DATA STRUCTURE

(PRACTICAL LAB)

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1.Write a program in C to implement insertion in 1-D Arrays?

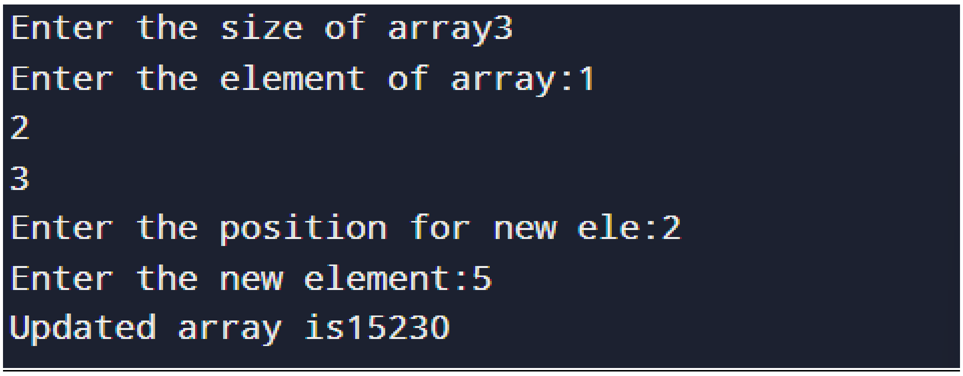
Insertion in array can be done in 3 positions in array:

1. In between first and last:

Input:

```
#include <stdio.h>
int main() {
int a[10],size,i,pos,ele;
printf("Enter the size of array");
scanf ("%d", &size);
printf("Enter the element of array:");
for(i=0;i<size;i++){
  scanf("%d", &a[i]);
}
printf("Enter the position for new ele:");
scanf("%d", & pos);
printf("Enter the new element:");
scanf("%d", & ele);
for(i=size-1; i >= pos-1;i--){
  a[i+1] = a[i];
}
a[pos - 1] = ele;
  size++;
printf("Updated array is");
for(i=0;i<=size;i++)
printf("%d", a[i]);

  return 0;
}
```

Output:



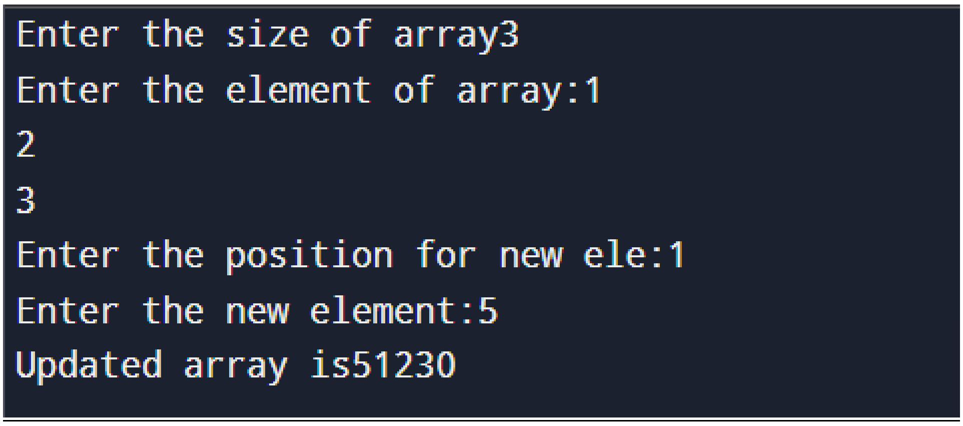
```
Enter the size of array3
Enter the element of array:1
2
3
Enter the position for new ele:2
Enter the new element:5
Updated array is15230
```

2. In First position:

Input:

```
#include <stdio.h>
int main() {
int a[10],size,i,pos,ele;
printf("Enter the size of array");
scanf ("%d", &size);
printf("Enter the element of array:");
for(i=0;i<size;i++){
  scanf("%d", &a[i]);
}
printf("Enter the position for new ele:");
scanf("%d", & pos);
printf("Enter the new element:");
scanf("%d", & ele);
for(i=size-1; i >= pos-1;i--){
  a[i+1] = a[i];
}
a[pos - 1] = ele;
  size++;
printf("Updated array is");
for(i=0;i<=size;i++)
printf("%d", a[i]);

  return 0;
}
```

Output:



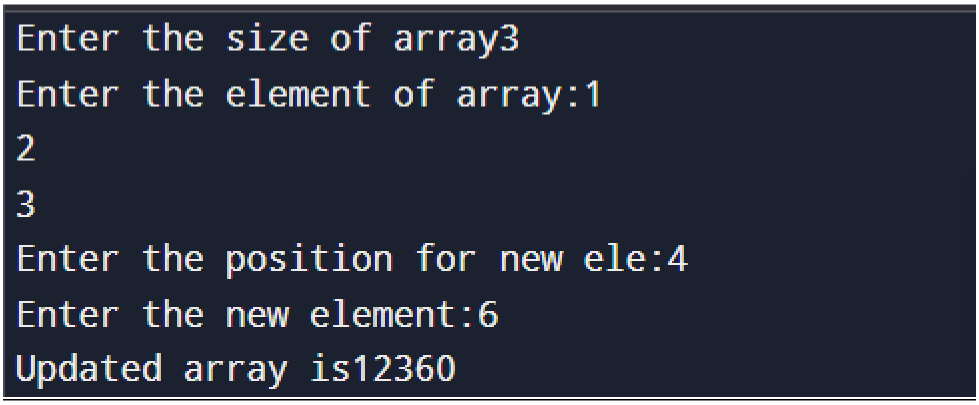
```
Enter the size of array3
Enter the element of array:1
2
3
Enter the position for new ele:1
Enter the new element:5
Updated array is51230
```

3. In last position

Input:

```
#include <stdio.h>
int main() {
int a[10],size,i,pos,ele;
printf("Enter the size of array");
scanf ("%d", &size);
printf("Enter the element of array:");
for(i=0;i<size;i++){
  scanf("%d", &a[i]);
}
printf("Enter the position for new ele:");
scanf("%d", & pos);
printf("Enter the new element:");
scanf("%d", & ele);
for(i=size-1; i >= pos-1;i--){
  a[i+1] = a[i];
}
a[pos - 1] = ele;
  size++;
printf("Updated array is");
for(i=0;i<=size;i++)
printf("%d", a[i]);

  return 0;
}
```

Output:



```
Enter the size of array3
Enter the element of array:1
2
3
Enter the position for new ele:4
Enter the new element:6
Updated array is12360
```

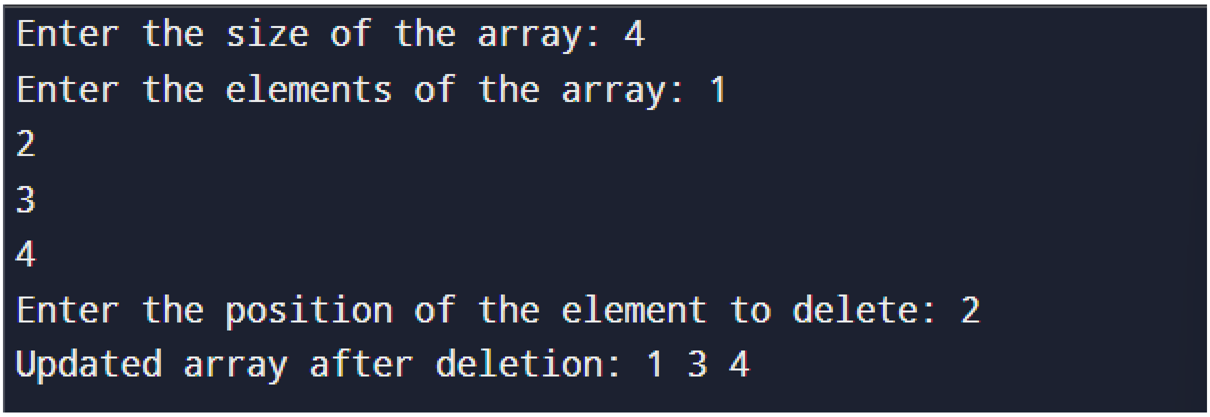
2.Write a program in C to implement deletion in 1-D Array?

INPUT:

```
#include <stdio.h>

int main() {

  int a[10], size, i, pos;

  printf("Enter the size of the array: ");

  scanf("%d", &size);

  printf("Enter the elements of the array: ");

  for (i = 0; i < size; i++) {

    scanf("%d", &a[i]);

  }

  printf("Enter the position of the element to delete: ");

  scanf("%d", &pos);


  if (pos < 1 || pos > size) {

    printf("Invalid position!\n");

    return 1;

  }
```

```
   for (i = pos - 1; i < size - 1; i++) {
      a[i] = a[i + 1];
   } size--;

   printf("Updated array after deletion: ");
   for (i = 0; i < size; i++) {
      printf("%d ", a[i]);
   }
 return 0;
}
```

Output:



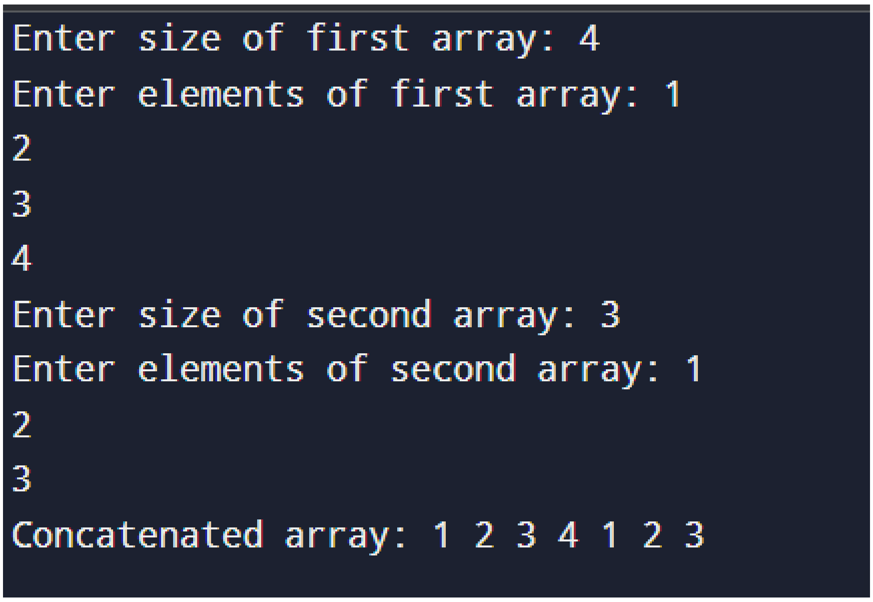
```
Enter the size of the array: 4
Enter the elements of the array: 1
2
3
4
Enter the position of the element to delete: 2
Updated array after deletion: 1 3 4
```

3. Write a program in C to concatenate two arrays?

INPUT:

```
#include <stdio.h>
int main() {
   int a[10], b[10], c[20];
   int size01, size02, i, j;
    printf("Enter size of first array: ");
   scanf("%d", &size01);

   printf("Enter elements of first array: ");

   for (i = 0; i < size01; i++) {

      scanf("%d", &a[i]);

   }

   printf("Enter size of second array: ");

   scanf("%d", &size02);

    printf("Enter elements of second array: ");

   for (i = 0; i < size02; i++) {

      scanf("%d", &b[i]);

   }

   for (i = 0; i < size01; i++) {

      c[i] = a[i];

   }

   for (j = 0; j < size02; j++) {

      c[size01 + j] = b[j];

   }

   printf("Concatenated array: ");

   for (i = 0; i < size01 + size02; i++) {

      printf("%d ", c[i]);

   }

  printf("\n");

   return 0;

}
```

Output:



```
Enter size of first array: 4
Enter elements of first array: 1
2
3
4
Enter size of second array: 3
Enter elements of second array: 1
2
3
Concatenated array: 1 2 3 4 1 2 3
```

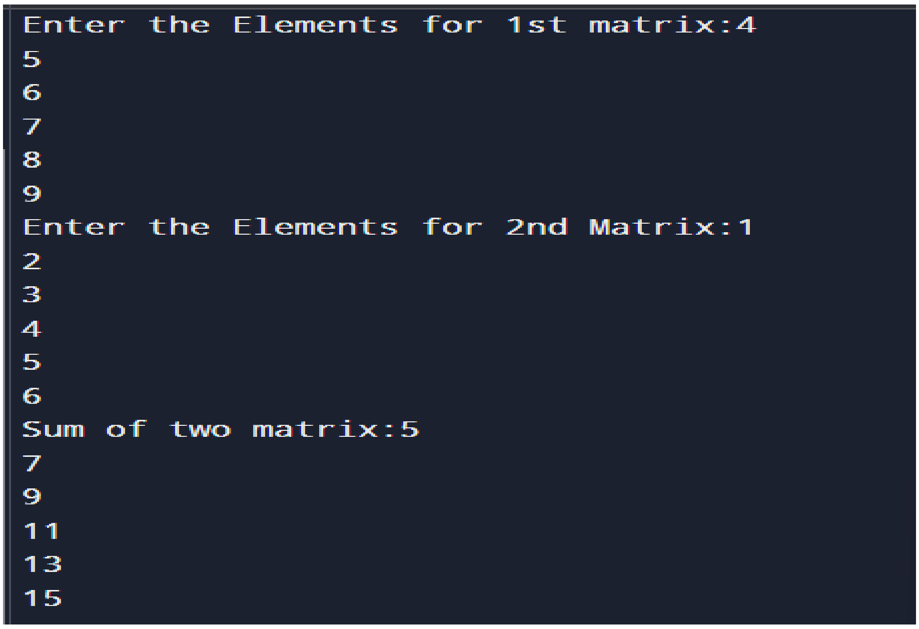
4. Write a program in C to implement the following Operations on 2-D Array (addition; subtraction; multiplication; transpose)?

1. Addition:

Input:

```
#include <stdio.h>

void main() {

int a[2][3],b[2][3],i,j,c[2][3];

  printf("Enter the Elements for 1st matrix:");

  for(i=0;i<2;i++){

    for(j=0;j<3;j++){

      scanf("%d", &a[i][j]);

    }

  }

  printf("Enter the Elements for 2nd Matrix:");

  for(i=0;i<2;i++){
    for(j=0;j<3;j++){
      scanf("%d", &b[i][j]);
    }
   }
  for(i=0;i<2;i++){
    for(j=0;j<3;j++){
      c[i][j] = a[i][j] + b[i][j];
    }
  }
  printf("Sum of two matrix:");
  for(i=0;i<2;i++){
    for(j=0;j<3;j++){
      printf("%d", c[i][j]);
      printf("\n");
    }
  }
}
```

Output:



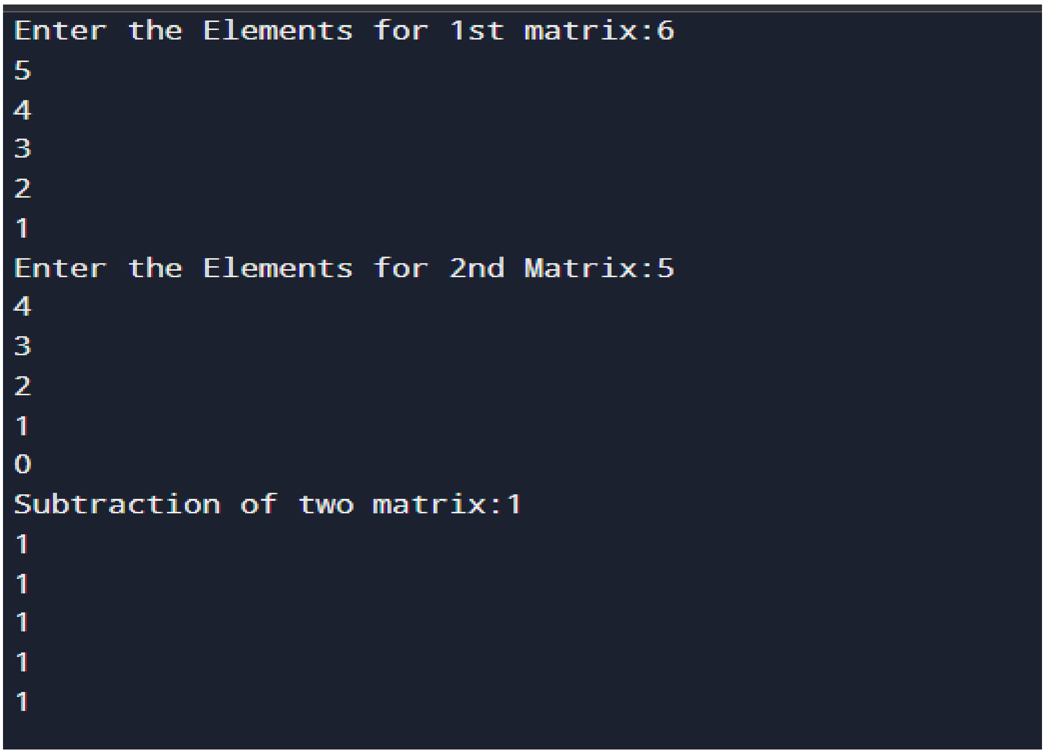
```
Enter the Elements for 1st matrix:4
5
6
7
8
9
Enter the Elements for 2nd Matrix:1
2
3
4
5
6
Sum of two matrix:5
7
9
11
13
15
```

2. Subtraction:

Input:

```
#include <stdio.h>
void main() {
int a[2][3],b[2][3],i,j,c[2][3];
  printf("Enter the Elements for 1st matrix:");
  for(i=0;i<2;i++){
    for(j=0;j<3;j++){
      scanf("%d", &a[i][j]);
    }
   }
   printf("Enter the Elements for 2nd Matrix:");
   for(i=0;i<2;i++){
    for(j=0;j<3;j++){
      scanf("%d", &b[i][j]);
    }
   }
  for(i=0;i<2;i++){
    for(j=0;j<3;j++){
      c[i][j] = a[i][j] - b[i][j];
    }
  }
  printf("Subtraction of two matrix:");
  for(i=0;i<2;i++){
    for(j=0;j<3;j++){
      printf("%d", c[i][j]);
      printf("\n");
    }
  }
}
```

Output:



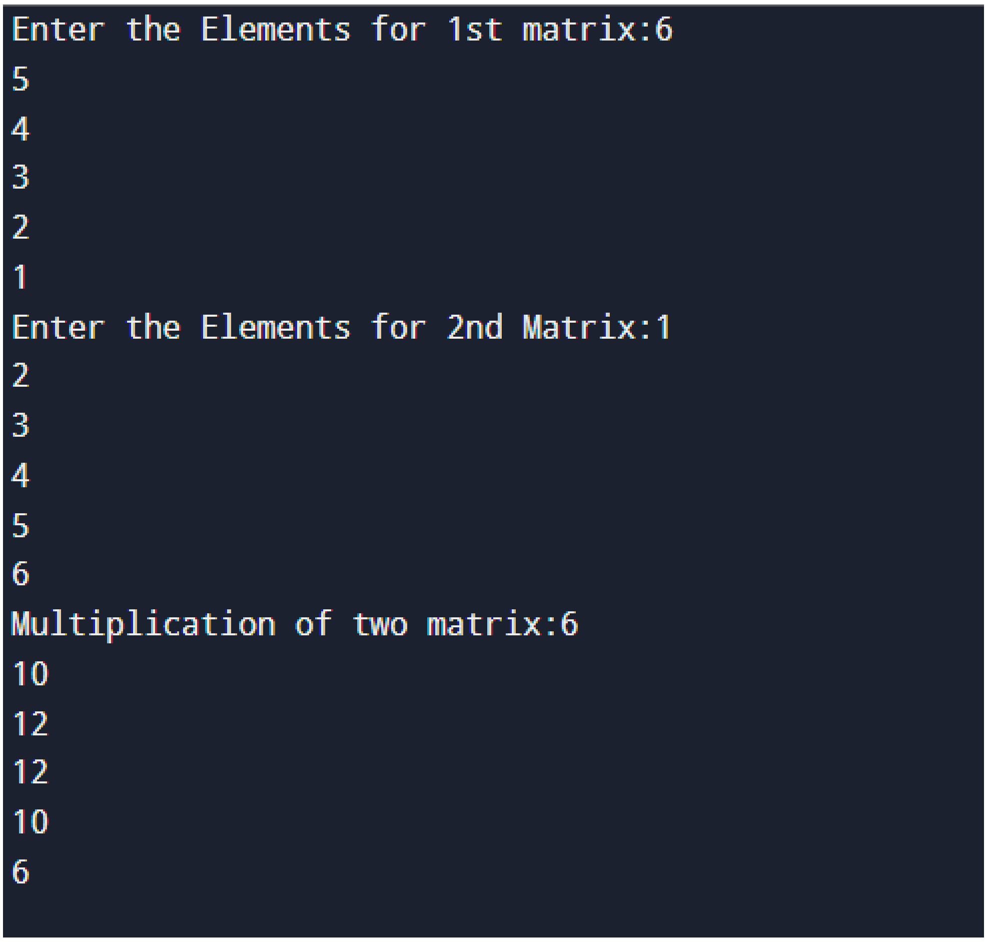
```
Enter the Elements for 1st matrix:6
5
4
3
2
1
Enter the Elements for 2nd Matrix:5
4
3
2
1
0
Subtraction of two matrix:1
1
1
1
1
1
```

3.Multiplication

Input:

```
#include <stdio.h>
void main() {
int a[2][3],b[2][3],i,j,c[2][3];
  printf("Enter the Elements for 1st matrix:");
  for(i=0;i<2;i++){
    for(j=0;j<3;j++){
      scanf("%d", &a[i][j]);
    }
    }
    printf("Enter the Elements for 2nd Matrix:");
    for(i=0;i<2;i++){
      for(j=0;j<3;j++){
          scanf("%d", &b[i][j]);
      }
    }
   for(i=0;i<2;i++){
      for(j=0;j<3;j++){
          c[i][j] = a[i][j] * b[i][j];
      }
   }
   printf("Subtract of two matrix:");
   for(i=0;i<2;i++){
      for(j=0;j<3;j++){
          printf("%d", c[i][j]);
          printf("\n");
      }
   }
}
```

Output:



```
Enter the Elements for 1st matrix:6
5
4
3
2
1
Enter the Elements for 2nd Matrix:1
2
3
4
5
6
Multiplication of two matrix:6
10
12
12
10
6
```

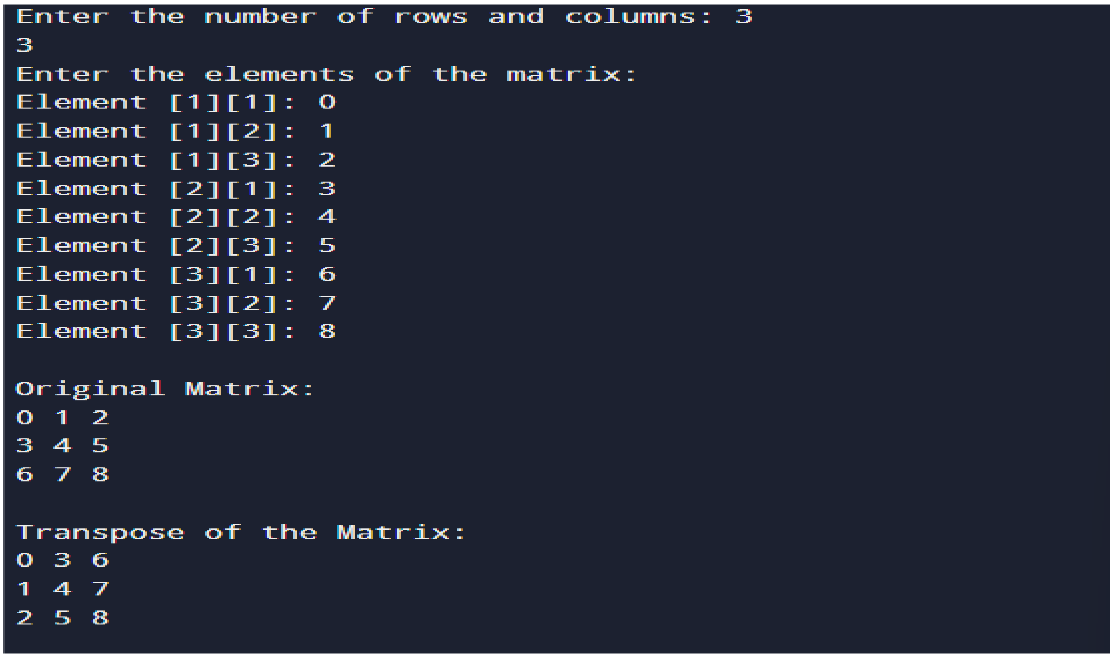
4.Transpose

Input:

```
#include <stdio.h>
        int main() {
  int matrix[10][10], transpose[10][10];
  int row, col, i, j;
        printf("Enter the number of rows and columns: ");
  scanf("%d %d", &row, &col);
printf("Enter the elements of the matrix:\n");
  for (i = 0; i < row; i++) {
    for (j = 0; j < col; j++) {
      printf("Element [%d][%d]: ", i + 1, j + 1);
      scanf("%d", &matrix[i][j]);
    }
  }
```

```
    for (i = 0; i < row; i++) {
        for (j = 0; j < col; j++) {
            transpose[j][i] = matrix[i][j];
        }
    }
    printf("\nOriginal Matrix:\n");
    for (i = 0; i < row; i++) {
        for (j = 0; j < col; j++) {
            printf("%d ", matrix[i][j]);
        }
        printf("\n");
    }
    printf("\nTranspose of the Matrix:\n");
    for (i = 0; i < col; i++) {
        for (j = 0; j < row; j++) {
            printf("%d ", transpose[i][j]);
        }
        printf("\n");
    }

    return 0;
}
```

Output:



```
Enter the number of rows and columns: 3
3
Enter the elements of the matrix:
Element [1][1]: 0
Element [1][2]: 1
Element [1][3]: 2
Element [2][1]: 3
Element [2][2]: 4
Element [2][3]: 5
Element [3][1]: 6
Element [3][2]: 7
Element [3][3]: 8

Original Matrix:
0 1 2
3 4 5
6 7 8

Transpose of the Matrix:
0 3 6
1 4 7
2 5 8
```

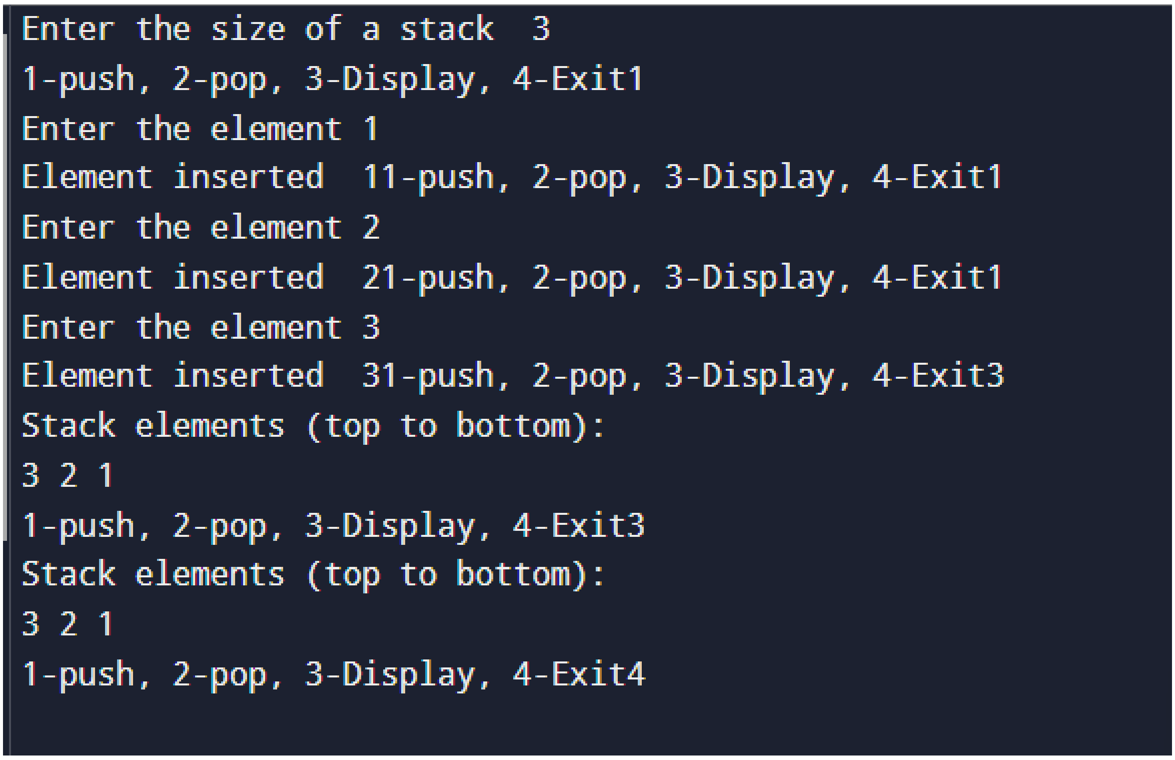
5.Write a program in C to implement operations on Stack using array ?

Input:

```
#include <stdio.h>
#include<stdlib.h>
void push();
void pop();
void display();
int maxstk, stack[10], top = -1;
void main() {
   int ch;
   printf("Enter the size of a stack");
   scanf("%d", & maxstk);
   while(1) {
   printf("1-push, 2-pop, 3-Display, 4-Exit");
   scanf("%d", &ch);
   switch(ch)
   {
   case 1:
   push();
   break;
   case 2:
   pop();
   break;
   case 3:
   display();
   break;
   case 4:
   exit(0);
   break;
   default:
   printf("Wrong choice");
    }
```

```
  }
}
void push()
{
int ele;

    if (top == maxstk-1){

    printf("Overflow\n");
    }
else
{
    printf("Enter the element");
    scanf("%d", & ele);
    top = top + 1;
    stack[top] = ele;
    printf("Element inserted %d", ele);
    }
}
void pop()
{
    if (top == -1) {
    printf("Underflow");
    }
    else
    {
         printf("Element deleted %d", stack[top]);
        top = top -1;
    }
}
void display()
{
    int i;
    if (top == -1){
        printf("underflow condition");
    }
    else {
    printf("Stack elements (top to bottom):\n");
      for(i = top; i >= 0; i--)
        printf("%d ", stack[i]);
      printf("\n");
  }
  }
```

Output:



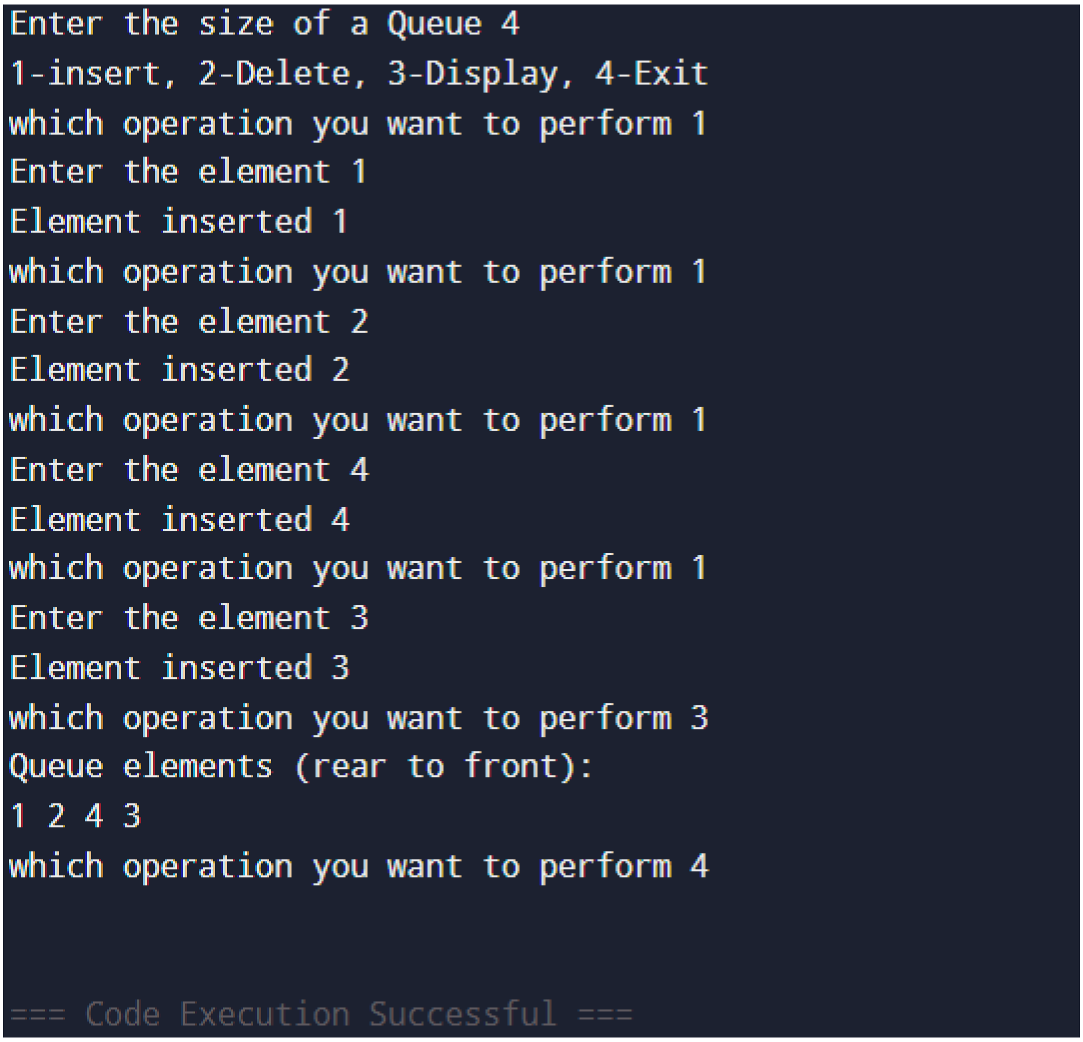
```
Enter the size of a stack  3
1-push, 2-pop, 3-Display, 4-Exit1
Enter the element 1
Element inserted  11-push, 2-pop, 3-Display, 4-Exit1
Enter the element 2
Element inserted  21-push, 2-pop, 3-Display, 4-Exit1
Enter the element 3
Element inserted  31-push, 2-pop, 3-Display, 4-Exit3
Stack elements (top to bottom):
3 2 1
1-push, 2-pop, 3-Display, 4-Exit3
Stack elements (top to bottom):
3 2 1
1-push, 2-pop, 3-Display, 4-Exit4
```

6. Write a program in C to implement operations on a queue using an array?

Input:

```
 #include <stdio.h>
#include<stdlib.h>
void insert();
void Delete();
void display();
int size, Queue[10],r=-1,f=-1;
void main() {
  int ch;
  printf("Enter the size of a Queue ");
  scanf("%d", & size);
  printf("1-insert, 2-Delete, 3-Display, 4-Exit\n");
  while(1) {
  printf("which operation you want to perform ");
  scanf("%d", &ch);
  switch(ch){
  case 1:
  insert();
  break;
  case 2:
  Delete();
  break;
  case 3:
  display();
  break;
  case 4:
  exit(0);
  break;
  default:
  printf("Wrong choice");
   }
 }
}
void insert()
{
int ele;

  if (r == size -1){

  printf("Overflow\n");
  }
  else{
    printf("Enter the element ");
  scanf("%d", & ele);
  if ((f==-1) && (r== -1)){
f=r=0;
}else
{
  r = r + 1;}

  Queue[r] = ele;
  printf("Element inserted %d\n", ele);
    }   }


void Delete()
{
  if (f == -1) {
  printf("Underflow");
  }
  else{
  if (f==r){
  f=r = -1;
}
  else
  {
   f = f +1;
  }
  printf("Element deleted");
  }
}
void display()
{
  int i;
  if (f == -1){
    printf("underflow condition");
  }
  else {
  printf("Queue elements (rear to front):\n");
    for(i = f; i <= r; i++)
      printf("%d ", Queue[i]);
    printf("\n");
}
}
```

OUTPUT:



```
Enter the size of a Queue 4
1-insert, 2-Delete, 3-Display, 4-Exit
which operation you want to perform 1
Enter the element 1
Element inserted 1
which operation you want to perform 1
Enter the element 2
Element inserted 2
which operation you want to perform 1
Enter the element 4
Element inserted 4
which operation you want to perform 1
Enter the element 3
Element inserted 3
which operation you want to perform 3
Queue elements (rear to front):
1 2 4 3
which operation you want to perform 4


=== Code Execution Successful ===
```

7. Write a program in C to implement operations on a circular queue using an array?

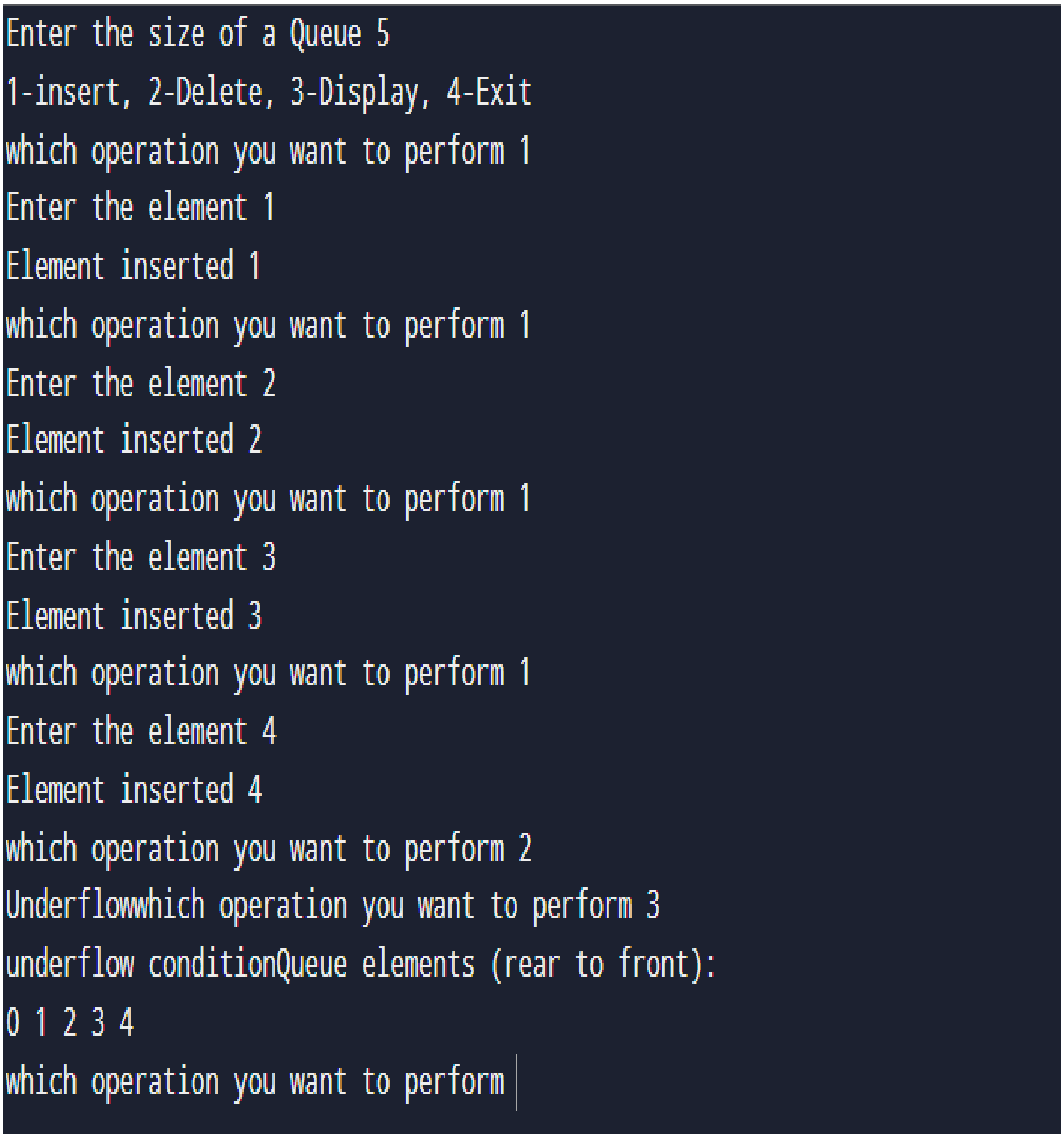
Input:

```
#include <stdio.h>

#include<stdlib.h>

void insert();

void Delete();

void display();

int size, Queue[10],r=-1,f=-1;

void main() {
  int ch;
  printf("Enter the size of a Queue ");
  scanf("%d", & size);
  printf("1-insert, 2-Delete, 3-Display, 4-Exit\n");
  while(1) {
  printf("which operation you want to perform ");
  scanf("%d", &ch);
  switch(ch){
  case 1:
  insert();
  break;
  case 2:
  Delete();
  break;
  case 3:
  display();
  break;
  case 4:
  exit(0);
  break;
  default:
  printf("Wrong choice");
   }
 }
}
void insert()
{
int ele;
```

```
  if (r == size -1){
r = 0;
  printf("Overflow\n");
  }
  else{
    printf("Enter the element ");
  scanf("%d", & ele);
  if ((f== 0) && (r== size -1)){
f=r= -1;
}else
{

  r = r + 1;}

  Queue[r] = ele;
  printf("Element inserted %d\n", ele);
    }  }



void Delete()
{
  if (f == -1) {
  printf("Underflow");
  }
  else{
  if (f==r){
  f=r = -1;
}
  else
  {
   f = f +1;
  }
  printf("Element deleted");
  }
}
void display()
{
  int i;
  if (f == -1){
    printf("underflow condition");
  }
   if(f<=r) {
  printf("Queue elements (rear to front):\n");
    for(i = f; i <= r; i++)
       printf("%d ", Queue[i]);
    printf("\n");
}


   else {
  for (i=f;i<=size-1;i++){
    printf("%d", &Queue[i]);
    for(i=0;i<=r;i++){
       printf("%d",Queue[i]);
    }
  }
```

```
}
}
```

OUTPUT:



```
Enter the size of a Queue 5
1-insert, 2-Delete, 3-Display, 4-Exit
which operation you want to perform 1
Enter the element 1
Element inserted 1
which operation you want to perform 1
Enter the element 2
Element inserted 2
which operation you want to perform 1
Enter the element 3
Element inserted 3
which operation you want to perform 1
Enter the element 4
Element inserted 4
which operation you want to perform 2
Underflowwhich operation you want to perform 3
underflow conditionQueue elements (rear to front):
0 1 2 3 4
which operation you want to perform
```

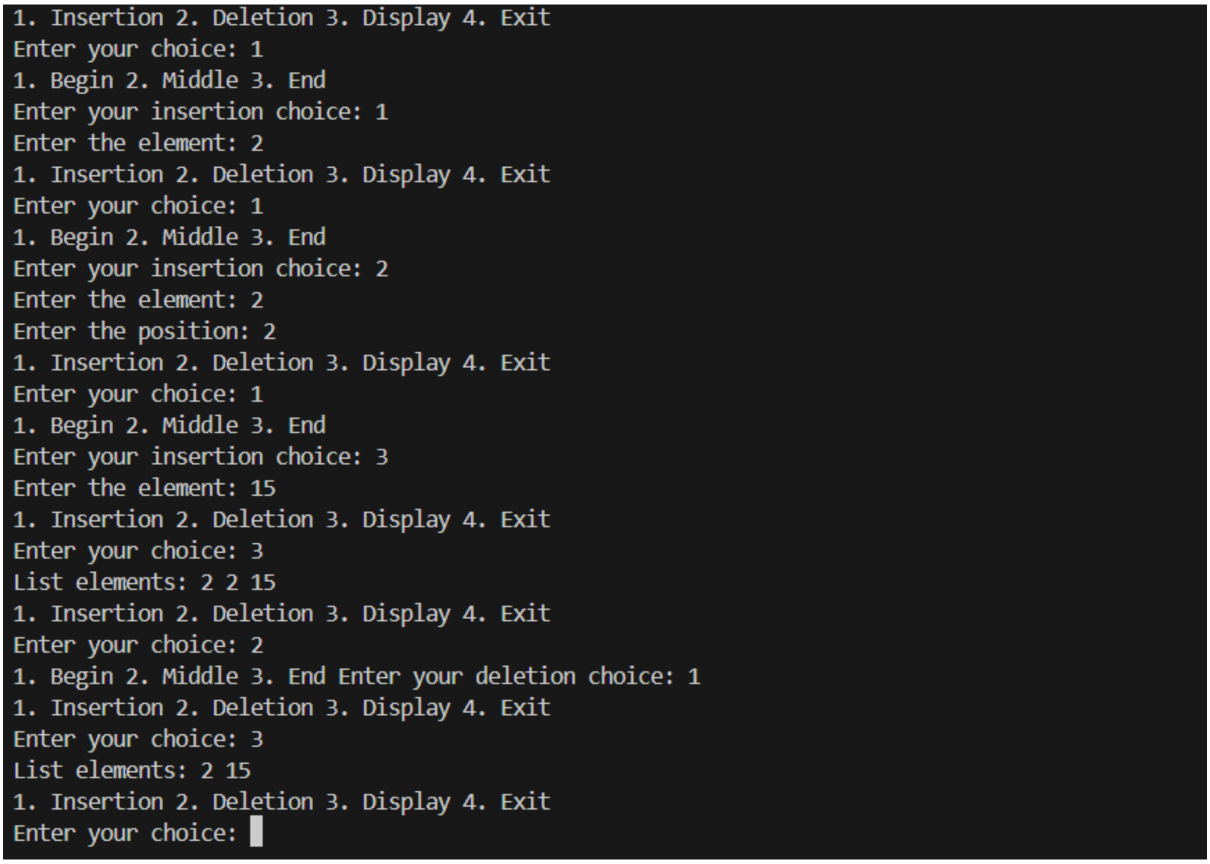
8,9. Write a program in C to implement insertion and deletion in a linked list(beg; mid; end) ?

Input:

```
#include <stdio.h>

#include <stdlib.h>

typedef struct node {

  int info;

  struct node *next;

} Node;


Node *start = NULL;

void insbeg();

void insmid();

void insend();

void delbeg();

void delmid();

void delend();

void display();


int main() {

  int ch, ch1;

  while (1)

  {

    printf("1. Insertion 2. Deletion 3. Display 4. Exit\n");

    printf("Enter your choice: ");

    scanf("%d", &ch);

    switch (ch) {

      case 1:

        printf("1. Begin 2. Middle 3. End\n");

        printf("Enter your insertion choice: ");
    scanf("%d", &ch1);

    switch (ch1) {

      case 1:

       insbeg();

      break;

      case 2:

       insmid();

      break;

      case 3:

       insend();

      break;

      default:

       printf("Invalid insertion choice\n");

        break;

    }

    break;

  case 2:

    printf("1. Begin 2. Middle 3. End ");

    printf("Enter your deletion choice: ");

    scanf("%d", &ch1);

    switch (ch1) {

      case 1:

       delbeg();

       break;

      case 2:

       delmid();

       break;

      case 3:
          delend();
          break;
          default:
          printf("Invalid deletion choice\n");
           break;
        }
        break;
      case 3:
        display();
        break;
      case 4:
        exit(0);
      default:
        printf("Invalid choice\n");
    }
  }
  return 0;
}

void insbeg() {
  Node *temp = (Node *)malloc(sizeof(Node));
  int ele;
  printf("Enter the element: ");
  scanf("%d", &ele);
  temp->info = ele;
  temp->next = start;
  start = temp;
}
```

```
void insmid() {
    Node *temp = (Node *)malloc(sizeof(Node));
    int ele, pos, i;
    printf("Enter the element: ");
    scanf("%d", &ele);
    printf("Enter the position: ");
    scanf("%d", &pos);
    temp->info = ele;

    if (pos == 1) {
        temp->next = start;
        start = temp;
        return;
    }

    Node *ptr = start;
    for (i = 1; i < pos - 1 && ptr != NULL; i++) {
        ptr = ptr->next;
    }

    if (ptr == NULL) {
        printf("Position out of range\n");
        free(temp);
        return;
    }

    temp->next = ptr->next;
    ptr->next = temp;
}

void insend() {
    Node *temp = (Node *)malloc(sizeof(Node));
    int ele;
    printf("Enter the element: ");
    scanf("%d", &ele);
    temp->info = ele;
    temp->next = NULL;

    if (start == NULL) {
        start = temp;
        return;
    }

    Node *ptr = start;
    while (ptr->next != NULL) {
        ptr = ptr->next;
    }
    ptr->next = temp;
}

void delbeg() {
    if (start == NULL) {
        printf("Underflow\n");
        return;
    }
    Node *ptr = start;
    start = start->next;
    free(ptr);
}

void delmid() {
    int pos, i;
    if (start == NULL) {
        printf("Underflow\n");
        return;
    }
    printf("Enter the position to delete: ");
    scanf("%d", &pos);
    if (pos == 1) {
        delbeg();
        return;
    }

    Node *ptr = start;
    Node *temp = NULL;
    for (i = 1; i < pos && ptr != NULL; i++) {
        temp = ptr;
        ptr = ptr->next;
    }

    if (ptr == NULL) {
        printf("Position out of range\n");
        return;
    }

    temp->next = ptr->next;
    free(ptr);
}

void delend() {
    if (start == NULL) {
        printf("Underflow\n");
        return;
    }

    if (start->next == NULL) {
        free(start);
        start = NULL;
        return;
    }

    Node *ptr = start;
    Node *temp = NULL;
    while (ptr->next != NULL) {
        temp = ptr;
        ptr = ptr->next;
    }

    temp->next = NULL;
    free(ptr);
}
```

```
void display() {
   if (start == NULL) {
      printf("List is empty\n");
      return;
   }
  Node *ptr = start;
   printf("List elements: ");
   while (ptr != NULL) {
      printf("%d ", ptr->info);
      ptr = ptr->next;
   }
   printf("\n");
}
```



```
1. Insertion 2. Deletion 3. Display 4. Exit
Enter your choice: 1
1. Begin 2. Middle 3. End
Enter your insertion choice: 1
Enter the element: 2
1. Insertion 2. Deletion 3. Display 4. Exit
Enter your choice: 1
1. Begin 2. Middle 3. End
Enter your insertion choice: 2
Enter the element: 2
Enter the position: 2
1. Insertion 2. Deletion 3. Display 4. Exit
Enter your choice: 1
1. Begin 2. Middle 3. End
Enter your insertion choice: 3
Enter the element: 15
1. Insertion 2. Deletion 3. Display 4. Exit
Enter your choice: 3
List elements: 2 2 15
1. Insertion 2. Deletion 3. Display 4. Exit
Enter your choice: 2
1. Begin 2. Middle 3. End Enter your deletion choice: 1
1. Insertion 2. Deletion 3. Display 4. Exit
Enter your choice: 3
List elements: 2 15
1. Insertion 2. Deletion 3. Display 4. Exit
Enter your choice: 
```