]=a[j+1];
                   a[j+1]=temp;
             }
           }
   printf("\n Array after %d pass --->",pass);
   for(i=0;i<n;i++)
   printf("%3d",a[i]);
   }

}

 void main()
 {
    int a[7]={5,3,1,6,0,2,4};
    int n=7;
    clrscr();
    printf("\n Input arrays : 5 3 1 6 0 2 4");
    BUBBLE_SORT(a,n);
    getch();
}
```

OUTPUT :

```
Input arrays : 5 3 1 6 0 2 4
Array after 1 pass --->  3  1  5  0  2  4  6
Array after 2 pass --->  1  3  0  2  4  5  6
Array after 3 pass --->  1  0  2  3  4  5  6
Array after 4 pass --->  0  1  2  3  4  5  6
Array after 5 pass --->  0  1  2  3  4  5  6
Array after 6 pass --->  0  1  2  3  4  5  6
```

3(a). **Perform the Insertion sort on the input {75,8,1,16,48,3,7,0} and display the output in descending order.**

```
// C program to perform Insertion sort
# include<stdio.h>
# include<conio.h>
// Insertion sort

void INSERTION_SORT(int a[], int n)
{
   int pass,k,temp,i,j;
         for(pass=1;pass<n;pass++)
         {
            k=a[pass];
            for(j=pass-1;j>=0 && k<a[j];j--)
            {
              a[j+1] = a[j];
            }
            a[j+1]=k;
   printf("\n\n Sorted arrays after %d pass -->",pass);
   for(i=0;i<n;i++)
   printf("%3d",a[i]);
   }

   printf("\n\n Sorted arrays using Insertion sort in Descending Order\n");
   for(i=n-1;i>=0;i--)
   {
    printf("%3d",a[i]);
   }
 }

 void main()
 {
    int a[8]={75,8,1,16,48,3,7,0};
    int n=8;
    clrscr();
    printf("\n Input arrays : 75,8,1,16,48,3,7,0");
    INSERTION_SORT(a,n);
    getch();
}
```

OUTPUT : INSERTION SORT

```
Input arrays : 75,8,1,16,48,3,7,0

Sorted arrays after 1 pass -->  8 75  1 16 48  3  7  0

Sorted arrays after 2 pass -->  1  8 75 16 48  3  7  0

Sorted arrays after 3 pass -->  1  8 16 75 48  3  7  0

Sorted arrays after 4 pass -->  1  8 16 48 75  3  7  0

Sorted arrays after 5 pass -->  1  3  8 16 48 75  7  0

Sorted arrays after 6 pass -->  1  3  7  8 16 48 75  0

Sorted arrays after 7 pass -->  0  1  3  7  8 16 48 75

Sorted arrays using Insertion sort in Descending Order
75 48 16  8  7  3  1  0_
```

3(b). **Perform the Selection sort on the input {75,8,1,16,48,3,7,0} and display the output in descending order.**

```
// C program to perform Selection sort
# include<stdio.h>
# include<conio.h>
// Selection sort
int MIN(int a[],int k, int n)
{
    int loc,j,min;
    min=a[k];
    loc=k;
    for(j=k+1;j<=n-1;j++)
    {
            if(min>a[j])
            {
              min=a[j];
              loc=j;
            }
     }
     return(loc);
}

void SELECTION_SORT(int a[], int k, int n)
{
   int i,loc,temp;
          for(k=0;k<n;k++)
          {
            loc=MIN(a,k,n);
            temp=a[k];
            a[k]=a[loc];
            a[loc]=temp;
   printf("\n\nSorted arrays after %d pass:-->",k);
   for(i=0;i<n;i++)
   printf("%3d",a[i]);
   }
   printf("\n\n Sorted arrays using Selection sort in Descending Order\n");
   for(i=n-1;i>=0;i--)
   {
    printf("%3d",a[i]);
   }
 }
 void main()
 {
    int a[8]={75,8,1,16,48,3,7,0};
    int n=8;
    clrscr();
 printf("\n Input arrays : 75,8,1,16,48,3,7,0");
    SELECTION_SORT(a,0,n);
    getch();
}
```

```
 Input arrays : 75,8,1,16,48,3,7,0

Sorted arrays after 0 pass:-->  0  8  1 16 48  3  7 75

Sorted arrays after 1 pass:-->  0  1  8 16 48  3  7 75

Sorted arrays after 2 pass:-->  0  1  3 16 48  8  7 75

Sorted arrays after 3 pass:-->  0  1  3  7 48  8 16 75

Sorted arrays after 4 pass:-->  0  1  3  7  8 48 16 75

Sorted arrays after 5 pass:-->  0  1  3  7  8 16 48 75

Sorted arrays after 6 pass:-->  0  1  3  7  8 16 48 75

Sorted arrays after 7 pass:-->  0  1  3  7  8 16 48 75

 Sorted arrays using Selection sort in Descending Order
 75 48 16  8  7  3  1  0_
```

4. **Write a program to insert the elements {61,16,8,27} into singly linked list and delete 8,61,27 from the list. Display your list after each insertion and deletion.**

```
// C program to insert {61,16,8,27} and delete {8,61,27} from the list
# include<stdio.h>
# include<conio.h>
# include<alloc.h>
# include<ctype.h>

typedef struct node
{
  int info;
  struct node *link;
}NODE;

NODE *header=NULL;
 void DISPLAY()
 {
    NODE *start=header;
    printf("\n *** LIST ***  :  ");
    while(start!=NULL)
    {
          printf("%4d",start->info);
          start=start->link;
    }
 }



void INSERT(int item)
{
   NODE *newnode,*curptr;
   newnode = (NODE *) malloc(sizeof(NODE));
   newnode->info=item;
   newnode->link=NULL;

   if(header==NULL)
   header=newnode;
   else
   {
          curptr=header;
          while(curptr->link !=NULL)
          {
            curptr=curptr->link;
          }
          curptr->link=newnode;
   }
   DISPLAY();
}
void DELETE(int item)
{
```

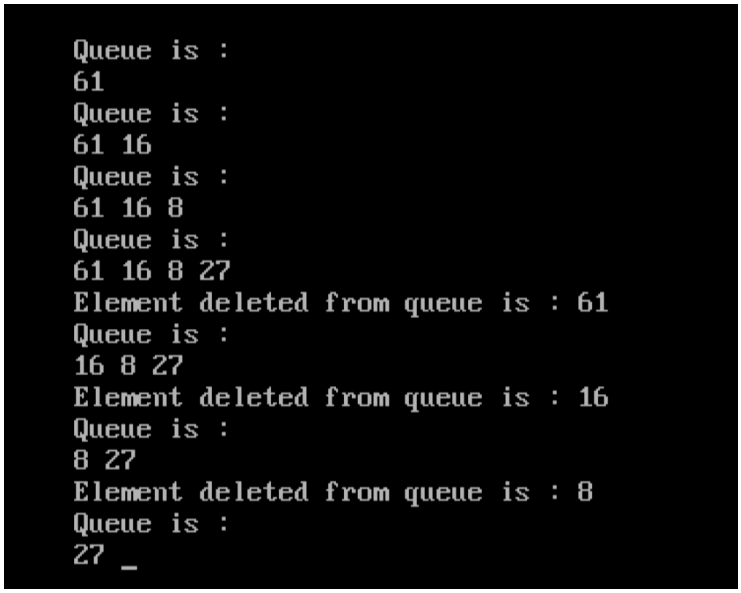
```
  NODE *curptr=header, *prevptr=header;

  if(header==NULL)
  {
    printf("\n EMPTY LIST");
  }
  else if(header->info==item)
  {
    header=header->link;
    free(curptr);
  }
  else
  {
                while(curptr!=NULL)
                {
                    if(curptr->info==item)
                    {
                                prevptr->link=curptr->link;
                                free(curptr);
                                curptr=curptr->link->link;
                    }
                    else
                    {
                                prevptr=curptr;
                                curptr=curptr->link;
                    }
                }
  }
  DISPLAY();
}

 void main()
 {
   int item,choice;
   clrscr();
   printf("\n Insertion :");
   INSERT(61);
   INSERT(16);
   INSERT(8);
   INSERT(27);
   printf("\n Deletion :");
   DELETE(8);
   DELETE(61);
   DELETE(27);
   getch();
 }
 }
```

```
Insertion :
*** LIST ***  :    61
*** LIST ***  :    61  16
*** LIST ***  :    61  16   8
*** LIST ***  :    61  16   8  27
Deletion :
*** LIST ***  :    61  16  27
*** LIST ***  :    16  27
*** LIST ***  :    16_
```

5. Write a program to insert the elements {61,16,8,27} into linear queue and delete three elements from the list. Display your list after each insertion and deletion.

```
// Program to insert the elements {61,16,8,27} into linear queue
// delete three elements from the list
#include <stdio.h>
#define MAX 50

int queue_array[MAX];
int rear = - 1;
int front = - 1;

void display()
{
   int i;
   if (front == - 1)
         printf("\nQueue is empty \n");
   else
   {
         printf("\nQueue is : \n");
         for (i = front; i <= rear; i++)
            printf("%d ", queue_array[i]);
   }
   getch();
}



void insert_Q(int item)
{
   if (rear == MAX - 1)
   printf("Queue Overflow \n");
   else
   {
         if (front == - 1)
         front = 0;
         rear = rear + 1;
         queue_array[rear] = item;
   }
   display();
}

void delete_Q()
{
   if (front == - 1 || front > rear)
   {
         printf("\nQueue Underflow ");
         return ;
   }
```

```
    else
    {
        printf("\nElement deleted from queue is : %d", queue_array[front]);
        front = front + 1;
    }
    display();

}
void main()
{
    int choice;
    clrscr();
    insert_Q(61);
    insert_Q(16);
    insert_Q(8);
    insert_Q(27);

    delete_Q();
    delete_Q();
    delete_Q();
    getch();
}
```



6. Write a program to insert the elements {61,16,8,27} into circular queue and delete 4 elements from the list. Display your list after each insertion and deletion

```
/*static circular queue*/
#include <stdio.h>
#define size 4
int front =  - 1;
int rear =  - 1;
int queue[size];
void display_CQ()
{
   int i;
   printf("\n Circular Queue : ");
   if (front > rear)
   {
          for (i = front; i < size; i++)
          {
             printf("%d ->", queue[i]);
          }
          for (i = 0; i <= rear; i++)
             printf("%d -> ", queue[i]);
   }
   else
   {
          for (i = front; i <= rear; i++)
             printf("%d ->", queue[i]);
   }
   printf("[%d]",queue[front]);
   getch();
}

void insert_CQ(int item)
{
   if ((front == 0 && rear == size - 1) || (front == rear + 1))
   {
          printf("queue is full");
          return;
   }
   else if (rear ==  - 1)
   {
          rear++;
          front++;
   }
   else if (rear == size - 1 && front > 0)
   {
          rear = 0;
   }
   else
   {
          rear++;
   }
```

```
    queue[rear] = item;
    display_CQ();
}



void delete_CQ()
{
    if (front ==  - 1)
    {
        printf("Queue is empty ");
    }
    else if (front == rear)
    {
        front =  - 1;
        rear =  - 1;
    }
    else
    {
        front++;
    }
    display_CQ();
}
int main()
{
  clrscr();
  printf("\n *** Insertion *** : ");
  insert_CQ(61);
  insert_CQ(16);
  insert_CQ(8);
  insert_CQ(27);
  printf("\n *** Deletion *** : ");
  delete_CQ();
  delete_CQ();
  delete_CQ();
  delete_CQ();

}
```

OUTPUT :

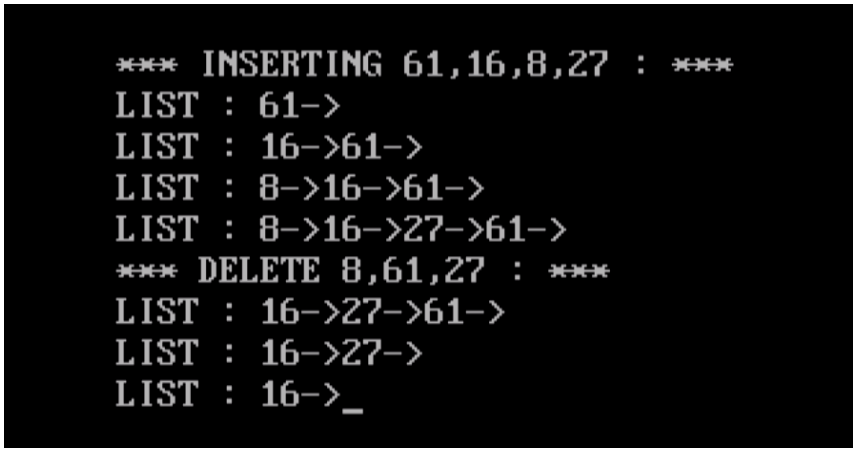
```
*** Insertion *** :
Circular Queue : 61 ->[61]
Circular Queue : 61 ->16 ->[61]
Circular Queue : 61 ->16 ->8 ->[61]
Circular Queue : 61 ->16 ->8 ->27 ->[61]
*** Deletion *** :
Circular Queue : 16 ->8 ->27 ->[16]
Circular Queue : 8 ->27 ->[8]
Circular Queue : 27 ->[27]
Circular Queue : 0 ->[0]
```

7. Write a program to insert the elements {61,16,8,27} into ordered singly linked list and delete 8,61,27 from the list. Display your list after each insertion and deletion

```
// C program to insert {61,16,8,27} in the ordered singly linked list
// and delete 8,61,27 from the list.

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

typedef struct node
{
    int info;
    struct node *link;
}NODE;

NODE *header;

void CREATE_HEADER()
{
    header = (NODE *) malloc(sizeof(NODE));
    header->info=0;
    header->link=NULL;
}


void INSERT_ORDERLIST(int item)
{
   NODE *NEWNODE, *PREVPTR, *CURPTR;

   NEWNODE = (NODE *) malloc(sizeof(NODE));
   NEWNODE->info = item;
   NEWNODE->link = NULL;

   if(header->link==NULL)
   {
            header->link=NEWNODE;
   }
   else if(item < header->info)
   {
            NEWNODE->link=header;
            header=NEWNODE;
   }
   else
   {
            PREVPTR=header;
            CURPTR=header->link;
            while(CURPTR!=NULL && item > CURPTR->info)
            {
               PREVPTR=CURPTR;
               CURPTR=CURPTR->link;
```

```
            }
            PREVPTR->link=NEWNODE;
            NEWNODE->link=CURPTR;

    }

}
void DISPLAY_NODE()
{
    NODE *CURPTR;
    CURPTR=header->link;
    printf("\n LIST : ");
    while(CURPTR!=NULL)
    {
          printf("%d->",CURPTR->info);
          CURPTR=CURPTR->link;
    }
}

void DELETE_NODE(int item)
{
     NODE *PREVPTR, *CURPTR;
     PREVPTR=header;
     CURPTR=header->link;
     if(item == header->info)
     {
           header=CURPTR;
           free(PREVPTR);
    }
    else
    {
            while(CURPTR!=NULL && CURPTR->info !=item)
            {
                  PREVPTR=CURPTR;
                  CURPTR=CURPTR->link;
            }
            if(CURPTR!=NULL)
            {
                  PREVPTR->link=CURPTR->link;
                  free(CURPTR);
            }
            else
            printf("\n Data not found");
    }
}

void main()
{
   clrscr();
   CREATE_HEADER();
```

```
    printf("\n *** INSERTING 61,16,8,27 :  ***");
    INSERT_ORDERLIST(61);
    DISPLAY_NODE();
    INSERT_ORDERLIST(16);
    DISPLAY_NODE();
    INSERT_ORDERLIST(8);
    DISPLAY_NODE();
    INSERT_ORDERLIST(27);
    DISPLAY_NODE();

    printf("\n *** DELETE 8,61,27 : ***");
    DELETE_NODE(8);
    DISPLAY_NODE();
    DELETE_NODE(61);
    DISPLAY_NODE();
    DELETE_NODE(27);
    DISPLAY_NODE();
    getch();
}
```



8. Write a program to add 6x3+10x2+0x+5 and 4x2+2x+1 using linked list.

```
/*WAP to add Polynomial using linked list*/
#include<stdio.h>
#include<stdlib.h>
#include<conio.h>
struct polynomial
{
int coeff;
int power;
struct polynomial *LINK;
};
typedef struct polynomial NODE;
NODE *poly1=NULL,*poly2=NULL,*poly3 = NULL;
NODE *create_poly();
NODE *add_poly(NODE *poly1,NODE *poly2);
void display_poly(NODE *ptr);


/* To create the polynomial*/
NODE *create_poly()
{
int flag;
int coeff,pow;
NODE *tmp_node =(NODE *)malloc(sizeof(NODE));//create thefirst node
NODE *poly=tmp_node;
do
{
printf("\n Enter coeff:");
scanf("%d",&coeff);
tmp_node->coeff=coeff;
printf("\n Enter Pow:");
scanf("%d",&pow);
tmp_node->power = pow;
tmp_node->LINK=NULL;
printf("\n Do you want to add more terms? (Y=1/N=0):");
scanf("%d",&flag);
if(flag==1)
{
tmp_node->LINK=(NODE *) malloc(sizeof(NODE));
tmp_node = tmp_node->LINK;
tmp_node -> LINK = NULL;
}
} while(flag);
return poly;
}
```

```
/*add two polynomial */
NODE *add_poly(NODE *poly1, NODE *poly2)
{
NODE *tmp_node,*poly;//Temporary storage for the linked list
tmp_node=(NODE *)malloc(sizeof(NODE));
tmp_node->LINK = NULL;
poly3=tmp_node;
//Loop while both of the linked list have value
while(poly1&&poly2)
{
if(poly1->power > poly2->power)
{
tmp_node->power=poly1->power;
tmp_node->coeff=poly1->coeff;
poly1=poly1->LINK;
}
else if (poly1->power < poly2->power)
{
tmp_node->power = poly2-> power;
tmp_node->coeff =poly2->coeff;
poly2 = poly2->LINK;
}
else
{
tmp_node->power = poly1->power;
tmp_node->coeff = poly1->coeff+poly2->coeff;
poly1=poly1->LINK;
poly2=poly2->LINK;
}
if(poly1&&poly2)
{
tmp_node->LINK=(NODE *)malloc(sizeof(NODE));
tmp_node=tmp_node->LINK;
tmp_node->LINK=NULL;
}
}
//Loop while either of the linked list has value
while(poly1||poly2)
{
tmp_node->LINK =(NODE *)malloc(sizeof(NODE));
tmp_node=tmp_node->LINK;
tmp_node->LINK=NULL;
if(poly1)
{
tmp_node->power=poly1->power;
tmp_node->coeff=poly1->coeff;
poly1=poly1->LINK;
}
if(poly2)
```

```
{
tmp_node->power=poly2->power;
tmp_node->coeff=poly2->coeff;
poly2=poly2->LINK;
}
}
}
/* Display polynomial */
void display(NODE *ptr)
{
while(ptr!=NULL)
{
printf("%dX^%d",ptr->coeff,ptr->power);
ptr=ptr->LINK;
if(ptr!=NULL)
printf(" + ");
}
}
int main()
{
clrscr();
printf("\n Create 1st Polynomial: ");
poly1=create_poly();
printf("\n First polynomial : ");
display(poly1);
printf("\n Create 2nd Polynomial:");
poly2=create_poly();
printf("\n Second polynomial :");
display(poly2);
add_poly(poly1,poly2);
printf("\n Addition of Two polynomials : ");
display(poly3);
getch();
}
```

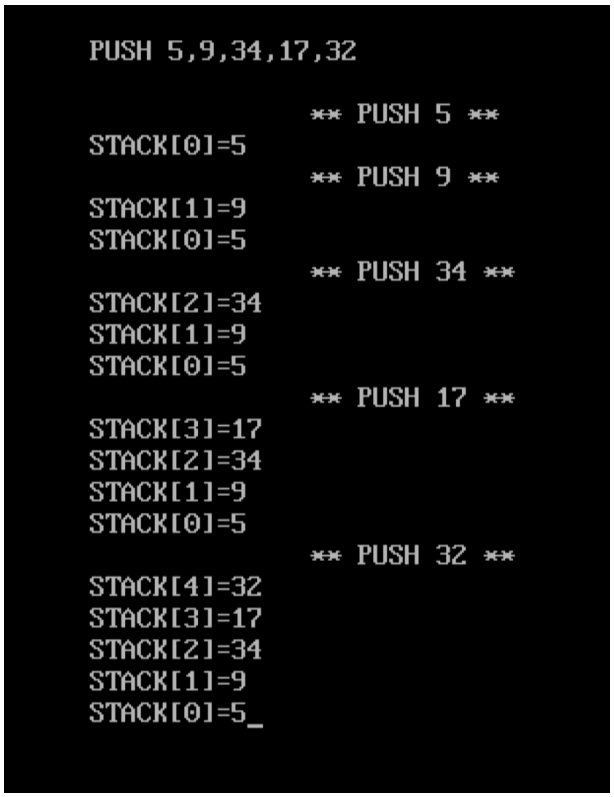
```
 Create 1st Polynomial:
Enter coeff:6
Enter Pow:3

 Do you want to add more terms? (Y=1/N=0):1

Enter coeff:10
Enter Pow:2

 Do you want to add more terms? (Y=1/N=0):1

Enter coeff:0
Enter Pow:1

 Do you want to add more terms? (Y=1/N=0):1

Enter coeff:5
Enter Pow:0
```

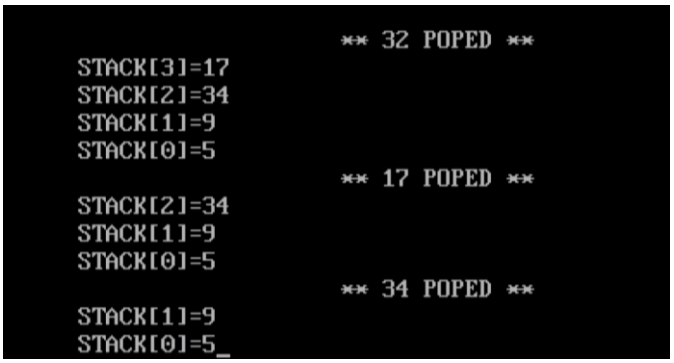
```
 Do you want to add more terms? (Y=1/N=0):0

 First polynomial : 6X^3 + 10X^2 + 0X^1 + 5X^0
 Create 2nd Polynomial:
       Enter coeff:4
Enter Pow:2

 Do you want to add more terms? (Y=1/N=0):1

       Enter coeff:2
Enter Pow:1

 Do you want to add more terms? (Y=1/N=0):1

       Enter coeff:1
Enter Pow:0

 Do you want to add more terms? (Y=1/N=0):0

 Second polynomial :4X^2 + 2X^1 + 1X^0
 Addition of Two polynomials : 6X^3 + 14X^2 + 2X^1 + 6X^0_
```

9. Write a program to push 5,9,34,17,32 into stack and pop 3 times from the stack, also display the popped numbers

```
//C program to push 5,9,34,17,32 into stack and
//pop 3 times from the stack (Array implementation)

# include<stdio.h>
# include<conio.h>
# define MAX 5


int STACK[MAX];
int TOP=-1;
void DISPLAY();
void PUSH(int item)
{
  if(TOP==MAX-1)
  {
    printf("\n STACK Overflow");
  }
  else
  {
     printf("\n ** PUSH %d **",item);
     TOP=TOP+1;
     STACK[TOP]=item;
     DISPLAY();
  }
}
void POP()
{
   if(TOP==-1)
   {
     printf("\n STACK Underflow");
     getch();
     }
   else
   {
    printf("\n ** %d POPED **",STACK[TOP]);
    TOP=TOP-1;
    DISPLAY();
   }
}

void DISPLAY()
{
   int i;
   for(i=TOP;i>=0;i--)
   {
    printf("\n STACK[%d]=%d",i,STACK[i]);
```

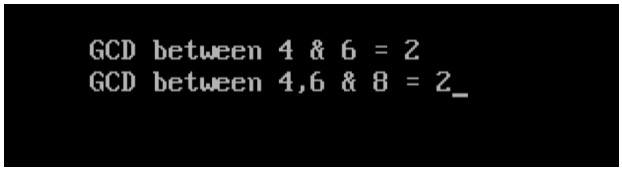
```
    }
    getch();
  }
  void main()
  {
    int i;
    clrscr();
    printf("\n PUSH 5,9,34,17,32\n");
    PUSH(5);
    PUSH(9);
    PUSH(34);
    PUSH(17);
    PUSH(32);
    printf("\n POP 3 elements\n");
    POP();
    POP();
    POP();
}
```





10. Write a recursive program to find GCD of 4,6,8.

```
// C program to find GCD (4,6,8) using recursion.

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

int GCD(int m, int n)
{
   if(n==0)
   {
     return(m);
   }
   else if(n>m)
   {
         return(GCD(n,m));
   }
   else
   {
     return(GCD(n,m%n));
   }
}
void main()
{
   // three nos 4,6,8
   int gcd12, gcd3;
   clrscr();
   gcd12=GCD(4,6);
   printf("\n GCD between 4 & 6 = %d",gcd12);
   gcd3=(GCD(gcd12,8));
   printf("\n GCD between 4,6 & 8 = %d",gcd3);
   getch();
}
```



12. Write a program to convert an infix expression x^y/(5*z)+2 to its postfix expression

```
#include <stdio.h>
#include <ctype.h>

#define SIZE 50

char stack[SIZE];
int top=-1;

push(char elem)
{
   stack[++top]=elem;
}

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

int pr(char symbol)
{

        if(symbol == '^')
        {
                return(3);
        }
        else if(symbol == '*' || symbol == '/')
        {
                return(2);
        }
        else if(symbol == '+' || symbol == '-')
        {
                return(1);
        }
        else
        {
                return(0);
        }
}

void main()
{
   char infix[50],postfix[50],ch,elem;
   int i=0,k=0;
   clrscr();
   printf("Enter Infix Expression : ");
   scanf("%s",infix);
   push('#');
   while( (ch=infix[i++]) != '\0')
```

```
        {
                if( ch == '(') push(ch);
                else
                   if(isalnum(ch)) postfix[k++]=ch;
                   else
                           if( ch == ')')
                           {
                              while( stack[top] != '('
                                      postfix[k++]=pop();
                              elem=pop();
                           }
                           else
                           {
                              while( pr(stack[top]) >= pr(ch) )
                                      postfix[k++]=pop();
                              push(ch);
                           }
        }
        while( stack[top] != '#')
                postfix[k++]=pop();
        postfix[k]='\0';
        printf("\nPostfix Expression =  %s\n",postfix);
        getch();
}
```

```
Enter Infix Expression : x^y/(5*z)+2

Postfix Expression =  xy^5z*/2+
```

13. Write a program to evaluate a postfix expression 5 3+8 2 - *.

```
#include<stdio.h>
int stack[20];
int top = -1;

void push(int x)
{
   stack[++top] = x;
}

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

int main()
{
   char *postfix;
   int A,B,RES,num;
   clrscr();
   printf("Enter the expression :: ");
   scanf("%s",postfix);
   while(*postfix != '\0')
   {

         if(isdigit(*postfix))
         {
            num = *postfix - 48; // converting char into num
            push(num);
         }
         else
         {
            A = pop();
            B = pop();
            switch(*postfix)
            {
            case '+':  RES = B + A;   break;
            case '-':  RES = B - A;   break;
            case '*':  RES = B * A;   break;
            case '/':  RES = B / A;   break;

            }
            push(RES);
         }
         postfix++;
   }
   printf("\nThe result of expression   =  %d\n\n",pop());
   getch();
}
```

```
Enter the expression :: 53+82-*

The result of expression   =  48
```

15. Write a program to create binary search tree with the elements {2,5,1,3,9,0,6} and perform inorder, preorder and post order traversal.

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

typedef struct BST {
  int data;
  struct BST *lchild, *rchild;
} node;

node *create_node() {
  node *temp;
  temp = (node *) malloc(sizeof(node));
  temp->lchild = NULL;
  temp->rchild = NULL;
  return temp;
}
void insert(node *root, node *new_node) {
  if (new_node->data < root->data) {
    if (root->lchild == NULL)
        root->lchild = new_node;
    else
        insert(root->lchild, new_node);
  }

  if (new_node->data > root->data) {
    if (root->rchild == NULL)
        root->rchild = new_node;
    else
        insert(root->rchild, new_node);
  }
}
void inorder(node *temp) {
  if (temp != NULL) {
    inorder(temp->lchild);
    printf("%3d", temp->data);
    inorder(temp->rchild);
  }
}
void preorder(node *temp) {
  if (temp != NULL) {
    printf("%3d", temp->data);
    preorder(temp->lchild);
    preorder(temp->rchild);
  }
}

void postorder(node *temp) {
  if (temp != NULL) {
```

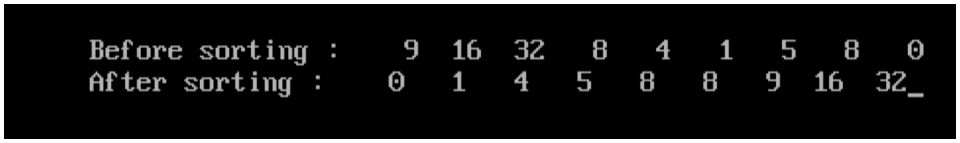
```
        postorder(temp->lchild);
        postorder(temp->rchild);
        printf("%3d", temp->data);
      }
    }
    void main()
    {
      int n=7,i=1;
      node *new_node, *root;
      node *create_node();
      root = NULL;
      clrscr();

      printf("\nProgram For Binary Search Tree ");
      for(i=1;i<=n;i++)
      {
              new_node = create_node();
              printf("\nEnter The Element ");
              scanf("%d", &new_node->data);

              if (root == NULL) /* Tree is not Created */
                root = new_node;
              else
                insert(root, new_node);
       }
              printf("\nThe Inorder display : ");
              inorder(root);
              printf("\nThe Preorder display : ");
              preorder(root);
              printf("\nThe Postorder display : ");
              postorder(root);
              getch();
}
```

```
Program For Binary Search Tree
Enter The Element 2

Enter The Element 5

Enter The Element 1

Enter The Element 3

Enter The Element 9

Enter The Element 0

Enter The Element 6

The Inorder display :   0  1  2  3  5  6  9
The Preorder display :   2  1  0  5  3  9  6
The Postorder display :   0  1  3  6  9  5  2
```

16. Write a program to Sort the following elements using heap sort {9.16,32,8,4,1,5,8,0}

```
// Heap Sort
# include<stdio.h>
void heapify(int a[], int n, int i)
{
   int largest = i;
   int left = 2 * i + 1;
   int right = 2 * i + 2;

   if(left < n && a[left] > a[largest])
   {
          largest = left;
   }

   if(right < n && a[right] > a[largest])
   {
           largest = right;
   }
   if(largest !=i)
   {
            int temp;
            temp = a[i];
            a[i] = a[largest];
            a[largest] = temp;
            heapify(a,n,largest);
   }
}

void HEAPSORT(int a[], int n)
{
  int i;
  for(i=n/2-1; i>=0;i--)
  heapify(a,n,i);
  for( i=n-1; i>=0; i--)
  {
            int temp;
            temp = a[0];
            a[0] = a[i];
            a[i] = temp;
            heapify(a,i,0);
   }
}
void printArr(int arr[], int n)
{
 int i;
 for( i=0; i<n; ++i)
 {
    printf("%4d",arr[i]);
 }
```

```
}

void main()
{
   int a[] = { 9,16,32,8,4,1,5,8,0 };
   int n = sizeof(a) / sizeof(a[0]);
   clrscr();
   printf("\n Before sorting : ");
   printArr(a,n);
   HEAPSORT(a,n);
   printf("\n After sorting : ");
   printArr(a,n);
   getch();
}
```



17. Given S1={“Flowers”} ; S2={“are beautiful”} I. Find the length of S1 II. Concatenate S1 and S2 III. Extract the substring “low” from S1 IV. Find “are” in S2 and replace it with “is”

```
// S1 = {"Flowers"} S2={"are beautiful"}
// Find : (a) Length of S1  (b) Concatenate S1 and S2
// (c) Extract the substring "low" from S1
// (d) Replace "are" with "is" in S2
# include<stdio.h>
# include<conio.h>
# include<string.h>

int LENGTH(char *str)
{
    int i=0, len=0;
    while(str[i]!='\0')
    {
      len++;
      i++;
    }
    return(len);
}

void CONCAT(char *str1, char *str2)
{
   int i=0,j=0;
   while(str1[i]!='\0')
   {
     i++;
   }
   while(str2[j]!='\0')
   {
     str1[i]=str2[j];
     i++;
     j++;
   }
   str1[i]='\0';
   printf("\n Concatenated string = %s",str1);
}
void EXTRACT(char *str,int pos, int elen)
{
   int i=0,j=0;
   char substr[10];
   for(i=pos;i<=elen;i++)
   {
          substr[j]=str[i];
          j++;
   }
   substr[j]='\0';
   printf("\n Substring = %s",substr);
}
```

```
void REPLACE(char *str, char *sstr, char *rstr, int pos)
{
    char output[50];
    int i=0,j=0,k=0;
    for(i=0;i<LENGTH(str);i++)
    {
          if(i==pos)
          {
             for(k=pos;k<LENGTH(rstr);k++)
             {
               output[j]=rstr[k];
               j++;
               i++;
             }
          }
          else
          {
              output[j]=str[i];
              j++;
          }
    }
    output[j]='\0';
    printf("\n Output = %s",output);
    getch();
}

void main()
{
  char *S1,*S2;
  int len,choice,pos,elen;
  while(1)
  {
  clrscr();
  strcpy(S1,"Flowers");
  strcpy(S2,"are beautiful");
  printf("\n S1 = %s  S2 = %s",S1,S2);
  printf("\n 1. Length 2.Concatenate 3.Extract Substring 4.REPLACE 5.Exit\n");
  printf("\n Enter your choice : ");
  scanf("%d",&choice);
  switch(choice)
  {
  case 1 : {
                    len = LENGTH(S1);
                    printf("\n Length of %s = %d",S1,len);
             }break;
  case 2:  {
                    CONCAT(S1,S2);
             }break;

  case 3: { printf("\n Enter position & length of substring in S1 : ");
```

```
                scanf("%d %d",&pos,&elen);
                EXTRACT(S1,pos,elen);
               }break;

        case 4: {
                REPLACE(S2,"are","is",0);
               }break;
        case 5: exit(0);
        default : printf("\n Invalid option");
       }
       getch();
       }
}
```

```
S1 = Flowers  S2 = are beautiful
1. Length 2.Concatenate 3.Extract Substring 4.REPLACE 5.Exit

Enter your choice : 1

Length of Flowers = 7_
```

```
S1 = Flowers  S2 = are beautiful
1. Length 2.Concatenate 3.Extract Substring 4.REPLACE 5.Exit

Enter your choice : 2

Concatenated string = Flowersare beautiful
```

```
S1 = Flowers  S2 = are beautiful
1. Length 2.Concatenate 3.Extract Substring 4.REPLACE 5.Exit

Enter your choice : 3

Enter position & length of substring in S1 : 1 3

Substring = low
```

```
S1 = Flowers  S2 = are beautiful
1. Length 2.Concatenate 3.Extract Substring 4.REPLACE 5.Exit

Enter your choice : 4

Output = is beautiful_
```