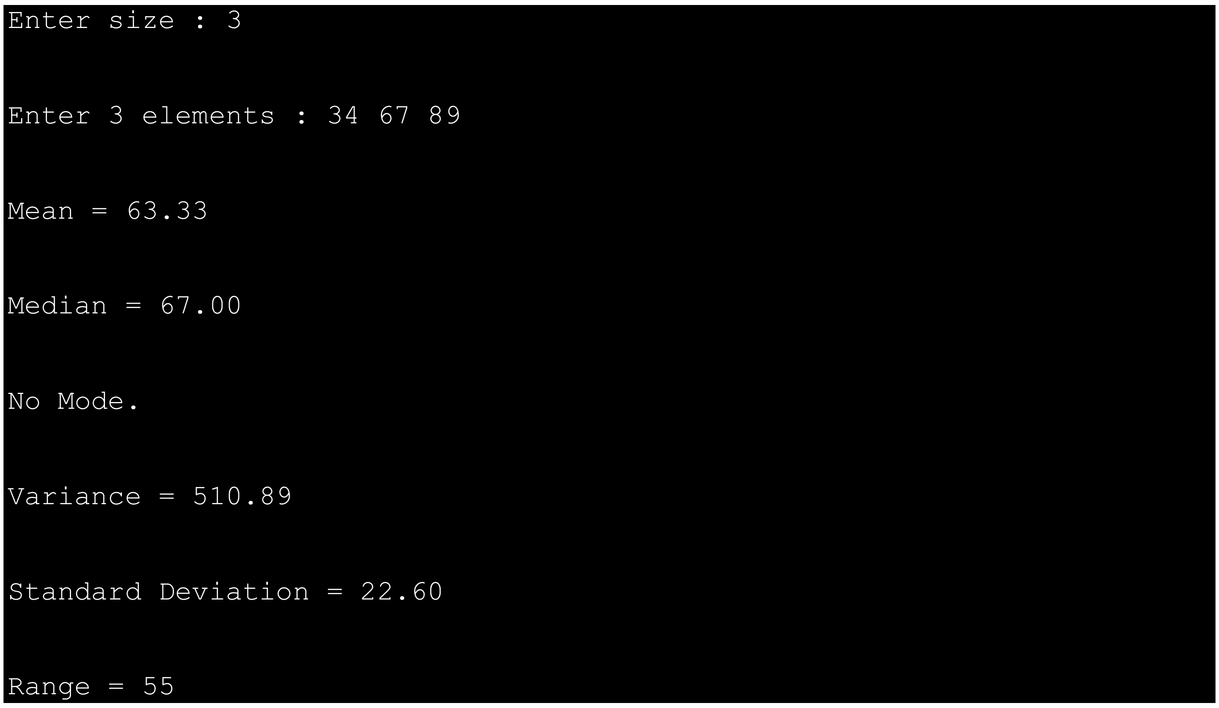
```
/* A. Array Manipulations using Pointers
One Dimensional Array: Write a C program to...
1. Find Mean, Median, Mode, Variance, Standard Deviation, and Range of 'n' elements in an
array */
#include<stdio.h>
int main()
{
 int arr[50],*p;
 p=arr;
 printf("Enter size : ");
 int size;
 scanf("%d",&size);
 printf("Enter %d elements : ",size);
 for(int i=0; i<size; i++)
 scanf("%d",p+i);
 // code for finding mean...
 float mean,sum=0.0;
 for(int i=0; i<size; i++)
 sum+=*(p+i);
 mean=sum/size;
 printf("Mean = %.2f",mean);
 // code for sorting the array...
 for(int round=1; round<size; round++)
 {
 for(int i=0; i<size-round; i++)
 {
 if(*(p+i)>*(p+i+1))
 {
 int temp=*(p+i);
 *(p+i)=*(p+i+1);
 *(p+i+1)=temp;
}
}
}
// code to find the median...
float median;
if(size%2)
median=*(p+size/2);
else
median=(*(p+size/2)+*(p+(size/2)-1))/2.0;
printf("\nMedian = %.2f",median);
// code to find the mode...
int C=0,mode;
for(int i=0; i<size; i++)
{
int count=0;
for(int j=0; j<size; j++)
{
if(*(p+i)==*(p+j))
count++;
}
if(count>C)
{
C=count;
mode=*(p+i);
}
}
if(C==1)
printf("\nNo Mode.");
else
printf("\nMode = %d",mode);
// code to find the variance...
```

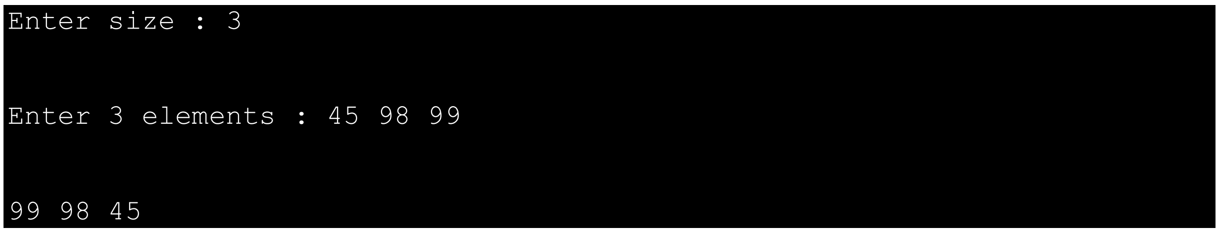
```
 sum=0.0;
 for(int i=0; i<size; i++)
 sum+=(*(p+i)-mean)*(*(p+i)-mean);
 printf("\nVariance = %.2f",sum/size);
 // code to find the standard deviation...
 printf("\nStandard Deviation = %.2f",sqrt(sum/size));
 // code to find the range...
 printf("\nRange = %d",*(p+size-1)-*(p));
 getch();
 return 0;
}
```



```
Enter size : 3

Enter 3 elements : 34 67 89

Mean = 63.33

Median = 67.00

No Mode.

Variance = 510.89

Standard Deviation = 22.60

Range = 55
```

```
/* A. Array Manipulations using Pointers
One Dimensional Array: Write a C program to...
2. Sort the 'n' elements of an array in Descending order */
#include<stdio.h>
int main()
{
 int arr[50],*p;
 p=arr;
```

```c
 printf("Enter size : ");
 int size;
 scanf("%d",&size);
 printf("Enter %d elements : ",size);
 for(int i=0; i<size; i++)
 scanf("%d",p+i);
 // code for sorting the array...
 for(int round=1; round<size; round++)
 {
 for(int i=0; i<size-round; i++)
 {
 if(*(p+i)<*(p+i+1))
 {
 int temp=*(p+i);
 *(p+i)=*(p+i+1);
 *(p+i+1)=temp;
 }
 }
}
 for(int i=0; i<size; i++)
 printf("%d ",*(p+i));
 getch();
 return 0;
}
```

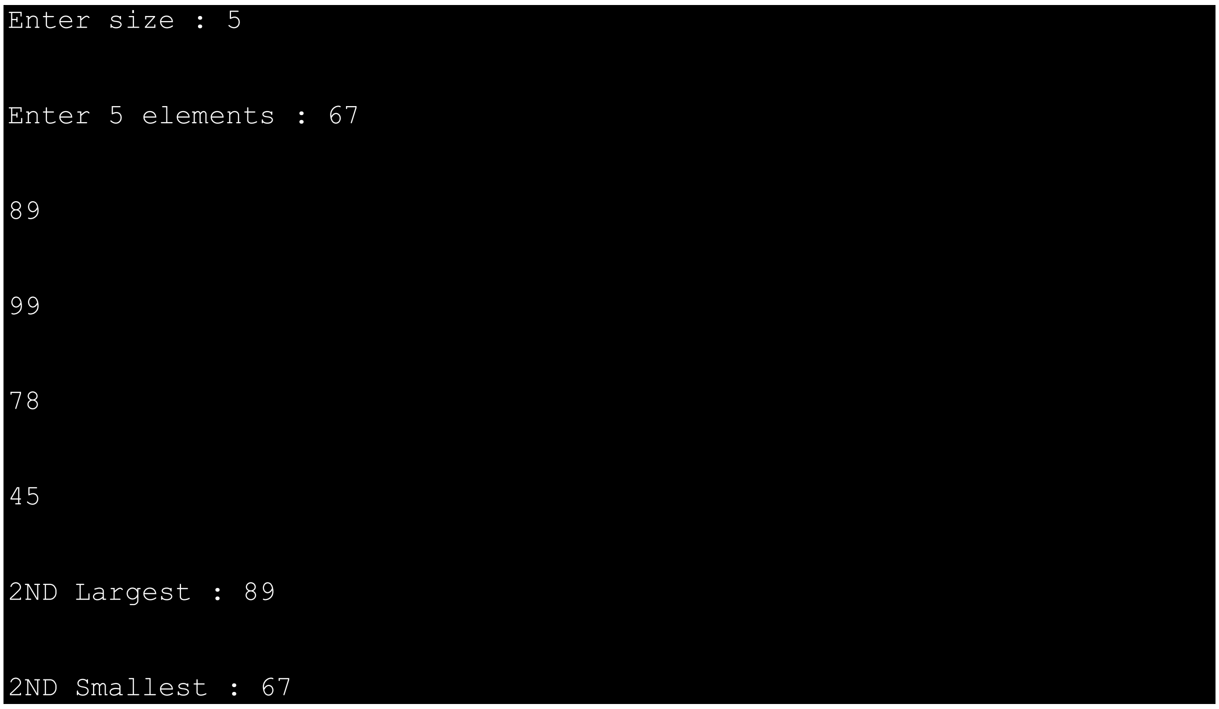


```
Enter size : 3

Enter 3 elements : 45 98 99

99 98 45
```

```c
/* A. Array Manipulations using Pointers
One Dimensional Array: Write a C program to...
3. Find the second largest and smallest element in an array */
```

```
#include<stdio.h>
#include<limits.h>
int main()
{
 int arr[50],*p;
 p=arr;
 printf("Enter size : ");
 int size;
 scanf("%d",&size);
 printf("Enter %d elements : ",size);
 for(int i=0; i<size; i++)
 scanf("%d",p+i);
 int l1,l2,s1,s2;
 l1=l2=INT_MIN;
 s1=s2=INT_MAX;
 for(int i=0; i<size; i++)
 {
 if(*(p+i)>l1)
 {
 l2=l1;
 l1=*(p+i);
 }
 else if(*(p+i)>l2 && *(p+i)!=l1)
 l2=*(p+i);
 if(*(p+i)<s1)
 {
 s2=s1;
 s1=*(p+i);
 }
 else if(*(p+i)<s2 && *(p+i)!=s1)
 s2=*(p+i);
```

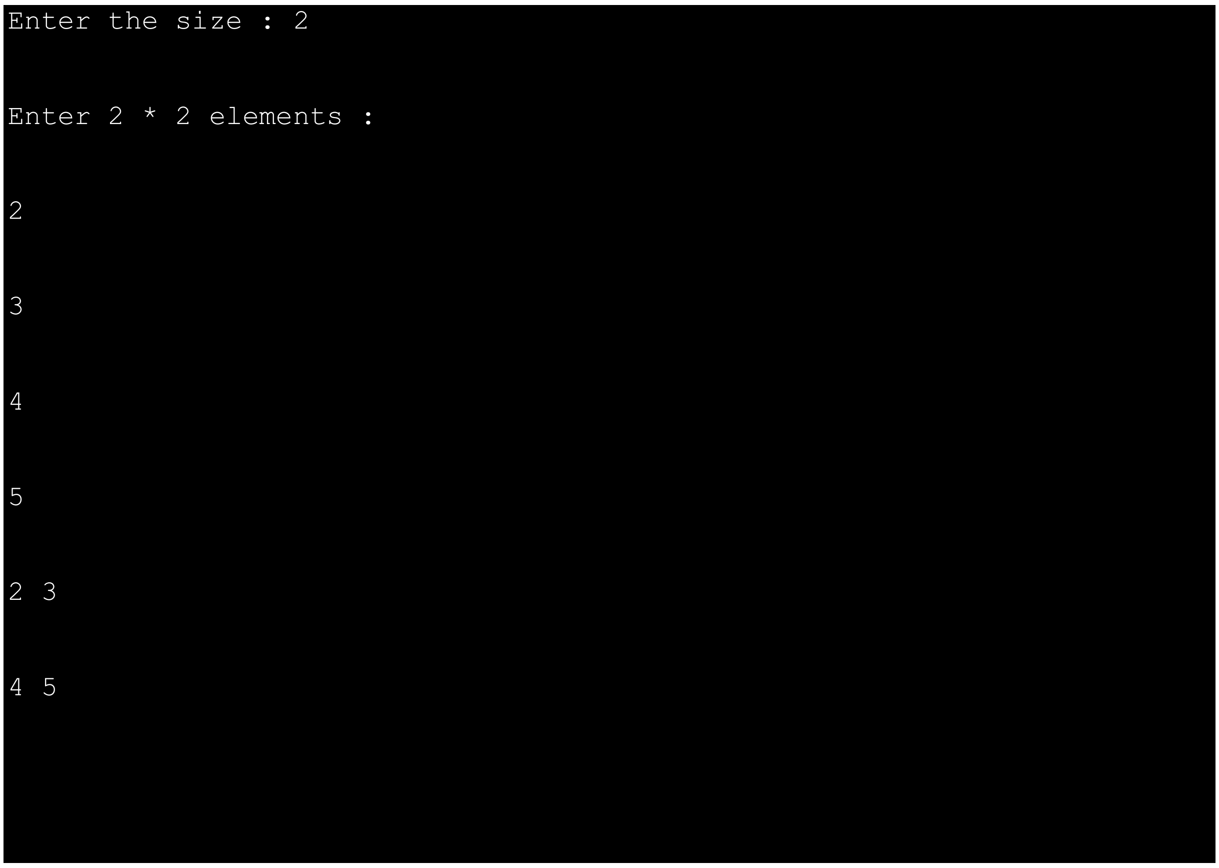
```c
 }
 printf("2ND Largest : %d",l2);
 printf("\n2ND Smallest : %d",s2);
}
```



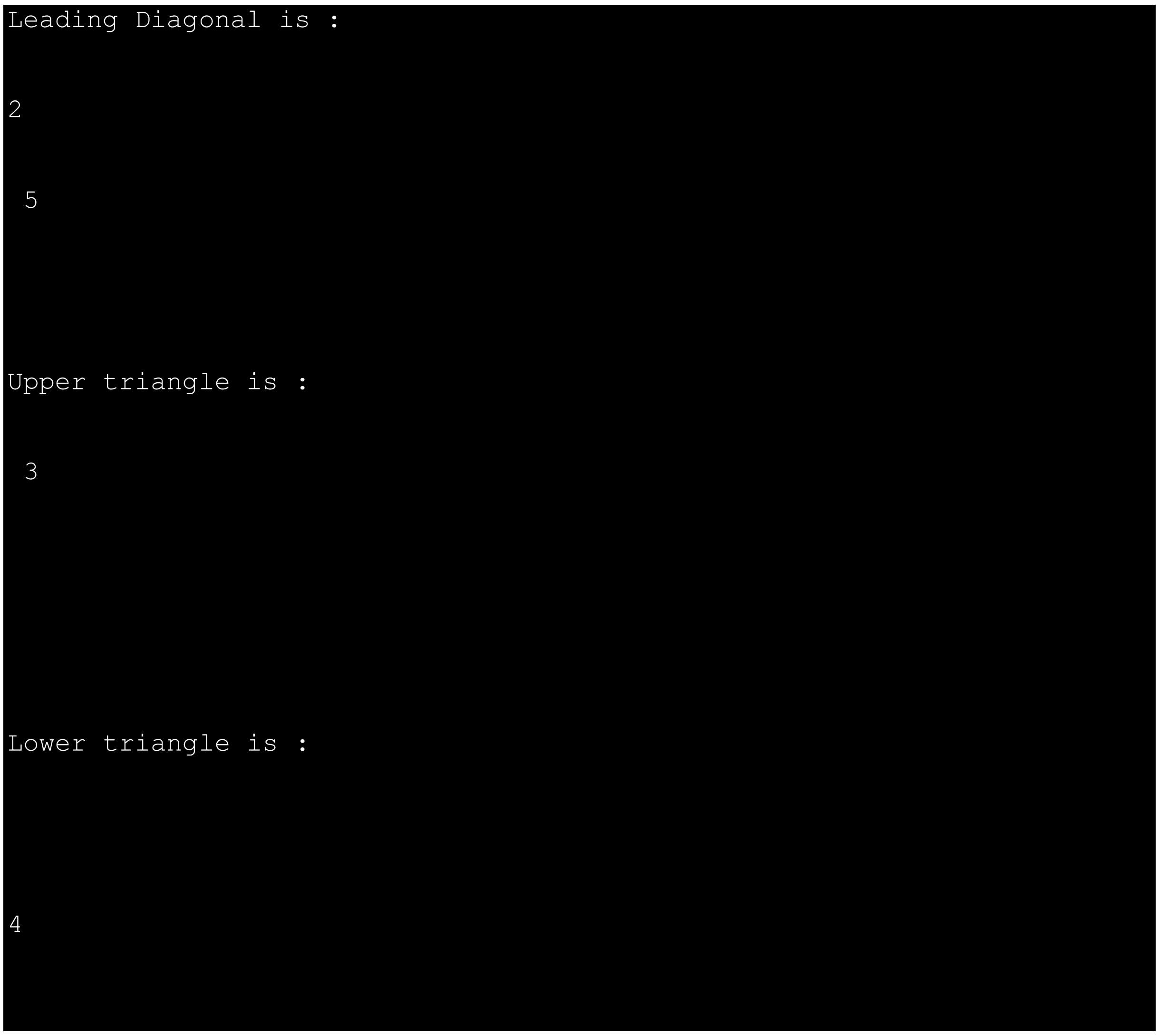
```
Enter size : 5

Enter 5 elements : 67

89

99

78

45

2ND Largest : 89

2ND Smallest : 67
```

```c
/* A. Array Manipulations using Pointers
Two Dimensional Array: Write a C program to...
4. Print the leading diagonal, upper triangular and lower triangular elements of mxm array
*/
int main()
{
 int arr[5][5],(*p)[5];
 p=arr;
 printf("Enter the size : ");
 int size;
 scanf("%d",&size);
 printf("Enter %d * %d elements : ",size,size);
 for(int i=0; i<size; i++)
 {
 for(int j=0; j<size; j++)
```

```
scanf("%d",*(p+i)+j);
}
for(int i=0; i<size; i++)
{
for(int j=0; j<size; j++)
{
printf("%d ",*(*(p+i)+j));
}
printf("\n");
}
printf("\nLeading Diagonal is : \n");
for(int i=0; i<size; i++)
{
for(int j=0; j<size; j++)
{
if(i==j)
printf("%d",*(*(p+i)+j));
else
printf(" ");
}
printf("\n");
}
printf("\nUpper triangle is : \n");
for(int i=0; i<size; i++)
{
for(int j=0; j<size; j++)
{
if(j>i)
printf("%d ",*(*(p+i)+j));
else
printf(" ");
}
printf("\n");
}
printf("\nLower triangle is : \n");
for(int i=0; i<size; i++)
{
for(int j=0; j<size; j++)
{
if(j<i)
printf("%d ",*(*(p+i)+j));
else
printf(" ");
}
printf("\n");
}
}
```



```
Enter the size : 2

Enter 2 * 2 elements :

2

3

4

5

2  3

4  5
```


```
Leading Diagonal is :

2

 5



Upper triangle is :

 3




Lower triangle is :



4
```

/* A. Array Manipulations using Pointers

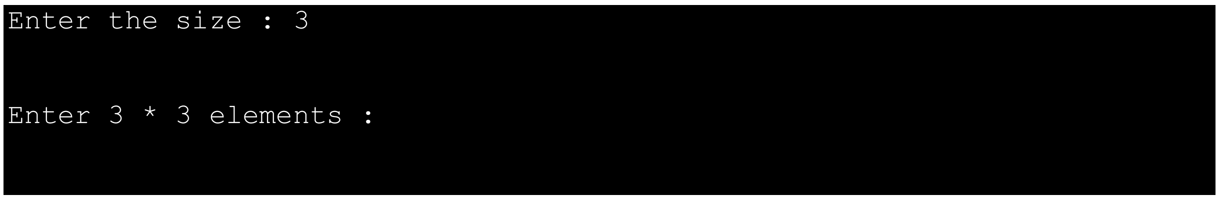
Two Dimensional Array: Write a C program to...

5. Find the maximum & minimum element in each row and each coloumn of mxm array */

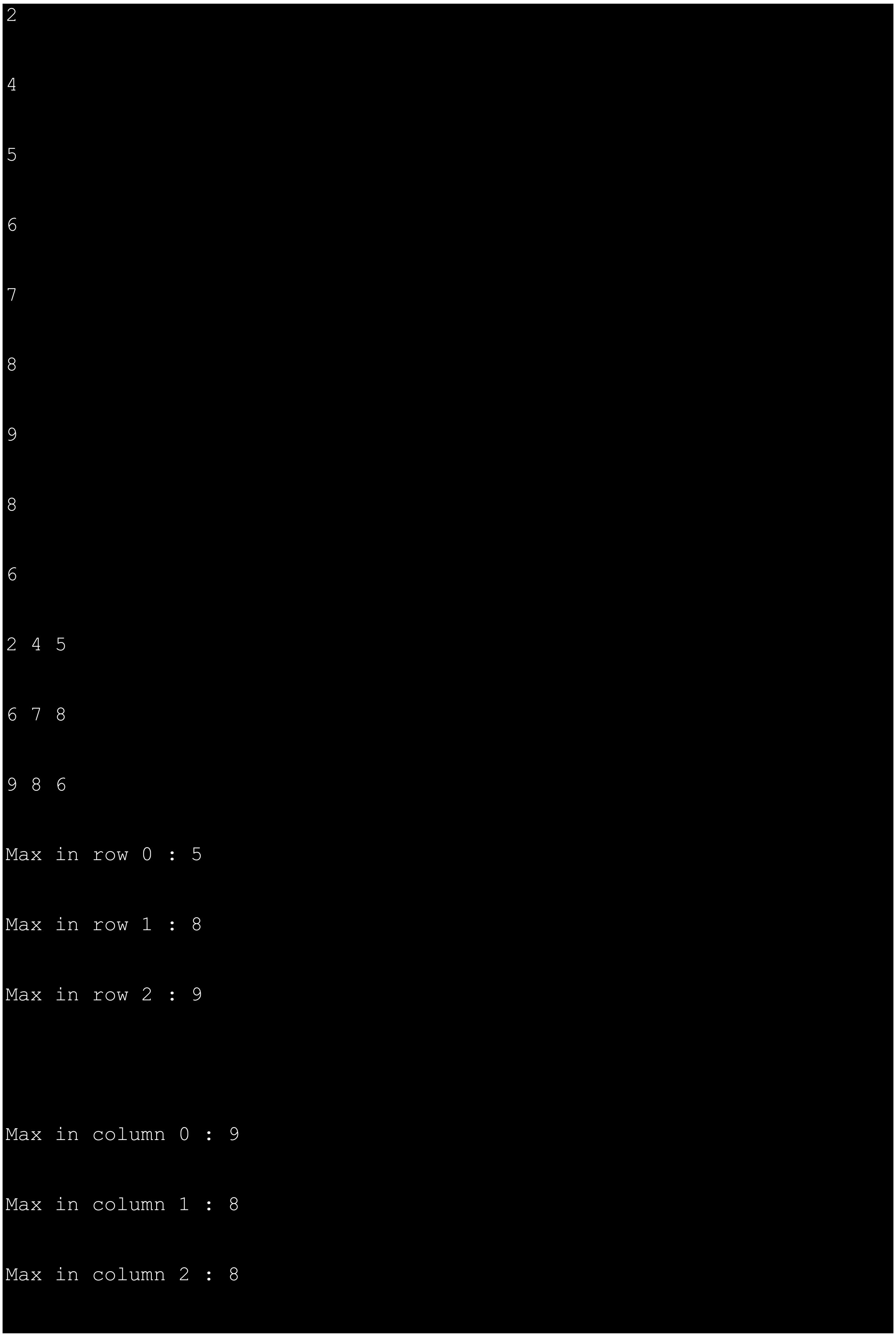
```
#include<stdio.h>

main()

{

 int arr[5][5],(*p)[5];

 p=arr;

 printf("Enter the size : ");

 int size;

 scanf("%d",&size);

 printf("Enter %d * %d elements : ",size,size);

 for(int i=0; i<size; i++)
```

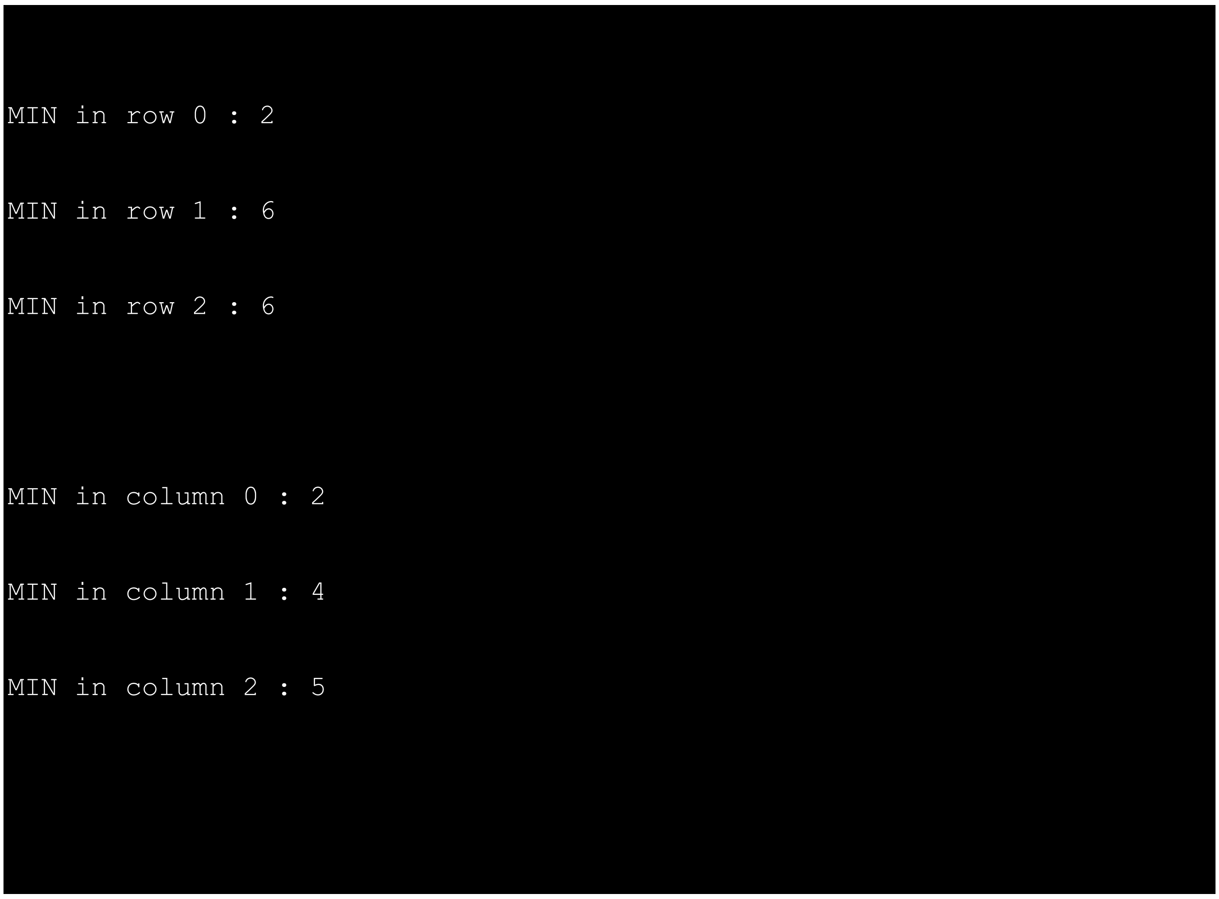
```
{
for(int j=0; j<size; j++)
scanf("%d",*(p+i)+j);
}
for(int i=0; i<size; i++)
{
for(int j=0; j<size; j++)
{
printf("%d ",*(*(p+i)+j));
}
printf("\n");
}
for(int i=0; i<size; i++)
{
int max=0;
for(int j=0; j<size; j++)
{
if(max< *(*(p+i)+j) )
max= *(*(p+i)+j);
}
printf("Max in row %d : %d\n",i,max);
}
printf("\n");
for(int i=0; i<size; i++)
{
int max=0;
for(int j=0; j<size; j++)
{
if(max< *(*(p+j)+i) )
max= *(*(p+j)+i);
}
```

```
 printf("Max in column %d : %d\n",i,max);
 }
 printf("\n");
 for(int i=0; i<size; i++)
 {
 int min=*(*(p+i));
 for(int j=0; j<size; j++)
 {
 if(min> *(*(p+i)+j) )
 min= *(*(p+i)+j);
 }
 printf("MIN in row %d : %d\n",i,min);
 }
 printf("\n");
 for(int i=0; i<size; i++)
 {
 int min=*(*(p)+i);
 for(int j=0; j<size; j++)
 {
 if(min> *(*(p+j)+i) )
 min= *(*(p+j)+i);
 }
 printf("MIN in column %d : %d\n",i,min);
 }
 getch();
 return 0;
}
```



```
Enter the size : 3


Enter 3 * 3 elements :
```


```
2

4

5

6

7

8

9

8

6

2 4 5

6 7 8

9 8 6

Max in row 0 : 5

Max in row 1 : 8

Max in row 2 : 9



Max in column 0 : 9

Max in column 1 : 8

Max in column 2 : 8
```

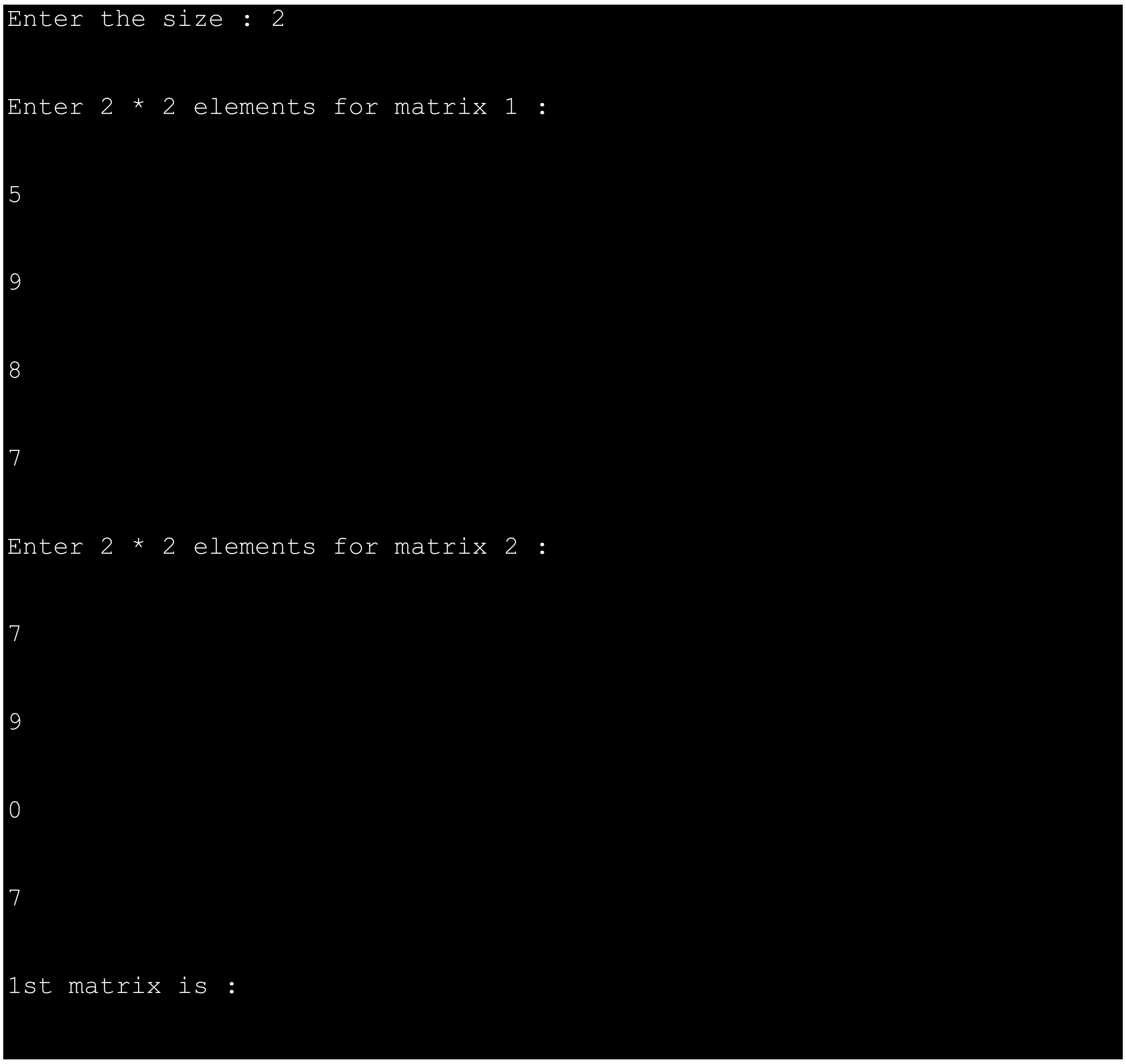


```
MIN in row 0 : 2

MIN in row 1 : 6

MIN in row 2 : 6


MIN in column 0 : 2

MIN in column 1 : 4

MIN in column 2 : 5
```

```
/* A. Array Manipulations using Pointers
Two Dimensional Array: Write a C program to...
6. Perform matrix multiplication between two mxm array */
#include<stdio.h>
int main()
{
 int arr[5][5],arr1[5][5],(*p)[5],(*p1)[5];
 p=arr;
 p1=arr1;
 printf("Enter the size : ");
 int size;
 scanf("%d",&size);
 printf("Enter %d * %d elements for matrix 1 : ",size,size);
 for(int i=0; i<size; i++)
 {
 for(int j=0; j<size; j++)
```

```
scanf("%d",*(p+i)+j);
}
printf("Enter %d * %d elements for matrix 2 : ",size,size);
for(int i=0; i<size; i++)
{
for(int j=0; j<size; j++)
scanf("%d",*(p1+i)+j);
}
printf("1st matrix is : \n");
for(int i=0; i<size; i++)
{
for(int j=0; j<size; j++)
{
printf("%d ",*(*(p+i)+j));
}
printf("\n");
}
printf("2nd matrix is : \n");
for(int i=0; i<size; i++)
{
for(int j=0; j<size; j++)
{
printf("%d ",*(*(p1+i)+j));
}
printf("\n");
}
for(int i=0; i<size; i++)
{
for(int j=0; j<size; j++)
{
int sum=0;
```

```
 for(int k=0; k<size; k++)
 {
 sum+=(*(*(p+i)+k)) * (*(*(p1+k)+j));
 }
 printf("%d ",sum);
 }
 printf("\n");
 }
 getch();
 return 0;
}
```



```
Enter the size : 2

Enter 2 * 2 elements for matrix 1 :

5

9

8

7

Enter 2 * 2 elements for matrix 2 :

7

9

0

7

1st matrix is :
```

```
5 9

8 7

2nd matrix is :

7 9

0 7

35 108

56 121
```

```
/* B. String Manipulations using Pointers
7. Write a C Program to convert
a. Upper case to Lower case,
b. Lower case to Upper case,
c. Togglecase,
d. Sentance case
*/
#include<stdio.h>
int main()
{
 char *a,str[20];
 printf("Enter a string : ");
 a=str;
 gets(a);
 puts(strupr(a));
 puts(strlwr(a));
 for(int i=0; *(a+i)!='\0'; i++)
 {
 if(i==0)
```

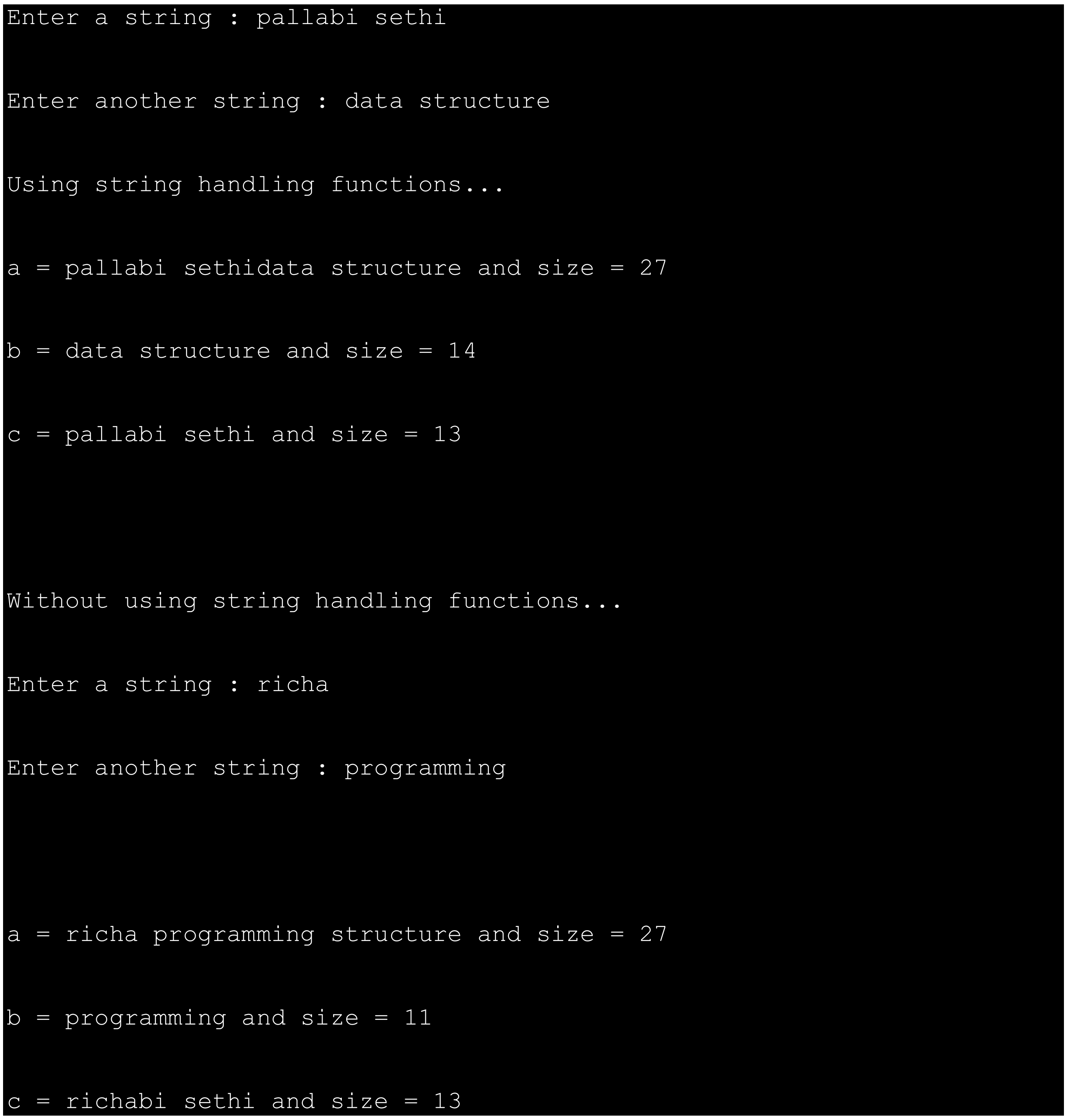
```
continue;

while(*(a+i)==32)

i+=2;

if(*(a+i)>=97 && *(a+i)<=122)

{

*(a+i)-=32;

}

}

puts(a);

for(int i=0; *(a+i)!='\0'; i++)

{

while(*(a+i)==32)

i++;

if(i==0)

if(*(a+i)>=97 && *(a+i)<=122)

*(a+i)-=32;

if(*(a+i)=='.')

{

printf("hello\n");

i++;

while(*(a+i)==32)

i++;

printf(" %d ",i);

if(*(a+i)>=97 && *(a+i)<=122)

{

*(a+i)=*(a+i)-32;

i++;

}

}

if(i!=0 && *(a+i)>=65 && *(a+i)<=90)

*(a+i)+=32;
```

```
 }
 puts(a);
}
```

```
/*B. String Manipulations using Pointers
8. Write a C Program to read 2 string constants into a and b.
Compare whether they are equal or not. if not, join them together.
Then copy the contents of a to the variable c.
At the end of the program, print the contents of all three variables and their length. (With
and Without String Handling Functions).
*/
#include<stdio.h>
int main()
{
 char str[20],str1[20],str3[20],*a,*b,*c;
 a=str;
 b=str1;
 c=str3;
 printf("Enter a string : ");
 gets(a);
 printf("Enter another string : ");
 gets(b);
 printf("Using string handling functions...\n");
 if(strcmp(a,b))
```

```
{
strcpy(c,a);
strcat(a,b);
}
printf("a = %s and size = %d\nb = %s and size = %d\nc = %s and size =
%d\n",a,strlen(a),b,strlen(b),c,strlen(c));
printf("\nWithout using string handling functions...");
a=str;
b=str1;
c=str3;
printf("\nEnter a string : ");
gets(a);
printf("Enter another string : ");
gets(b);
int i;
for(i=0; *(a+i)!='\0'; i++)
{
if(*(a+i) != *(b+i))
{
i=-1;
break;
}
}
if(i=-1)
{
int l1=strlen(a);
int l2=strlen(b);
for(i=0; *(a+i)!='\0'; i++)
*(c+i)=*(a+i);
*(a+l1)=32;
int j=0;
```

```
 for(int i=l1+1; i<=l1+l2; i++,j++)
 *(a+i)=*(b+j);
 }
 printf("\na = %s and size = %d\nb = %s and size = %d\nc = %s and size =
%d\n",a,strlen(a),b,strlen(b),c,strlen(c));
}
```



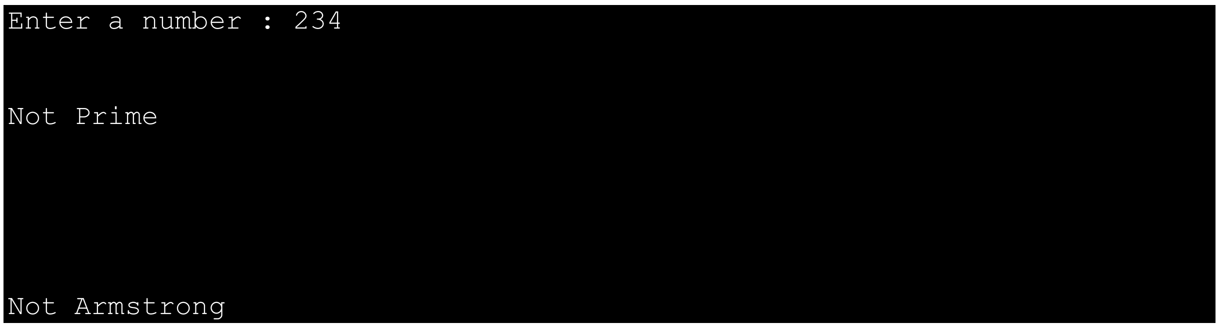
```
Enter a string : pallabi sethi

Enter another string : data structure

Using string handling functions...

a = pallabi sethidata structure and size = 27

b = data structure and size = 14

c = pallabi sethi and size = 13



Without using string handling functions...

Enter a string : richa

Enter another string : programming



a = richa programming structure and size = 27

b = programming and size = 11

c = richabi sethi and size = 13
```

```
/* B. String Manipulations using Pointers

9. Write a C program to read a string and prints if it is a palindrome or not. */

#include<stdio.h>

#include<string.h>
```

```
int main()
{
 char str[20],copy[20],temp,*p;
 int i,l;
 printf("Enter a string : ");
 p=str;
 gets(p);
 strcpy(copy,str);
 for(l=0; *(p+l)!='\0'; l++);
 for(i=0; i<l/2; i++)
 {
 temp=*(p+i);
 *(p+i)=(*(p+l-i-1));
 *(p+l-i-1)=temp;
 }
 if(strcmp(p,copy))
 printf("Not pallindrome");
 else
 printf("Pallindrome");
 getch();
 return 0;
}
```

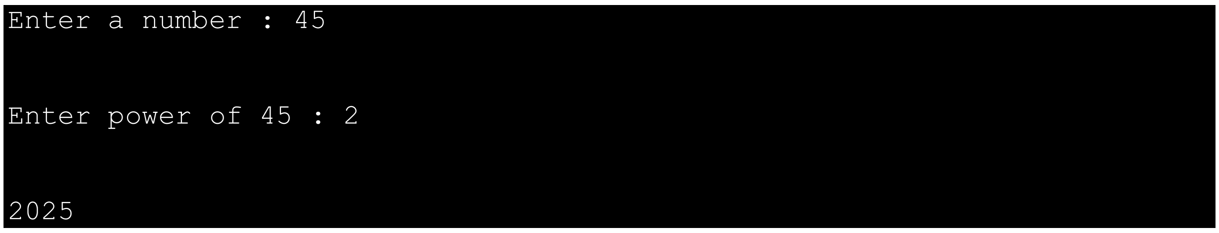
```
Enter a string : pallabi sethi


Not pallindrome
Enter a string : hih


Pallindrome
```

```
/* C. Functions using Pointers Write a C Program (Using Call by Value, Call by Reference &
Category of Functions)
10. Check Prime and Armstrong Number by making function */
int main()
{
 int n;
 printf("Enter a number : ");
 scanf("%d",&n);
 primeCBV(n);
 printf("\n");
 armstrong(n);
 getch();
 return 0;}
void primeCBV(int n)
{
 int i;
 for(i=2; i<n; i++)
 {
 if(n%i==0)
 break;
 }
 if(i==n)
 printf("Prime");
 else
 printf("Not Prime");
}
void primeCBR(int *n)
{
 int i;
 for(i=2; i<*n; i++)
 {
 if(*n%i==0)
 break;
 }
 if(i==*n)
 printf("Prime");
 else
 printf("Not Prime");
}
void armstrong(int n)
{
 int num=0,t=n;
 while(n)
 {
 int r=n%10;
 num=num+(r*r*r);
 n=n/10;
 }
 if(t==num)
 printf("\nArmstrong");
 else
 printf("\nNot Armstrong");
}
```



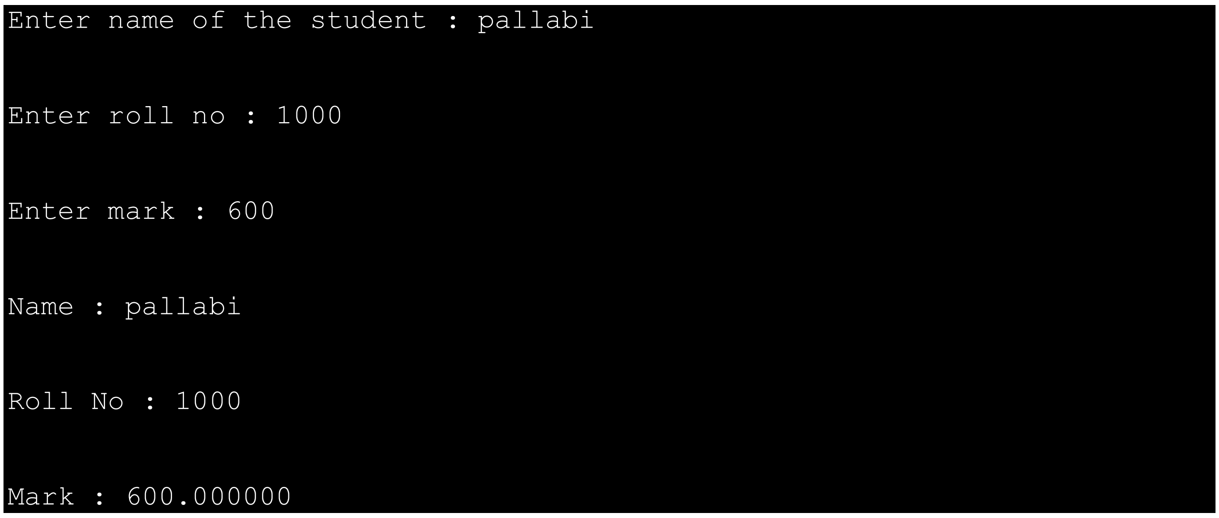
```
Enter a number : 234


Not Prime






Not Armstrong
```

```
/*C. Functions using Pointers
Write a C Program (Using Call by Value, Call by Reference & Category of Functions)
11. Reverse a sentence using String Functions */
#include<stdio.h>
#include<string.h>
char *revSen(char *s);
int main()
{
 printf("Enter a sentence : ");
 char str[50];
 gets(str);
 revSentence(str);
 puts(str);
 char *s=revSen(str);
 puts(s);
}
void revSentence(char str[])
{
 strrev(str);
}
char *revSen(char *s)
{
 strrev(s);
 return s;
}
/*C. Functions using Pointers
Write a C Program (Using Call by Value, Call by Reference & Category of Functions)
12. Calculate the power of a number using recursion*/
#include<stdio.h>
int power(int,int);
int (*func_pointer)(int,int);
int main()
{
 printf("Enter a number : ");
 int n;
 scanf("%d",&n);
 printf("Enter power of %d : ",n);
 int p;
 scanf("%d",&p);
 func_pointer=&power;
 printf("%d",(*func_pointer)(n,p));
}
int power(int n,int p)
{
 if(p==0)
 return 1;
 return(n*power(n,p-1));
}
```



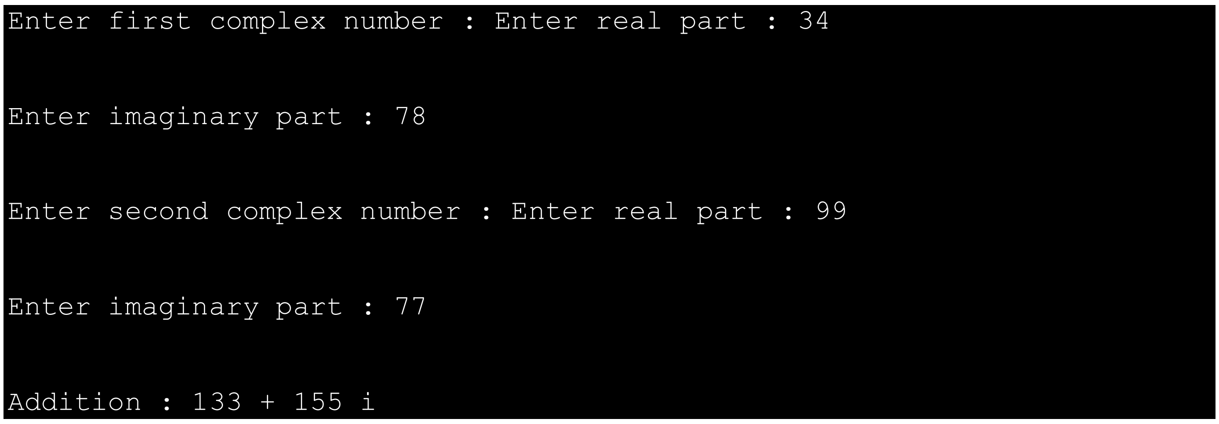
```
Enter a number : 45

Enter power of 45 : 2

2025
```

```
/* D. Structures using Pointers Write a C Program,
13. Store Information(name, roll and marks) of a Student Using Structure */
struct student
{
 char name[20];
 int rollno;
 float marks;
};
int main()
{
 struct student s1,*sp;
 sp=&s1;
 printf("Enter name of the student : ");
 gets(sp->name);
 printf("Enter roll no : ");
 scanf("%d",&sp->rollno);
 printf("Enter mark : ");
 scanf("%f",&sp->marks);
 printf("Name : %s\nRoll No : %d\nMark : %f",sp->name,sp->rollno,sp->marks);
 getch();
 return 0;
}
```



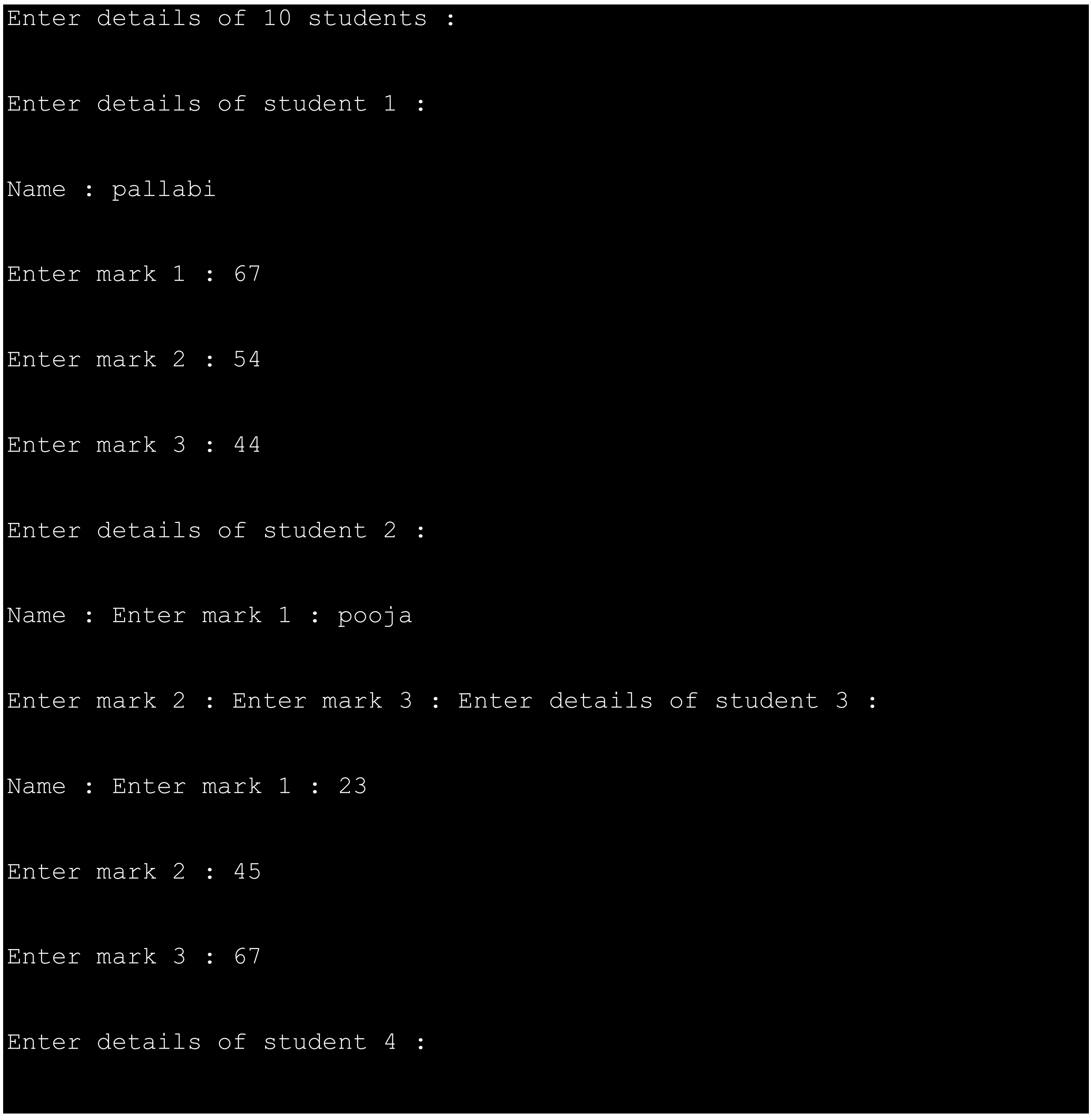
```
Enter name of the student : pallabi

Enter roll no : 1000

Enter mark : 600

Name : pallabi

Roll No : 1000

Mark : 600.000000
```

```
/* D. Structures using Pointers Write a C Program,
14. Add Two Complex Numbers by Passing Structure to a Function */
#include<stdio.h>
struct complex
{
 int real;
 int imag;
};
struct complex * add(struct complex *p,struct complex *p1);
int main()
{
 struct complex a,b,*p,*p1;
 p=&a; p1=&b;
 printf("Enter first complex number : ");
 printf("Enter real part : ");
 scanf("%d",&p->real);
 printf("Enter imaginary part : ");
 scanf("%d",&p->imag);
 printf("Enter second complex number : ");
 printf("Enter real part : ");
 scanf("%d",&p1->real);
 printf("Enter imaginary part : ");
 scanf("%d",&p1->imag);
 p=add(p,p1);
 printf("Addition : %d + %d i",p->real,p->imag);
 getch();
 return 0;
}
struct complex * add(struct complex *p,struct complex *p1)
{
 struct complex *n,b;
 n=&b;
 n->real=p->real+p1->real;
 n->imag=p->imag+p1->imag;
 return n;
}
```

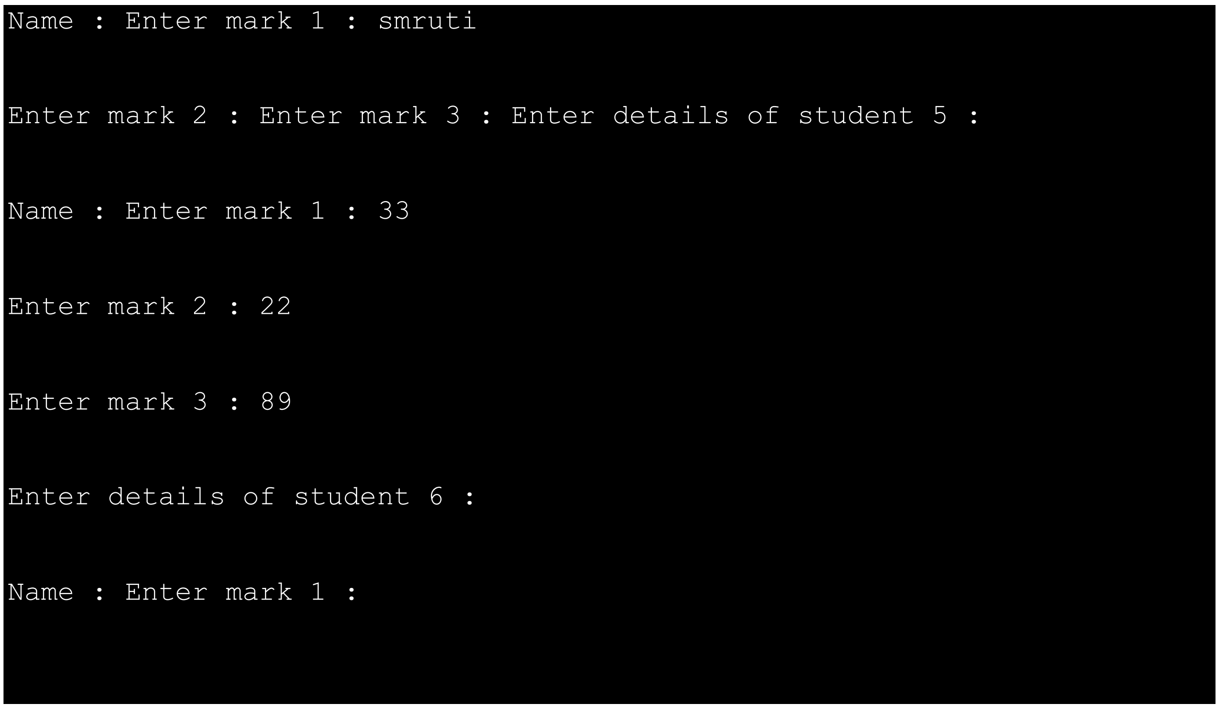


```
Enter first complex number : Enter real part : 34

Enter imaginary part : 78

Enter second complex number : Enter real part : 99

Enter imaginary part : 77

Addition : 133 + 155 i
```

```
/* D. Structures using Pointers Write a C Program,
15. Store & Retrieve Information, Calculate Total, Average and Rank of 10 Students Using
Structure
*/
#include<stdio.h>
typedef struct
{
 char name[20];
 int m1;
 int m2;
 int m3;
}students;
int main()
{
 students s[10],*p;
 p=s;
 printf("Enter details of 10 students : \n");
 for(int i=0; i<10; i++)
 {
 printf("Enter details of student %d :\n",i+1);
 printf("Name : ");
 fflush(stdin);
 gets(p[i].name);
 printf("Enter mark 1 : ");
 scanf("%d",&(p+i)->m1);
 printf("Enter mark 2 : ");
 scanf("%d",&(p+i)->m2);
 printf("Enter mark 3 : ");
 scanf("%d",&(p+i)->m3);
 }
 for(int i=0; i<10; i++)
 {
 int sum=0;
 sum=(p+i)->m1+(p+i)->m2+(p+i)->m3;
 printf("%s\nSum of marks : %d, Average : %f",(p+i)->name,sum,sum/3.0);
 float per=(sum*100)/600;
 if(per>=60)
 printf(" Rank 1");
 else if(per>=50 && per<60)
 printf(" Rank 2");
 else if(per>=30)
 printf(" Rank 3");
 else
 printf(" Fail");
 printf("\n");
 }
}
```



```
Enter details of 10 students :

Enter details of student 1 :

Name : pallabi

Enter mark 1 : 67

Enter mark 2 : 54

Enter mark 3 : 44

Enter details of student 2 :

Name : Enter mark 1 : pooja

Enter mark 2 : Enter mark 3 : Enter details of student 3 :

Name : Enter mark 1 : 23

Enter mark 2 : 45

Enter mark 3 : 67

Enter details of student 4 :
```



```
Name : Enter mark 1 : smruti

Enter mark 2 : Enter mark 3 : Enter details of student 5 :

Name : Enter mark 1 : 33

Enter mark 2 : 22

Enter mark 3 : 89

Enter details of student 6 :

Name : Enter mark 1 :
```