MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

DATA STRUCTURE USING C LAB FILE

4.5CA151C01

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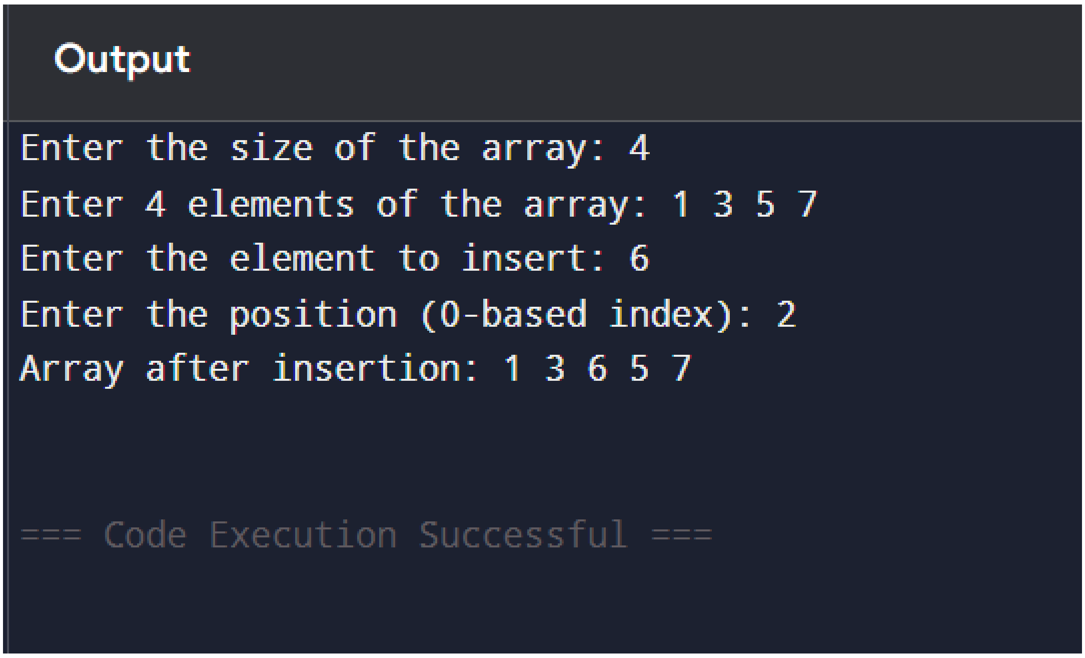
ROLL NUMBER – 24/SCA/BCA(AI&ML)/042

Q1. Write a program in C to implement insertion in 1D Array .

Ans. Input :–

```
#include <stdio.h>
void insertElement(int arr[], int *size, int element, int position) {
   if (position < 0 || position > *size) {
      printf("Invalid position!\n");
      return;
   }
   for (int i = *size; i > position; i--) {
      arr[i] = arr[i - 1];
   }
   arr[position] = element;
   (*size)++;
}
int main() {
   int arr[100], size, element, position;
   printf("Enter the size of the array: ");
   scanf("%d", &size);
   printf("Enter %d elements of the array: ", size);
   for (int i = 0; i < size; i++) {
      scanf("%d", &arr[i]);
   }
   printf("Enter the element to insert: ");
   scanf("%d", &element);
   printf("Enter the position (0-based index): ");
   scanf("%d", &position);
   insertElement(arr, &size, element, position);
   printf("Array after insertion: ");
   for (int i = 0; i < size; i++) {
      printf("%d ", arr[i]);
   }
   printf("\n");
   return 0;
}
```

Output :-



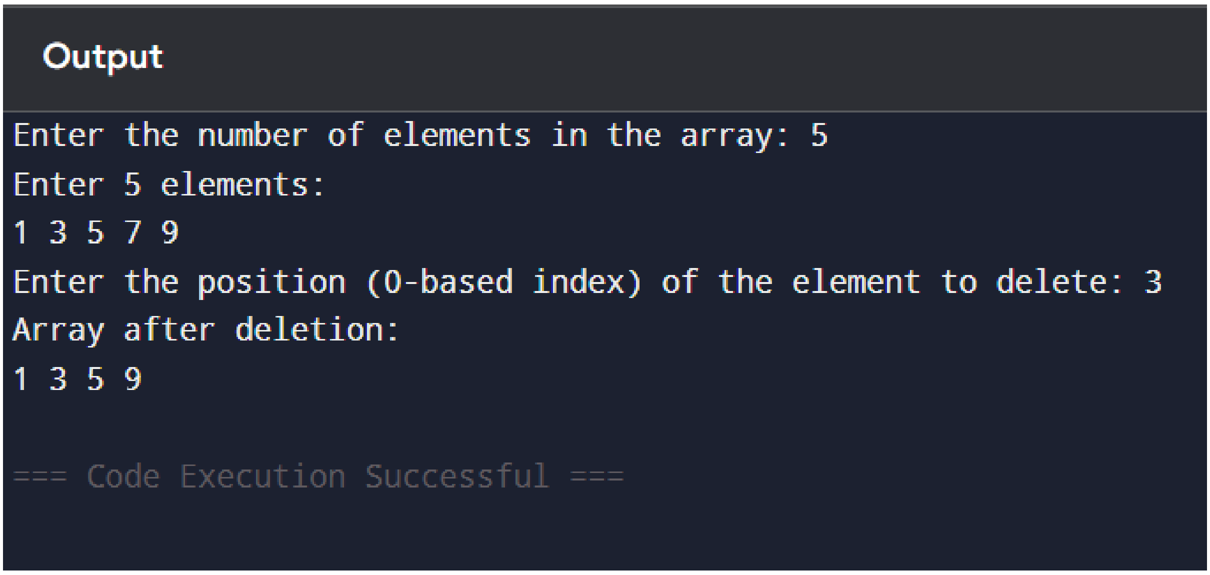
```
Enter the size of the array: 4
Enter 4 elements of the array: 1 3 5 7
Enter the element to insert: 6
Enter the position (0-based index): 2
Array after insertion: 1 3 6 5 7


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

Q2. Write a program in C to implement deletion in 1D Array .

Ans. Input :-

```
#include <stdio.h>
void deleteElement(int arr[], int *size, int pos) {
    if (pos < 0 || pos >= *size) {
        printf("Invalid position! Please enter a valid index (0 to %d).\n", *size - 1);
        return;
    }
    for (int i = pos; i < *size - 1; i++) {
        arr[i] = arr[i + 1];
    }
    (*size)--;
}
int main() {
    int arr[100], n, pos;
    printf("Enter the number of elements in the array: ");
    scanf("%d", &n);
    printf("Enter %d elements:\n", n);
    for (int i = 0; i < n; i++) {
        scanf("%d", &arr[i]);
    }
    printf("Enter the position (0-based index) of the element to delete: ");
    scanf("%d", &pos);
    deleteElement(arr, &n, pos);
    printf("Array after deletion:\n");
    for (int i = 0; i < n; i++) {
        printf("%d ", arr[i]);
    }
    return 0;
}
```

Output :-



Output

```
Enter the number of elements in the array: 5
Enter 5 elements:
1 3 5 7 9
Enter the position (0-based index) of the element to delete: 3
Array after deletion:
1 3 5 9

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

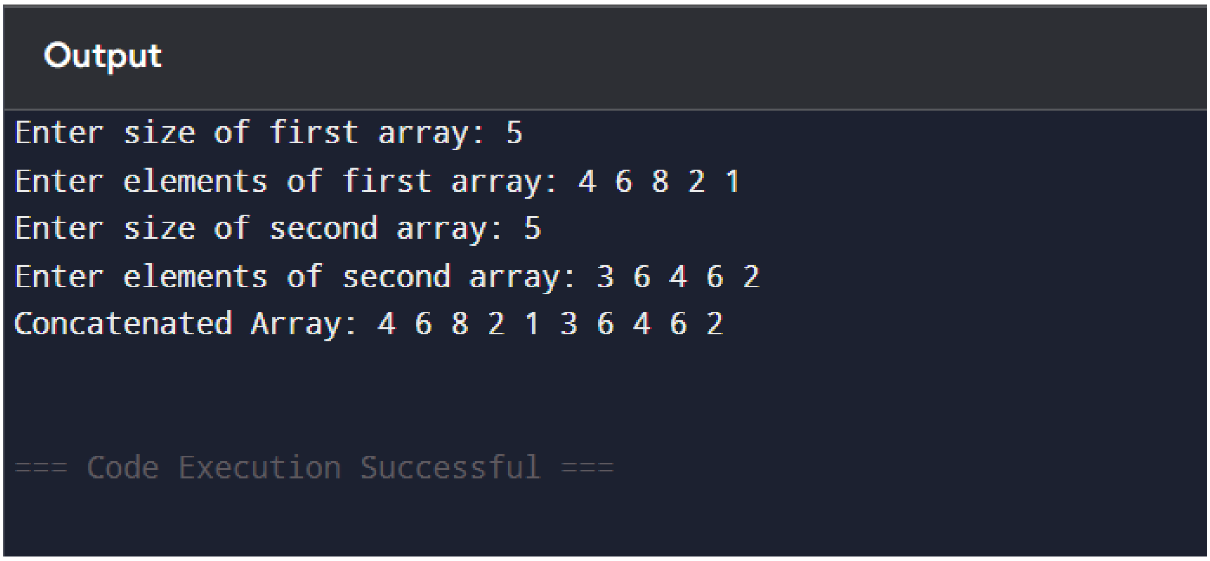
Q3. Write a program in C to concatenate two array .

Ans. Input :-

```
#include <stdio.h>
void concatenateArrays(int arr1[], int size1, int arr2[], int size2, int result[]) {
   int i, j;
   for (i = 0; i < size1; i++) {
      result[i] = arr1[i];
   }
   for (j = 0; j < size2; j++) {
      result[i + j] = arr2[j];
   }
}
void displayArray(int arr[], int size) {
   for (int i = 0; i < size; i++) {
      printf("%d ", arr[i]);
   }
   printf("\n");
}
int main() {
   int size1, size2;
   printf("Enter size of first array: ");
   scanf("%d", &size1);
   int arr1[size1];
   printf("Enter elements of first array: ");
```

```
    for (int i = 0; i < size1; i++) {
        scanf("%d", &arr1[i]);
    }
    printf("Enter size of second array: ");
    scanf("%d", &size2);
    int arr2[size2];
    printf("Enter elements of second array: ");
    for (int i = 0; i < size2; i++) {
        scanf("%d", &arr2[i]);
    }
    int result[size1 + size2];
    concatenateArrays(arr1, size1, arr2, size2, result);
    printf("Concatenated Array: ");
    displayArray(result, size1 + size2);
    return 0;
}
```

Output :-



```
Enter size of first array: 5
Enter elements of first array: 4 6 8 2 1
Enter size of second array: 5
Enter elements of second array: 3 6 4 6 2
Concatenated Array: 4 6 8 2 1 3 6 4 6 2


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

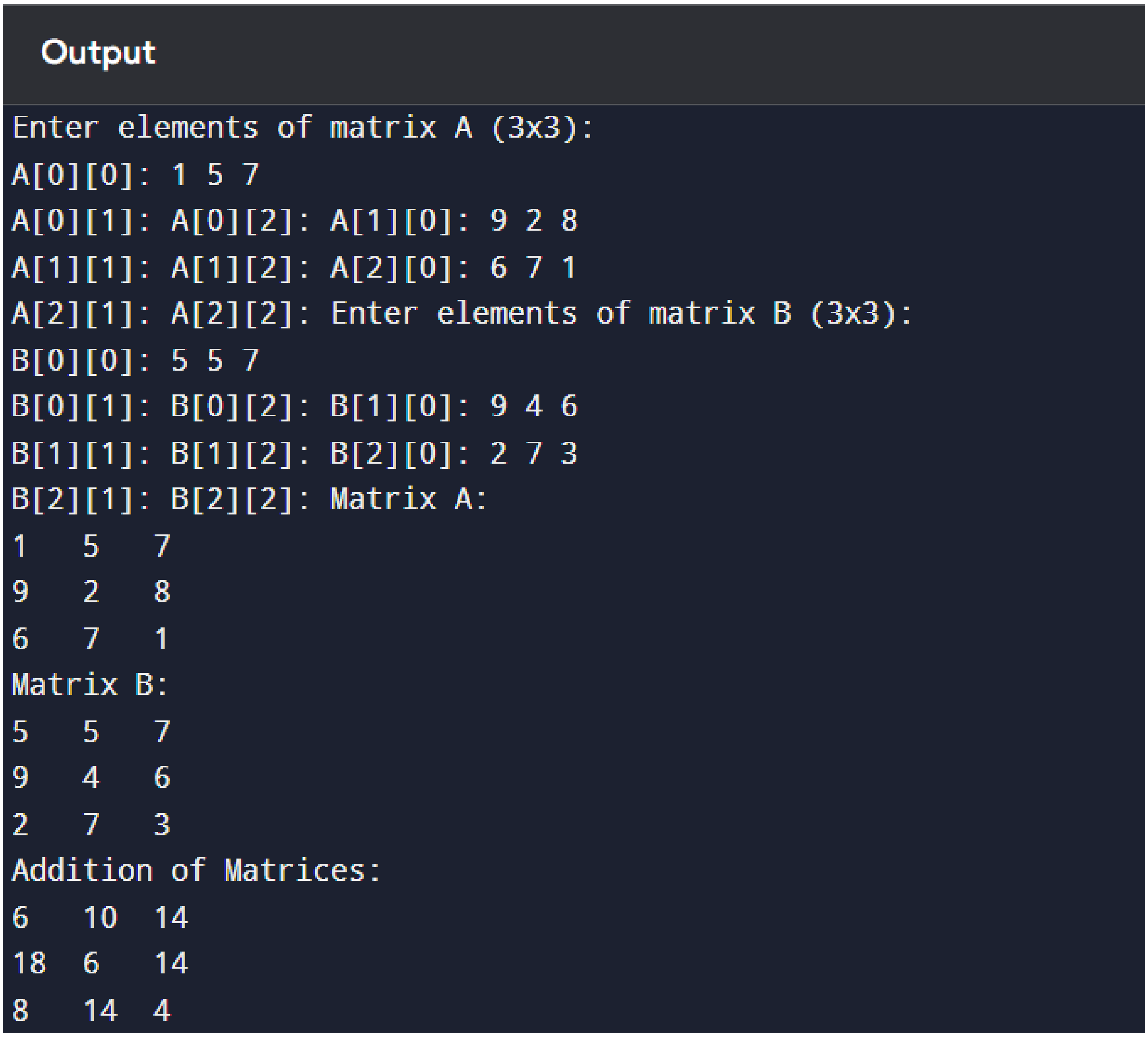
Q4. Write a program in c to implement the following operations on 2d array (addition, subtraction, multiplication, transpose) .

Ans. Input :-

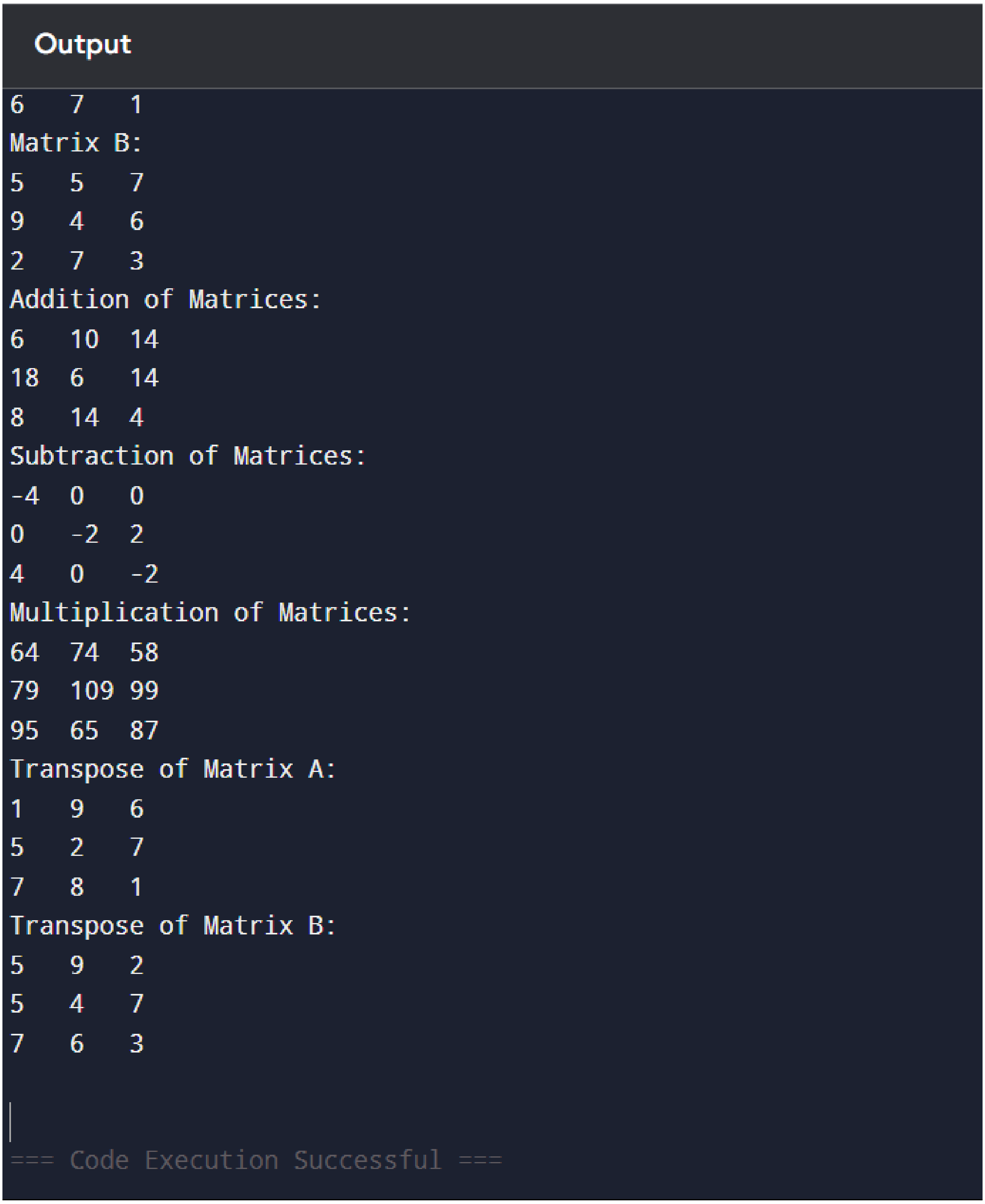
```
#include <stdio.h>

#define ROW 3

#define COL 3

void inputMatrix(int matrix[ROW][COL], char name) {

  printf("Enter elements of matrix %c (%dx%d):\n", name, ROW, COL);

  for (int i = 0; i < ROW; i++) {

    for (int j = 0; j < COL; j++) {

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

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

    }

  }

}

void displayMatrix(int matrix[ROW][COL]) {

  for (int i = 0; i < ROW; i++) {

    for (int j = 0; j < COL; j++) {

      printf("%d\t", matrix[i][j]);

    }

    printf("\n");

  }

}

void addMatrices(int A[ROW][COL], int B[ROW][COL], int result[ROW][COL]) {

  for (int i = 0; i < ROW; i++) {

    for (int j = 0; j < COL; j++) {

      result[i][j] = A[i][j] + B[i][j];
```

```
        }
    }
}
void subtractMatrices(int A[ROW][COL], int B[ROW][COL], int
result[ROW][COL]) {
    for (int i = 0; i < ROW; i++) {
        for (int j = 0; j < COL; j++) {
            result[i][j] = A[i][j] - B[i][j];
        }
    }
}
void multiplyMatrices(int A[ROW][COL], int B[ROW][COL], int
result[ROW][COL]) {
    for (int i = 0; i < ROW; i++) {
        for (int j = 0; j < COL; j++) {
            result[i][j] = 0;
            for (int k = 0; k < COL; k++) {
                result[i][j] += A[i][k] * B[k][j];
            }
        }
    }
}
void transposeMatrix(int A[ROW][COL], int result[ROW][COL]) {
    for (int i = 0; i < ROW; i++) {
        for (int j = 0; j < COL; j++) {
            result[j][i] = A[i][j];
        }
    }
}
int main() {
    int A[ROW][COL], B[ROW][COL], result[ROW][COL];

    inputMatrix(A, 'A');
    inputMatrix(B, 'B');

    printf("Matrix A:\n");
    displayMatrix(A);
    printf("Matrix B:\n");
    displayMatrix(B);

    addMatrices(A, B, result);
    printf("Addition of Matrices:\n");
    displayMatrix(result);

    subtractMatrices(A, B, result);
    printf("Subtraction of Matrices:\n");
    displayMatrix(result);

    multiplyMatrices(A, B, result);
    printf("Multiplication of Matrices:\n");
    displayMatrix(result);

    transposeMatrix(A, result);
    printf("Transpose of Matrix A:\n");
    displayMatrix(result);

    transposeMatrix(B, result);
    printf("Transpose of Matrix B:\n");
    displayMatrix(result);

    return 0;
}
```

Output :-



```
Enter elements of matrix A (3x3):
A[0][0]: 1 5 7
A[0][1]: A[0][2]: A[1][0]: 9 2 8
A[1][1]: A[1][2]: A[2][0]: 6 7 1
A[2][1]: A[2][2]: Enter elements of matrix B (3x3):
B[0][0]: 5 5 7
B[0][1]: B[0][2]: B[1][0]: 9 4 6
B[1][1]: B[1][2]: B[2][0]: 2 7 3
B[2][1]: B[2][2]: Matrix A:
1   5   7
9   2   8
6   7   1
Matrix B:
5   5   7
9   4   6
2   7   3
Addition of Matrices:
6   10  14
18  6   14
8   14  4
```



Output

```
6   7   1
Matrix B:
5   5   7
9   4   6
2   7   3
Addition of Matrices:
6   10  14
18  6   14
8   14  4
Subtraction of Matrices:
-4  0   0
0   -2  2
4   0   -2
Multiplication of Matrices:
64  74  58
79  109 99
95  65  87
Transpose of Matrix A:
1   9   6
5   2   7
7   8   1
Transpose of Matrix B:
5   9   2
5   4   7
7   6   3


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

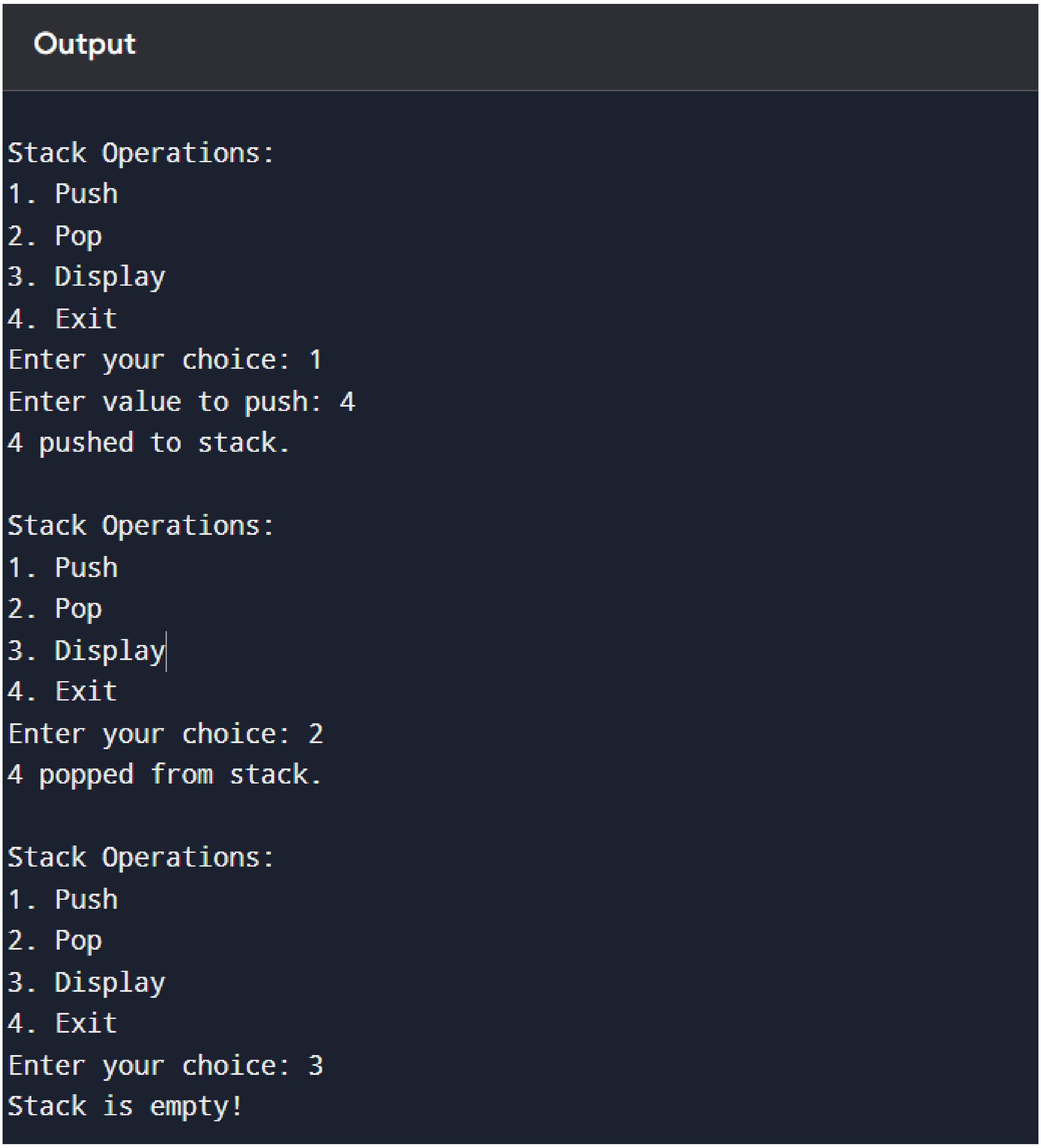
Q5. Write a program in C to implement operations on stack using array.

Ans. Input :-

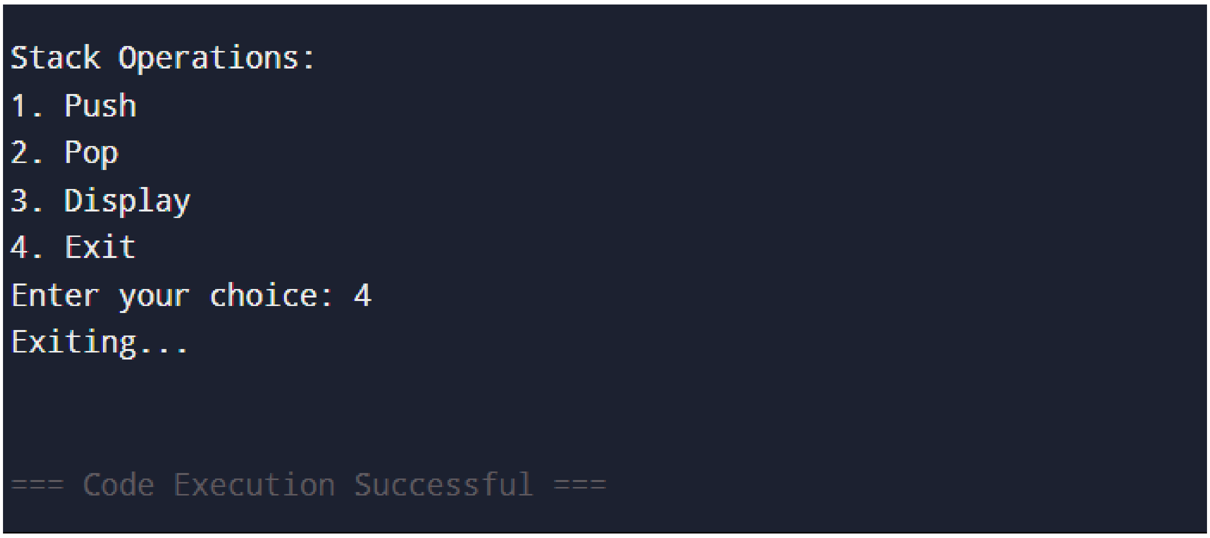
```
#include <stdio.h>
#define MAX 10
int stack[MAX], top = -1;
void push() {
   int value;
   if (top == MAX - 1) {
      printf("Stack Overflow!\n");
      return;
   }
   printf("Enter value to push: ");
   scanf("%d", &value);
   stack[++top] = value;
   printf("%d pushed to stack.\n", value);
}
void pop() {
   if (top == -1) {
      printf("Stack Underflow!\n");
      return;
   }
   printf("%d popped from stack.\n", stack[top--]);
}
void display() {
   if (top == -1) {
      printf("Stack is empty!\n");
```

```
        return;
    }
    printf("Stack elements: ");
    for (int i = top; i >= 0; i--) {
        printf("%d ", stack[i]);
    }
    printf("\n");
}
int main() {
    int choice;
    do {
        printf("\nStack Operations:\n");
        printf("1. Push\n2. Pop\n3. Display\n4. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1: push(); break;
            case 2: pop(); break;
            case 3: display(); break;
            case 4: printf("Exiting...\n"); break;
            default: printf("Invalid choice!\n");
        }
    } while (choice != 4);
    return 0;
}
```

Output :-



```
Stack Operations:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 1
Enter value to push: 4
4 pushed to stack.

Stack Operations:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 2
4 popped from stack.

Stack Operations:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 3
Stack is empty!
```



```
Stack Operations:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 4
Exiting...


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

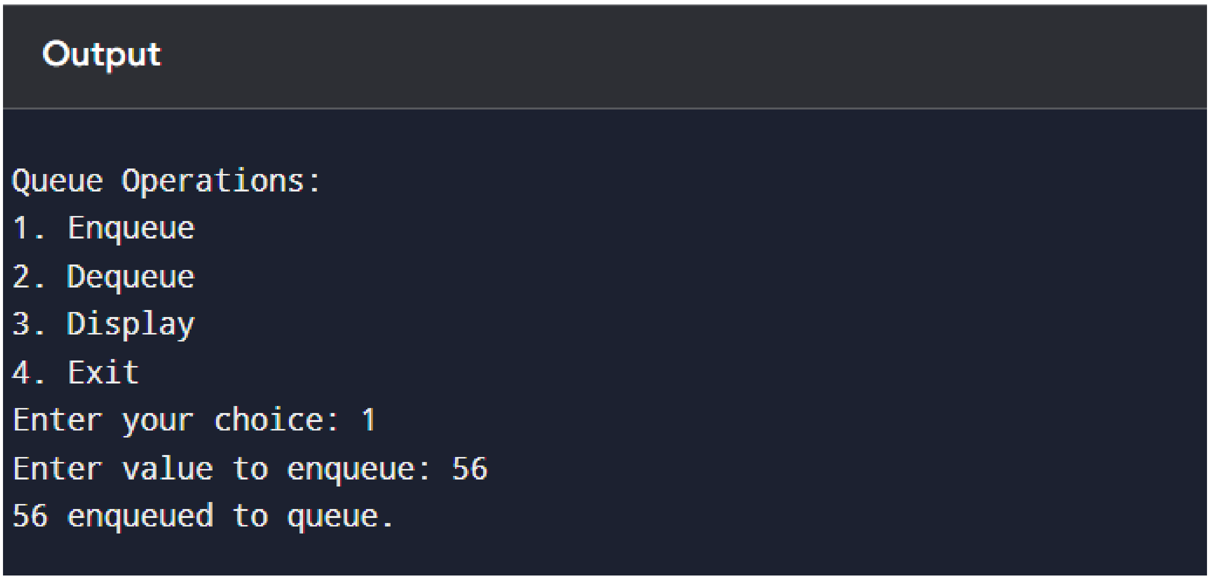
Q6. Write a program in C to implement operations on queue using array.

Ans. Input :-

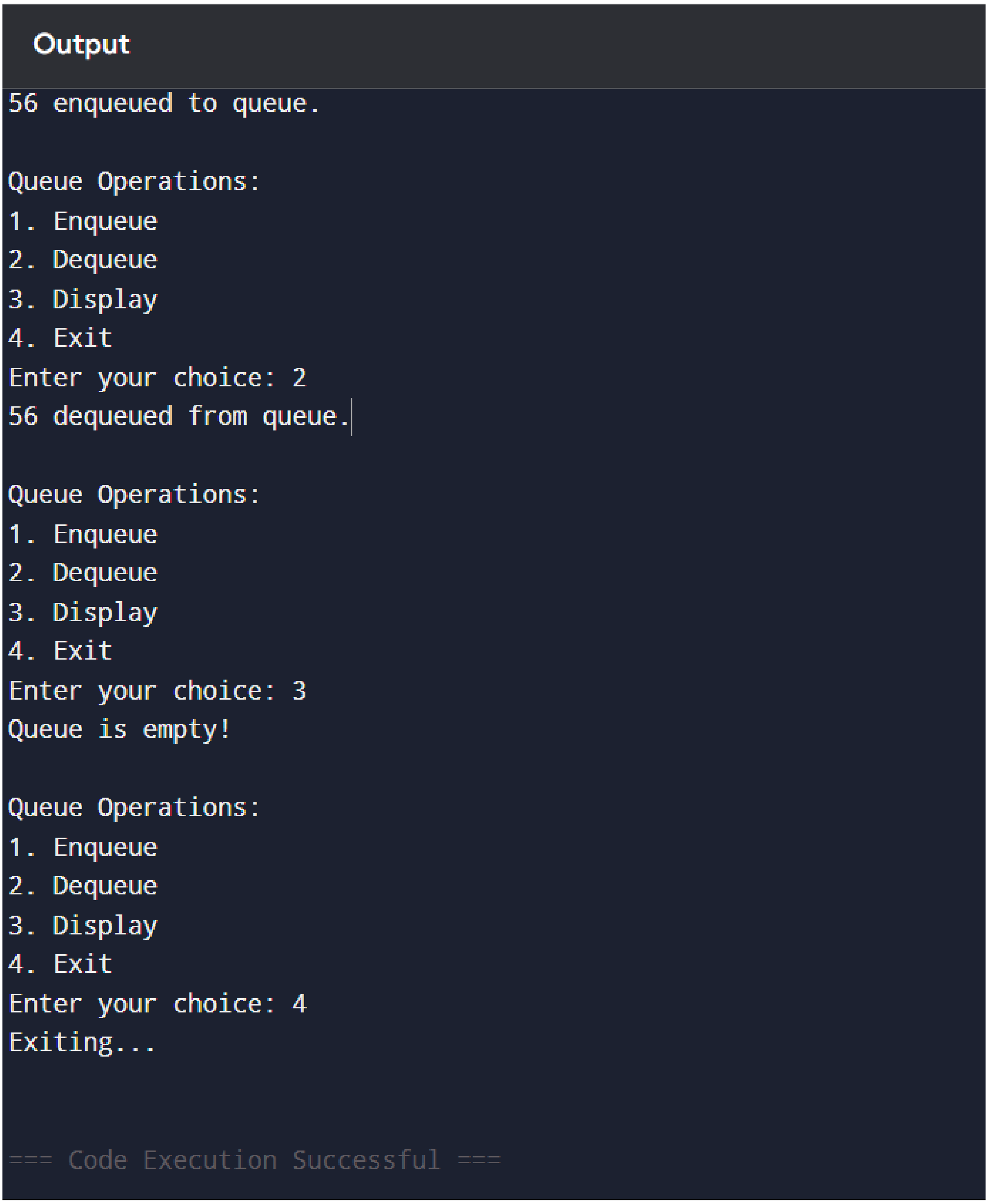
```
#include <stdio.h>
#define MAX 10
int queue[MAX], front = -1, rear = -1;
void enqueue() {
    int value;
    if (rear == MAX - 1) {
        printf("Queue Overflow!\n");
        return;
    }
    printf("Enter value to enqueue: ");
    scanf("%d", &value);
    if (front == -1) front = 0;
    queue[++rear] = value;
    printf("%d enqueued to queue.\n", value);
```

```
}
void dequeue() {
    if (front == -1 || front > rear) {
        printf("Queue Underflow!\n");
        front = rear = -1;
        return;
    }
    printf("%d dequeued from queue.\n", queue[front++]);
}
void display() {
    if (front == -1 || front > rear) {
        printf("Queue is empty!\n");
        return;
    }
    printf("Queue elements: ");
    for (int i = front; i <= rear; i++) {
        printf("%d ", queue[i]);
    }
    printf("\n");
}
int main() {
    int choice;
    do {
        printf("\nQueue Operations:\n");
        printf("1. Enqueue\n2. Dequeue\n3. Display\n4. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);

        switch (choice) {
            case 1: enqueue(); break;
            case 2: dequeue(); break;
            case 3: display(); break;
            case 4: printf("Exiting...\n"); break;
            default: printf("Invalid choice!\n");
        }
    } while (choice != 4);
    return 0;
}
```

Output :-



```
Queue Operations:
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 1
Enter value to enqueue: 56
56 enqueued to queue.
```



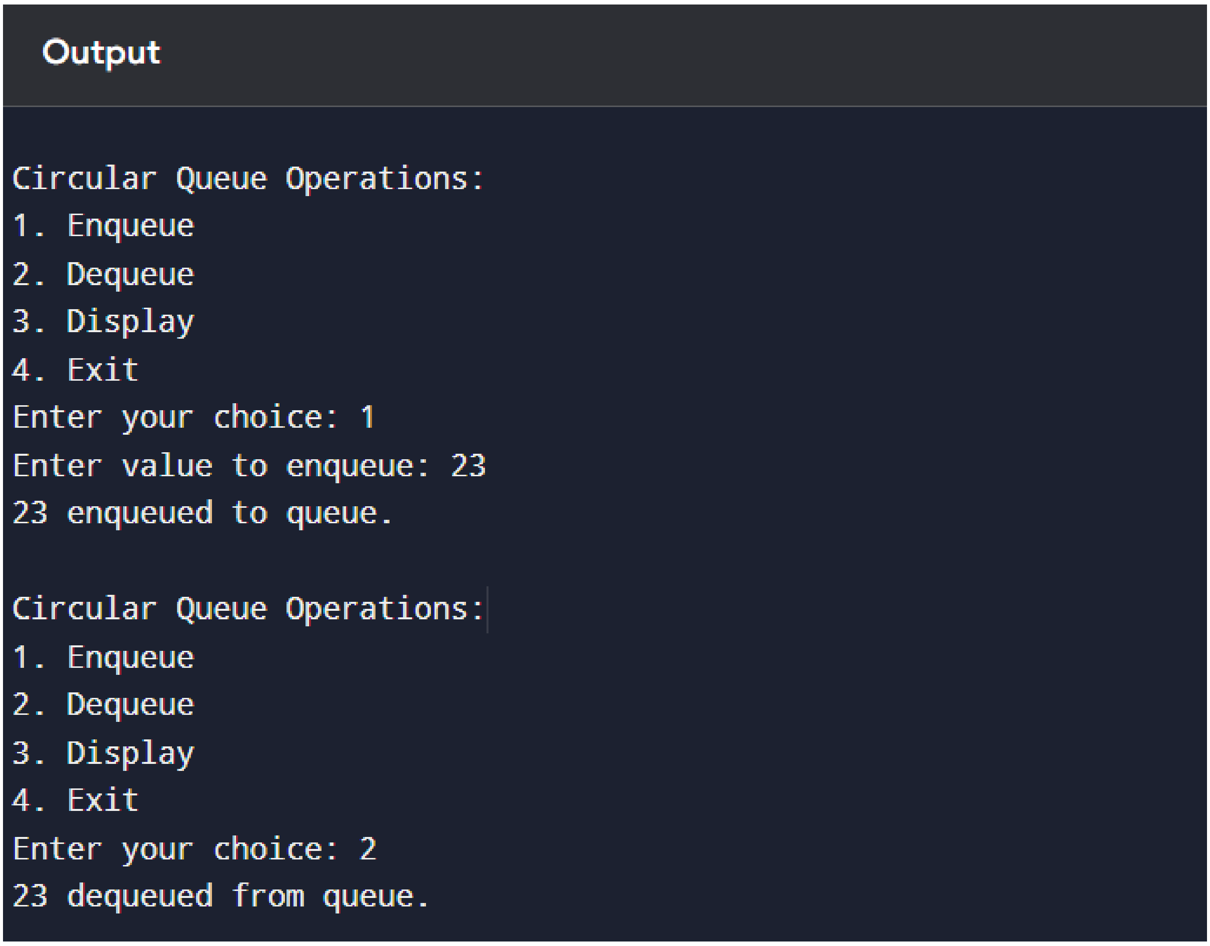
```
56 enqueued to queue.

Queue Operations:
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 2
56 dequeued from queue.

Queue Operations:
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 3
Queue is empty!

Queue Operations:
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 4
Exiting...



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

Q7. Write a program in C to implement operations on circular queue using array.

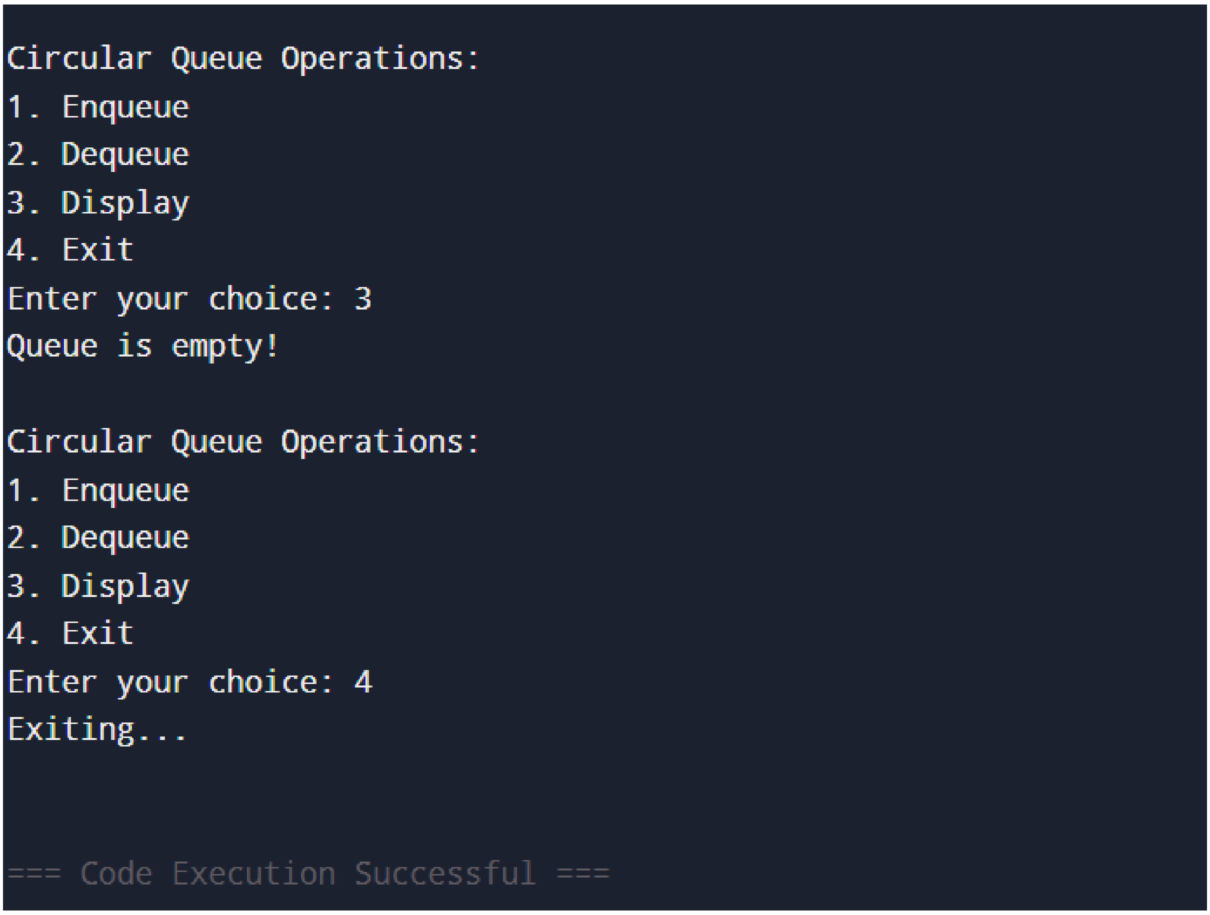
Ans. Input :-

```
#include <stdio.h>
#define MAX 5
int queue[MAX], front = -1, rear = -1;
void enqueue() {
    int value;
    if ((rear + 1) % MAX == front) {
        printf("Queue Overflow!\n");
        return;
    }
    printf("Enter value to enqueue: ");
    scanf("%d", &value);
    if (front == -1) front = 0;
    rear = (rear + 1) % MAX;
    queue[rear] = value;
    printf("%d enqueued to queue.\n", value);
}
void dequeue() {
    if (front == -1) {
        printf("Queue Underflow!\n");
        return;
    }
    printf("%d dequeued from queue.\n", queue[front]);
    if (front == rear) {
        front = rear = -1;
    } else {
        front = (front + 1) % MAX;
    }
}
void display() {
    if (front == -1) {
        printf("Queue is empty!\n");
        return;
    }
    printf("Queue elements: ");
    int i = front;
    while (1) {
        printf("%d ", queue[i]);
        if (i == rear) break;
        i = (i + 1) % MAX;
    }
    printf("\n");
}
int main() {
    int choice;
    do {
        printf("\nCircular Queue Operations:\n");
        printf("1. Enqueue\n2. Dequeue\n3. Display\n4. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);
        switch (choice) {
            case 1: enqueue(); break;
            case 2: dequeue(); break;
            case 3: display(); break;
            case 4: printf("Exiting...\n"); break;
            default: printf("Invalid choice!\n");
        }
    } while (choice != 4);

    return 0;
}
```

Output :-



```
Circular Queue Operations:
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 1
Enter value to enqueue: 23
23 enqueued to queue.

Circular Queue Operations:
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 2
23 dequeued from queue.
```



```
Circular Queue Operations:
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 3
Queue is empty!

Circular Queue Operations:
1. Enqueue
2. Dequeue
3. Display
4. Exit
Enter your choice: 4
Exiting...


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

Q8. Perform insertion operation in link list(beginning, mid, end) and perform deletion operation in link list (beginning, mid , end) .

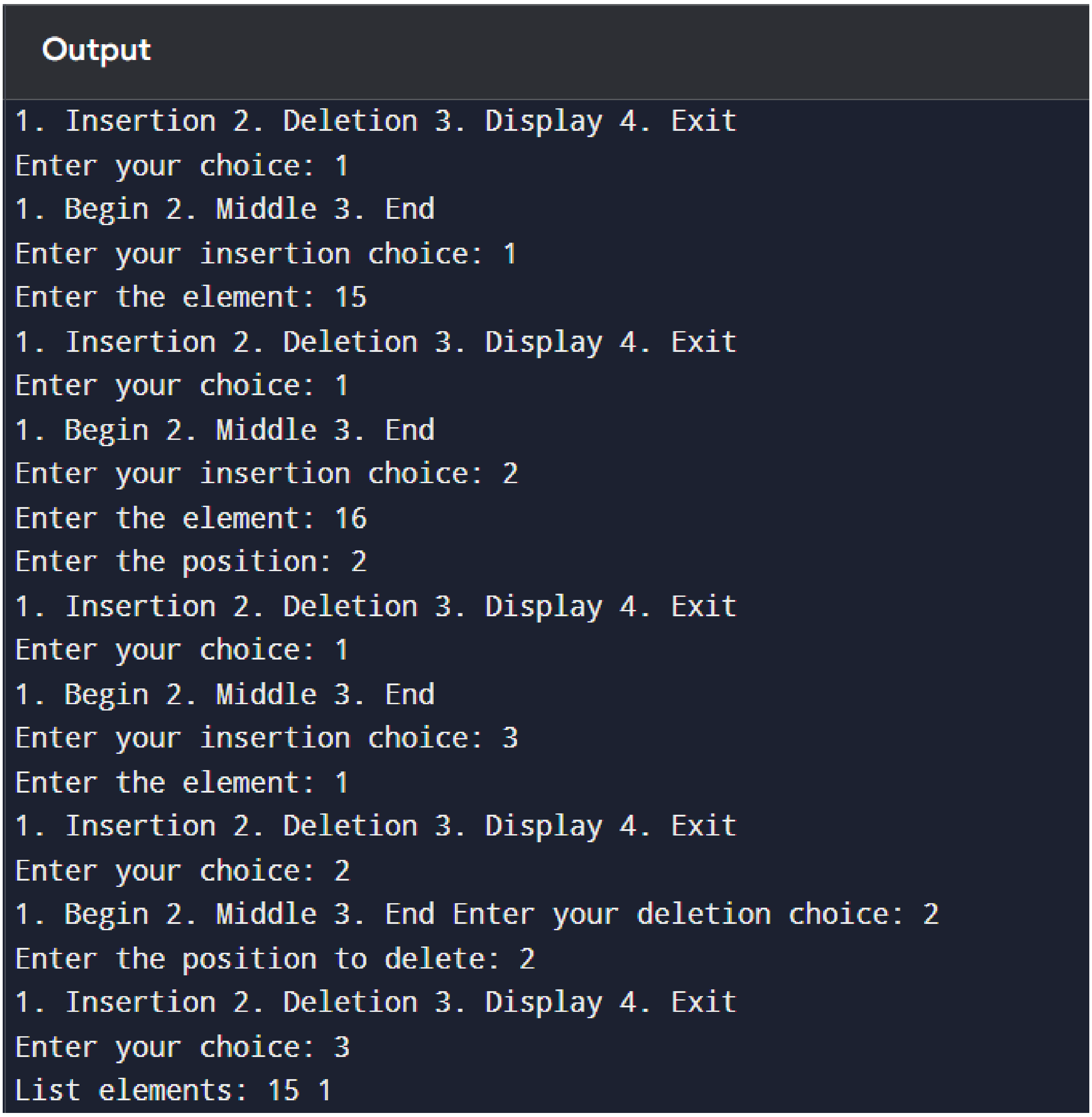
Ans. Input :-

```
#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");
}
```

Output :-



Output

```
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: 15
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: 16
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: 1
1. Insertion 2. Deletion 3. Display 4. Exit
Enter your choice: 2
1. Begin 2. Middle 3. End Enter your deletion choice: 2
Enter the position to delete: 2
1. Insertion 2. Deletion 3. Display 4. Exit
Enter your choice: 3
List elements: 15 1
```