Data Structures and Algorithms

ASSESSMENT-1

24BBS0115

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PSEUDOCODE

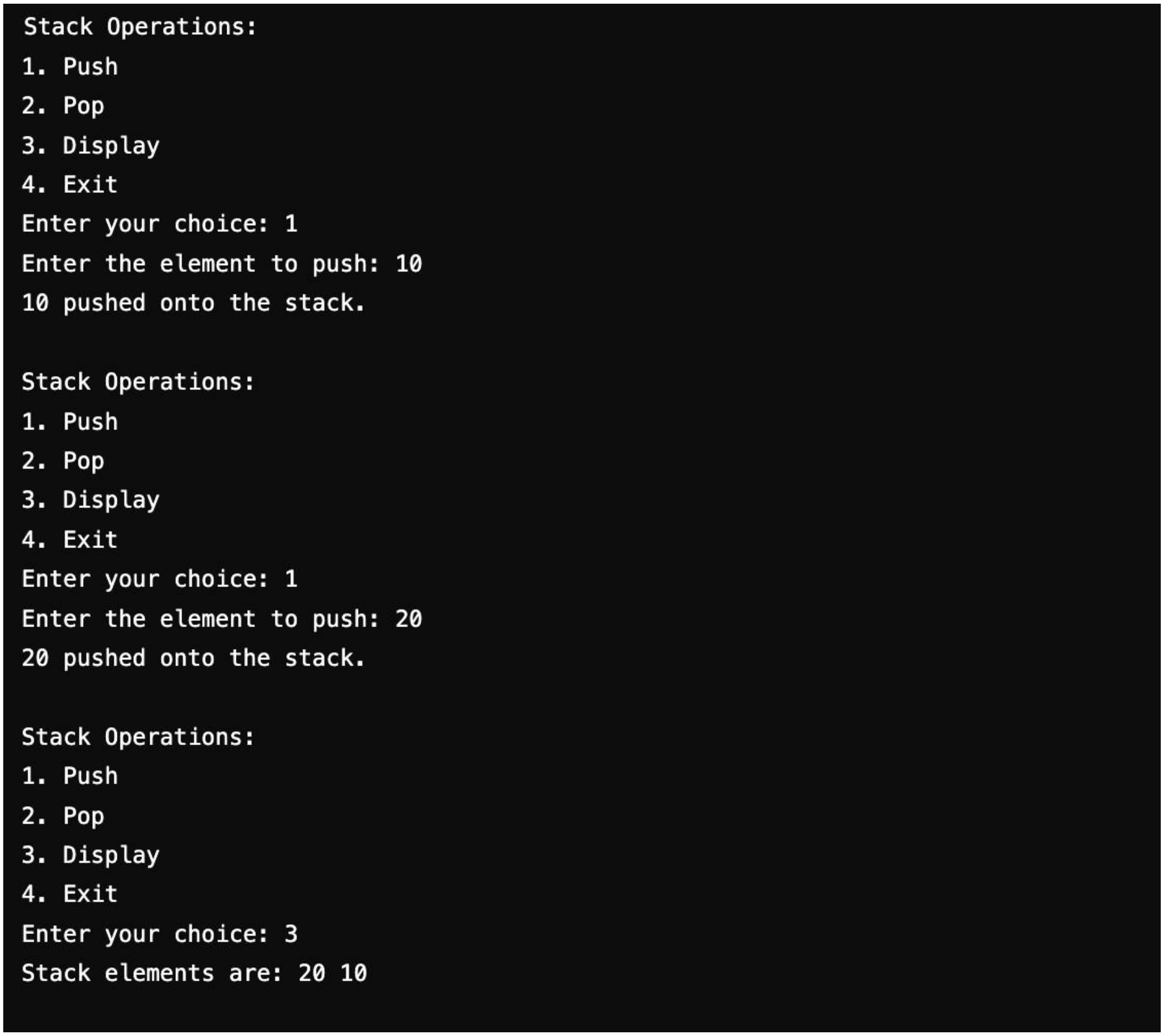
```
START
Initialize stack[MAX] and top = -1
FUNCTION PUSH():
  IF top == MAX - 1:
    PRINT "Stack Overflow"
  ELSE:
    READ element
    INCREMENT top by 1
    stack[top] = element
FUNCTION POP():
  IF top == -1:
    PRINT "Stack Underflow"
  ELSE:
    DECREMENT top by 1
FUNCTION DISPLAY():
  IF top == -1:
    PRINT "Stack is empty"
  ELSE:
    FOR i = top TO 0:
      PRINT stack[i]
MAIN    PROGRAM
```

```
WHILE TRUE:
    PRINT "1. PUSH  2. POP  3. DISPLAY  4. EXIT"
    READ choice
    SWITCH(choice):
      CASE 1: CALL PUSH()
      CASE 2: CALL POP()
      CASE 3: CALL DISPLAY()
      CASE 4: EXIT
      DEFAULT: PRINT "Invalid choice"
END
```

PROGRAM:

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

#define MAX 5

int stack[MAX], top = -1;

void push() {
  int element;
  if (top == MAX - 1) {
    printf("Stack Overflow!\n");
  } else {
    scanf("%d", &element);
    stack[++top] = element;
  }
}

void pop() {
  if (top == -1) {
        printf("Stack Underflow!\n");
} else {
top--;
    }
}

void display() {
    if (top == -1) {
        printf("Stack is empty.\n");
    } else {
for (int i = top; i >= 0; i--) {
printf("%d ", stack[i]);
        }
        printf("\n");
    }
}

int main() {
    int choice;
    while (1) {
        scanf("%d", &choice);
        switch (choice) {
            case 1: push(); break;
            case 2: pop(); break;
            case 3: display(); break;
            case 4: exit(0);
        }
    }
    return 0;
}
```

OUTPUT:



```
Stack Operations:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 1
Enter the element to push: 10
10 pushed onto the stack.

Stack Operations:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 1
Enter the element to push: 20
20 pushed onto the stack.

Stack Operations:
1. Push
2. Pop
3. Display
4. Exit
Enter your choice: 3
Stack elements are: 20 10
```

PSEUDOCODE:

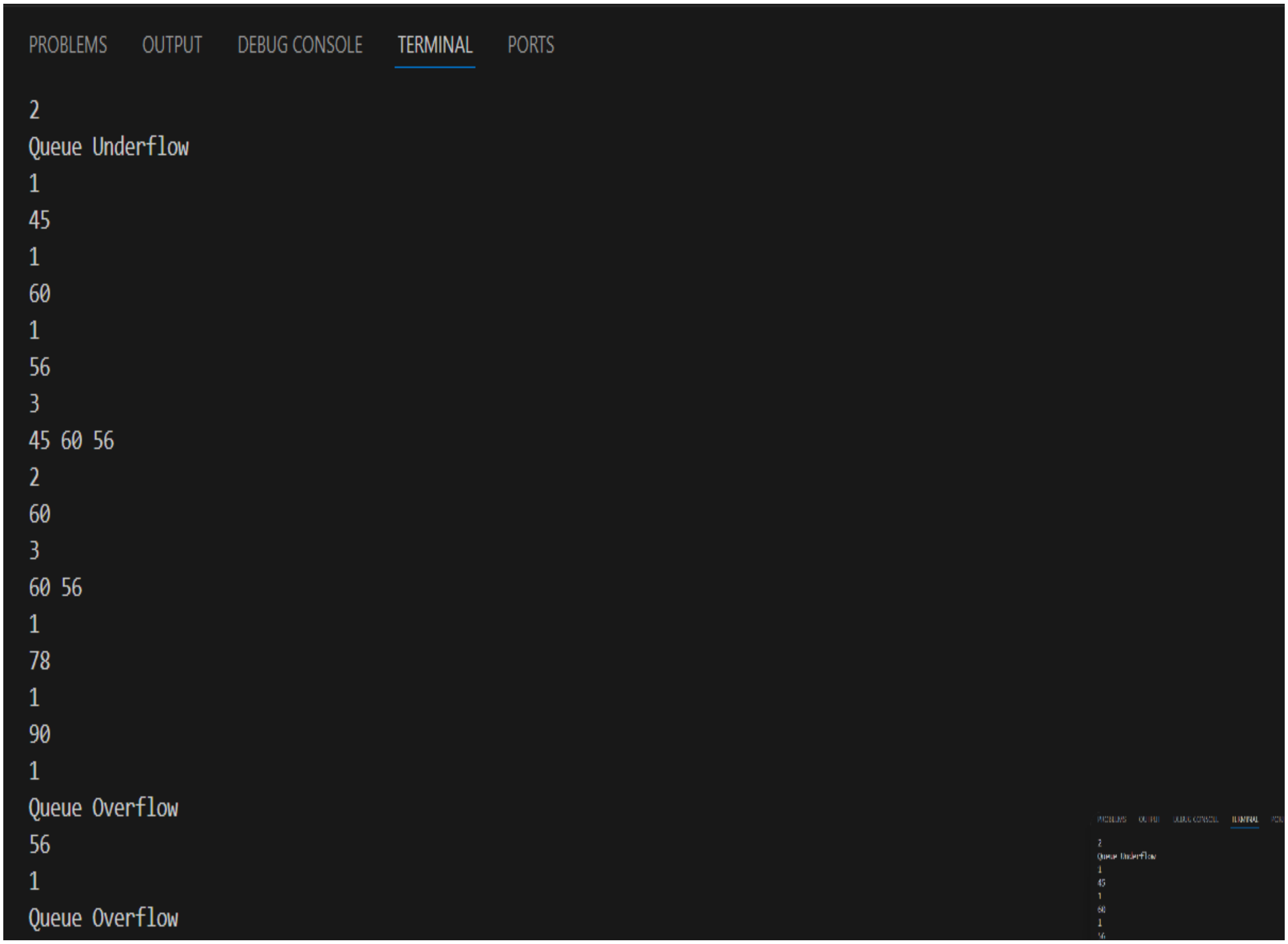
```
START
Initialize queue[MAX], front = -1, rear = -1
FUNCTION ENQUEUE():
    IF rear == MAX - 1:
        PRINT "Queue Overflow"
    ELSE:
        READ element
        IF front == -1:
            front = 0
        INCREMENT rear by 1
        queue[rear] = element
FUNCTION DEQUEUE():
    IF front == -1 OR front > rear:
        PRINT "Queue Underflow"
        front = -1, rear = -1
    ELSE:
        INCREMENT front by 1
FUNCTION DISPLAY():
    IF front == -1 OR front > rear:
        PRINT "Queue is empty"
    ELSE:
        FOR i = front TO rear:
            PRINT queue[i]
MAIN PROGRAM:
    WHILE TRUE:
        PRINT "1. ENQUEUE  2. DEQUEUE  3. DISPLAY  4. EXIT"
        READ choice
        SWITCH(choice):
            CASE 1: CALL ENQUEUE()
            CASE 2: CALL DEQUEUE()
            CASE 3: CALL DISPLAY()
            CASE 4: EXIT
END
```

PROGRAM:

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

```
#define MAX 5

int queue[MAX], front = -1, rear = -1;

void enqueue() {
    int element;
    if (rear == MAX - 1) {
        printf("Queue Overflow\n");
    } else {
        scanf("%d", &element);
        if (front == -1) front = 0;
        queue[++rear] = element;
    }
}

void dequeue() {
    if (front == -1 || front > rear) {
        printf("Queue Underflow\n");
        front = -1;
        rear = -1;
    } else {
        front++;
    }
}

void display() {
    if (front == -1 || front > rear) {
        printf("Queue is empty\n");
    } else {
        for (int i = front; i <= rear; i++) {
            printf("%d ", queue[i]);
        }
        printf("\n");
    }
}

int main() {
    int choice;
    while (1) {
        scanf("%d", &choice);
        switch (choice) {
            case 1: enqueue(); break;
            case 2: dequeue(); break;
            case 3: display(); break;
            case 4: exit(0);
        }
    }
    return 0;
}

]
```

OUTPUT:
Test Case 1,2,3-



```
2
Queue Underflow
1
45
1
60
1
56
3
45 60 56
2
60
3
60 56
1
78
1
90
1
Queue Overflow
56
1
Queue Overflow
```

PSEUDOCODE

```
START
Initialize queue[MAX], front = -1, rear = -1
FUNCTION ENQUEUE():
    IF (front == 0 AND rear == MAX - 1) OR (rear + 1) % MAX == front:
        PRINT "Queue Overflow"
    ELSE:
        READ element
        IF front == -1:
            front = 0
        rear = (rear + 1) % MAX
        queue[rear] = element
FUNCTION DEQUEUE():
    IF front == -1:
        PRINT "Queue Underflow"
    ELSE:
        IF front == rear:
            front = -1, rear = -1
        ELSE:
            front = (front + 1) % MAX
FUNCTION DISPLAY():
    IF front == -1:
        PRINT "Queue is empty"
    ELSE:
        SET i = front
        WHILE i != rear:
            PRINT queue[i]
            i = (i + 1) % MAX
        PRINT queue[rear]
```

MAIN PROGRAM:

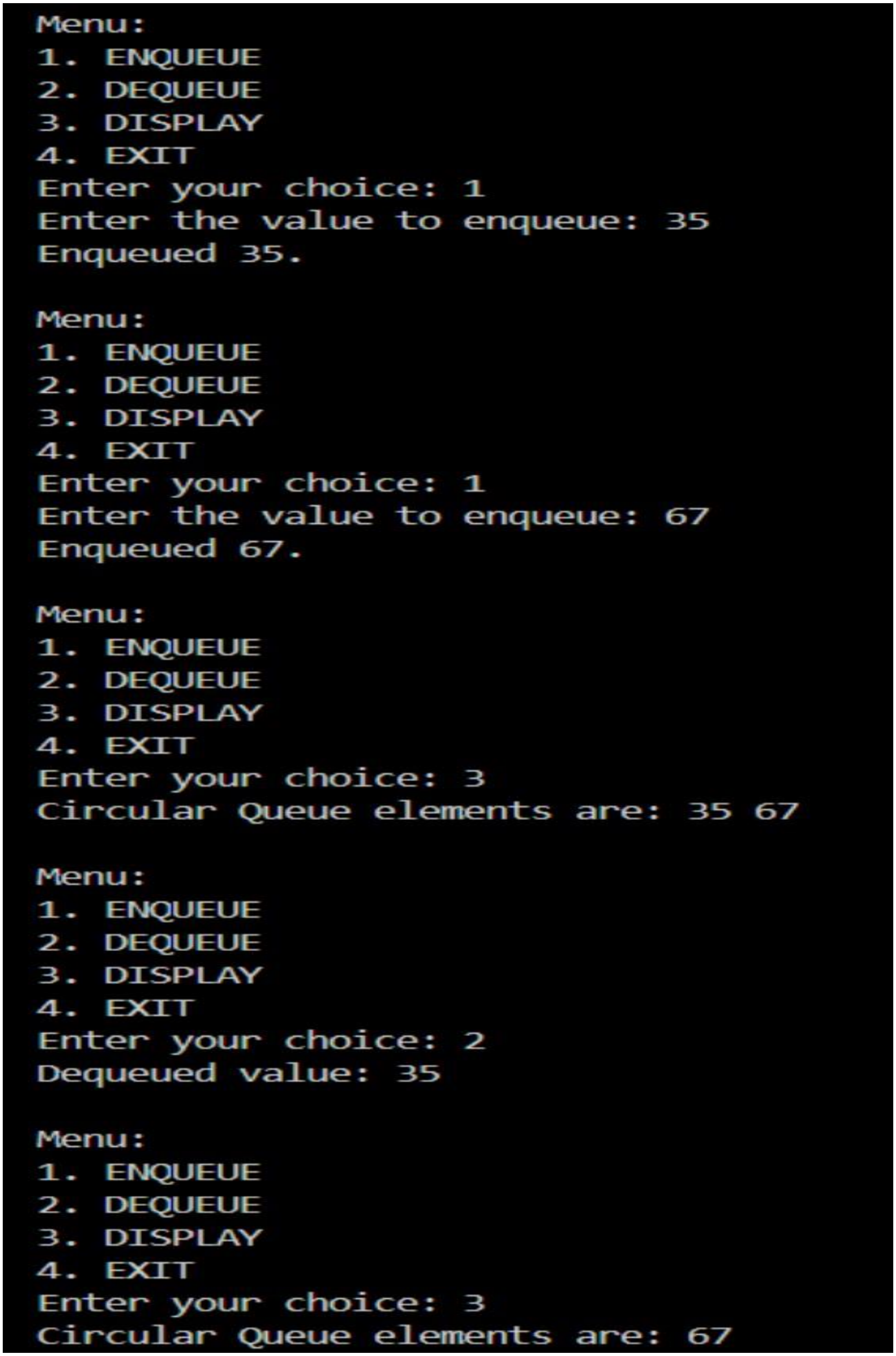
```
WHILE TRUE:
    PRINT "1. ENQUEUE  2. DEQUEUE  3. DISPLAY  4. EXIT"
    READ choice
    SWITCH(choice):
      CASE 1: CALL ENQUEUE()
      CASE 2: CALL DEQUEUE()
      CASE 3: CALL DISPLAY()
      CASE 4: EXIT
END
```

PROGRAM:

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

#define MAX 5

int queue[MAX], front = -1, rear = -1;

void enqueue() {
  int element;
  if ((front == 0 && rear == MAX - 1) || (rear + 1) % MAX == front) {
    printf("Queue Overflow\n");
  } else {
    scanf("%d", &element);
    if (front == -1) front = 0;
    rear = (rear + 1) % MAX;
    queue[rear] = element;
  }
}
```

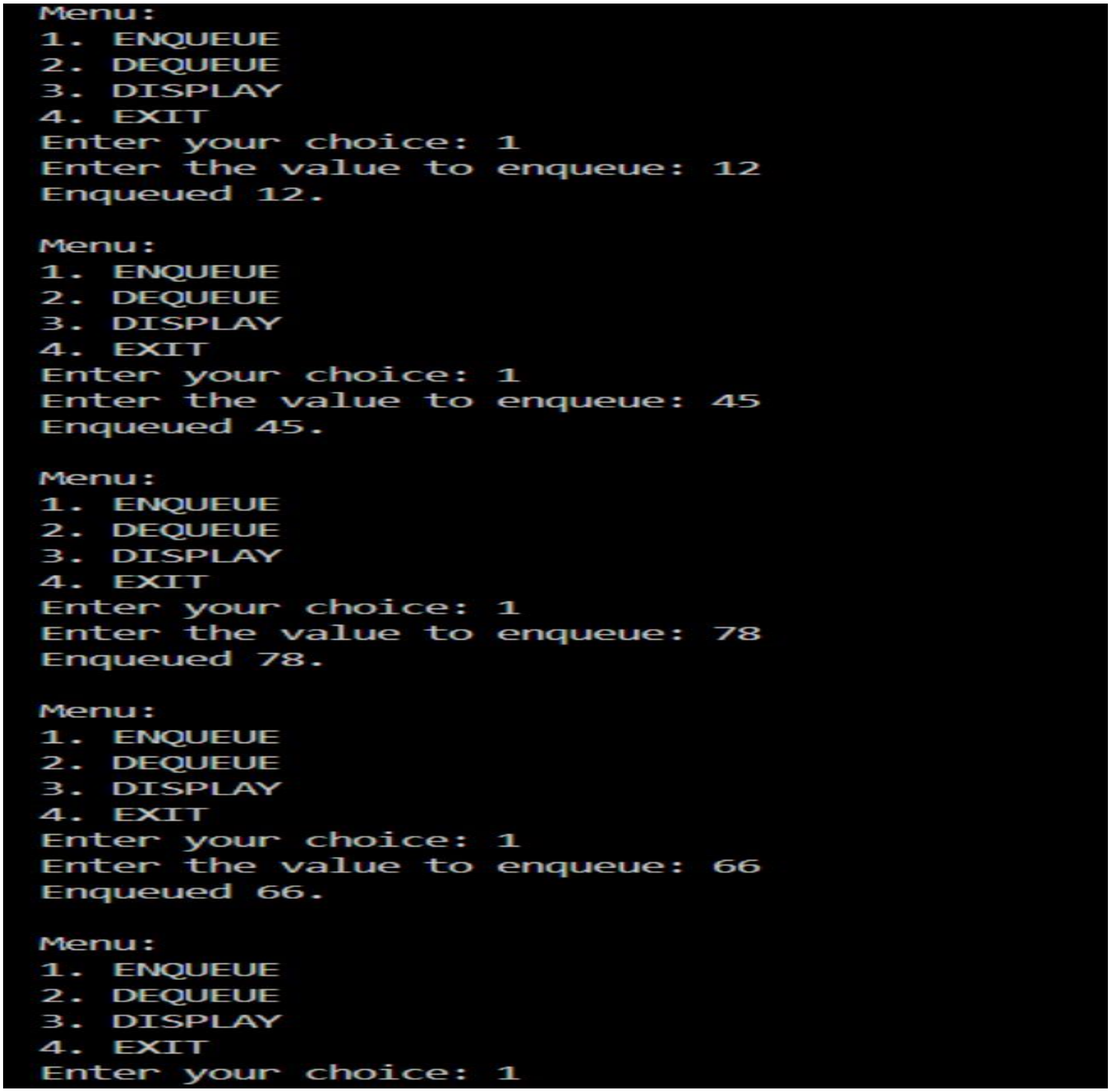
```
void dequeue() {
    if (front == -1) {
        printf("Queue Underflow\n");
    } else {
        if (front == rear) {
            front = -1;
            rear = -1;
        } else {
            front = (front + 1) % MAX;
        }
    }
}

void display() {
    if (front == -1) {
        printf("Queue is empty\n");
    } else {
        int i = front;
        while (i != rear) {
            printf("%d ", queue[i]);
            i = (i + 1) % MAX;
        }
        printf("%d\n", queue[rear]);
    }
}

int main() {
    int choice;
    while (1) {
        scanf("%d", &choice);
        switch (choice) {
            case 1: enqueue(); break;
            case 2: dequeue(); break;
            case 3: display(); break;
            case 4: exit(0);
        }
    }
    return 0;
}
```

OUTPUT
TEST CASE 1



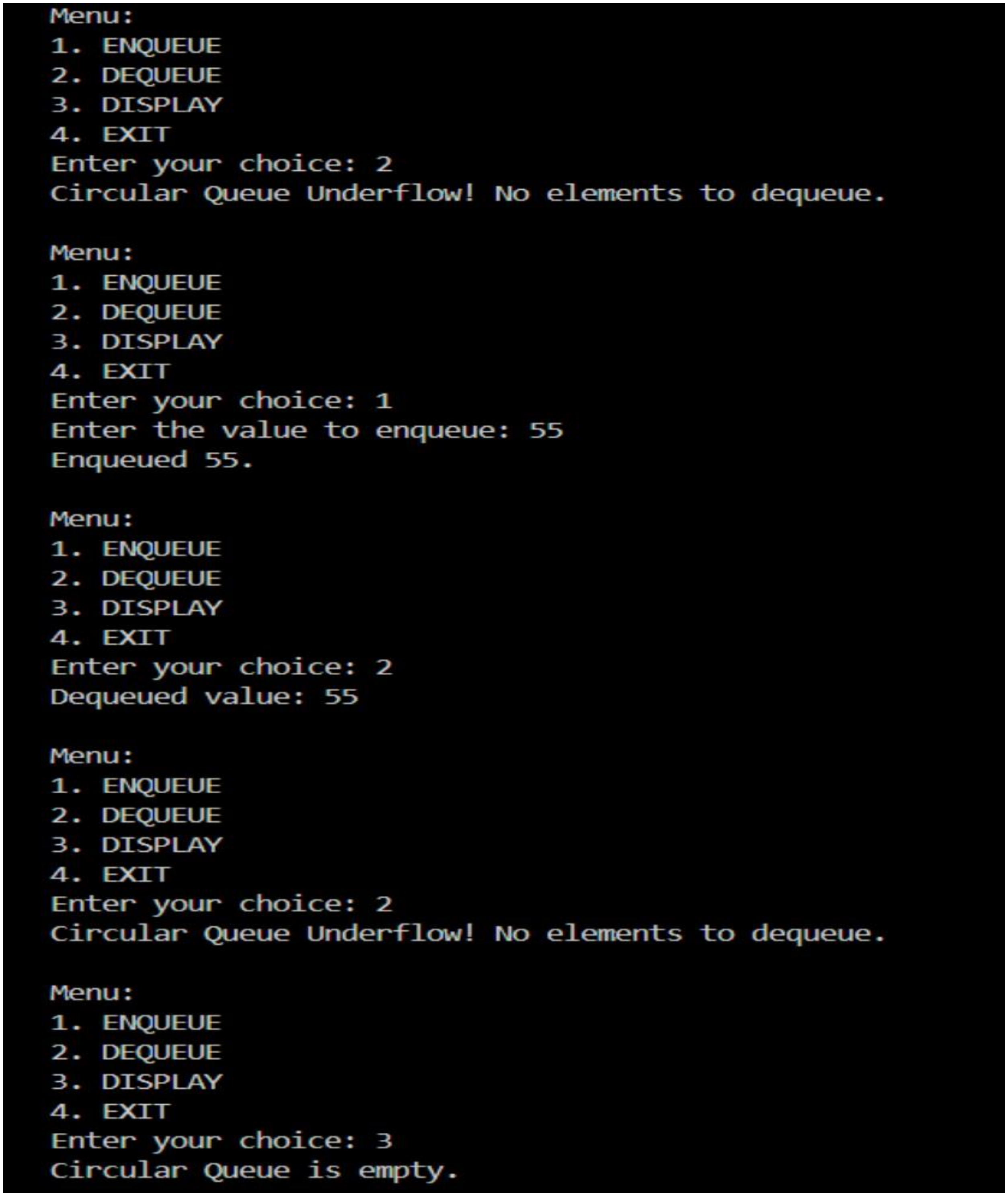
```
Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 1
Enter the value to enqueue: 35
Enqueued 35.

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 1
Enter the value to enqueue: 67
Enqueued 67.

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 3
Circular Queue elements are: 35 67

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 2
Dequeued value: 35

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 3
Circular Queue elements are: 67
```

Test case 2:



```
Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 1
Enter the value to enqueue: 12
Enqueued 12.

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 1
Enter the value to enqueue: 45
Enqueued 45.

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 1
Enter the value to enqueue: 78
Enqueued 78.

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 1
Enter the value to enqueue: 66
Enqueued 66.

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 1
```

Test case 3:



```
Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 2
Circular Queue Underflow! No elements to dequeue.

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 1
Enter the value to enqueue: 55
Enqueued 55.

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 2
Dequeued value: 55

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 2
Circular Queue Underflow! No elements to dequeue.

Menu:
1. ENQUEUE
2. DEQUEUE
3. DISPLAY
4. EXIT
Enter your choice: 3
Circular Queue is empty.
```

PSEUOCODE:

```
Head = NULL
11
Junction Insert B (value):
Create new Node new Nod. date = value Head new Node.
 next= Hand = New Node
Print " Value inserted in beginning
Junction Insert E():
create new Node
new Node date- value new Node  - NULL HEAD == NULL; Head New Node else:
set temp = head
while temp. next != NULL;
temp = temp next!= NULL: temp-temp-next temp. next = newNode
punt "value inserted at end"
Junction Insert N (head, pos.)
create new Node new Node date = value
is position ==1;newnode.next=Head
 head = new Node
else
 set temp Head
for <= 5 to position - 2:
temp = temp. next
if temp = NULL print "saved"
return
newNode, next = temp.
 next = new Node
temp next print (value inserted)
```

```
Junction delete B(): if HEAD NULL; print "empty"
set temp Head
Head-Head next
delete temp
print "Deleted value from beginning "77
delete
Junction () {
if head == NULL
punt "List is empty"
Hij if head. next = NULL delete HEAD VALUE
Junction (search temp); sit = Head = dreship nature, while temp. data = value
14 Buick &
}
temp!= NULL
return temp = temp.
next print ("Value find a
2019”

 temp = temp. next
print
"List is empty”
display ():

1 head == temp

else:
et is head != number
is time temp = NULL;
white temp != NULL
line temp date temp = temp need



main program
```

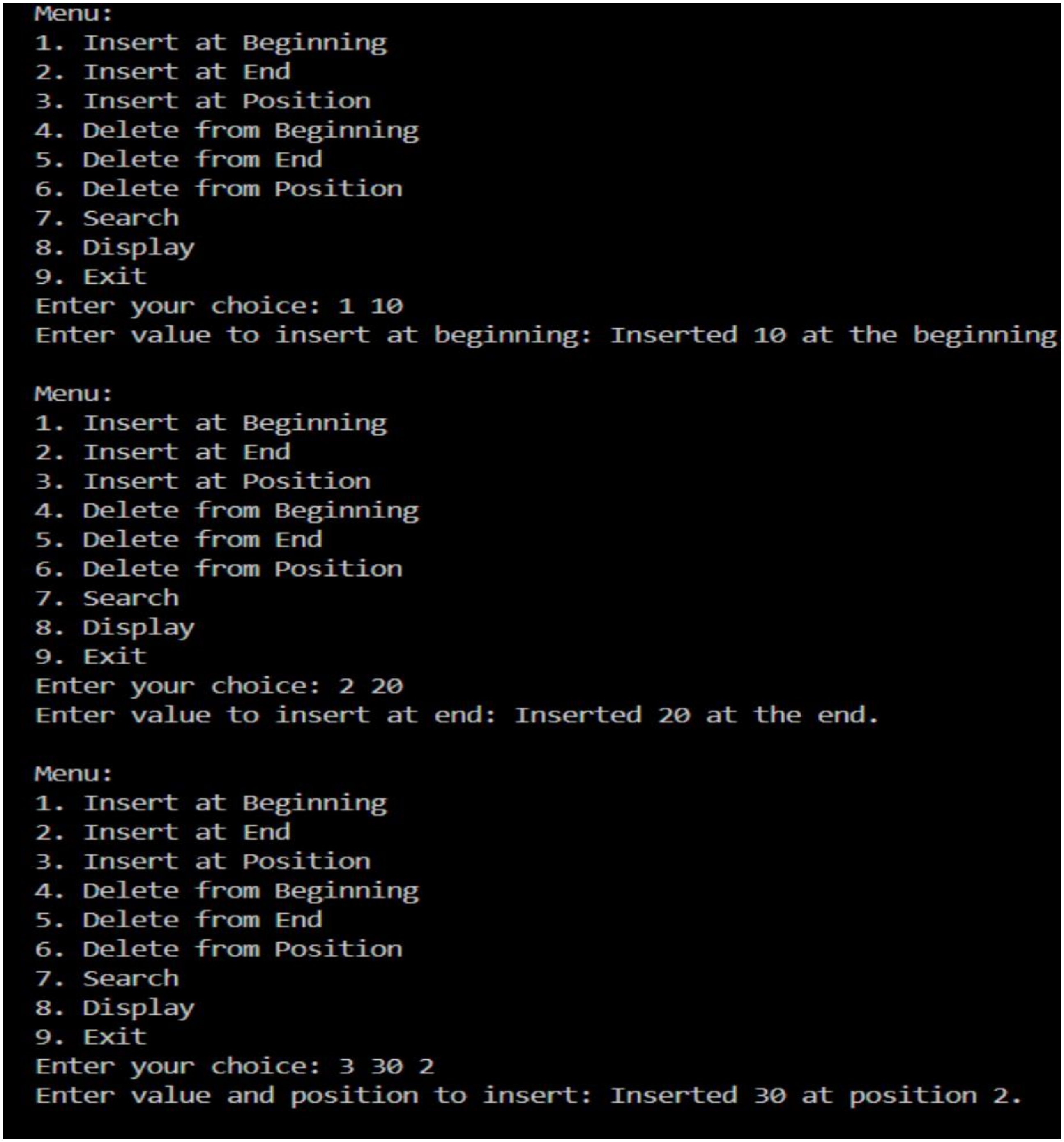
```
while.
Display and
punt menu (Insert, Delete, search exist input choice
switch case
case 1:
input value (CAA)  style
 Insert B (value)
Insert E
(value,pos)
case 4:
Delete B (G
case 5:
print (14
classes
case 6:
Input position
Delete position input positions
delete_position (position
case 7:
case 8
case9
Input mal search (value)
display()
print" exiting
Break"
print “invalid choice”
default:
Print >> "Invalid choice"
```

Program:

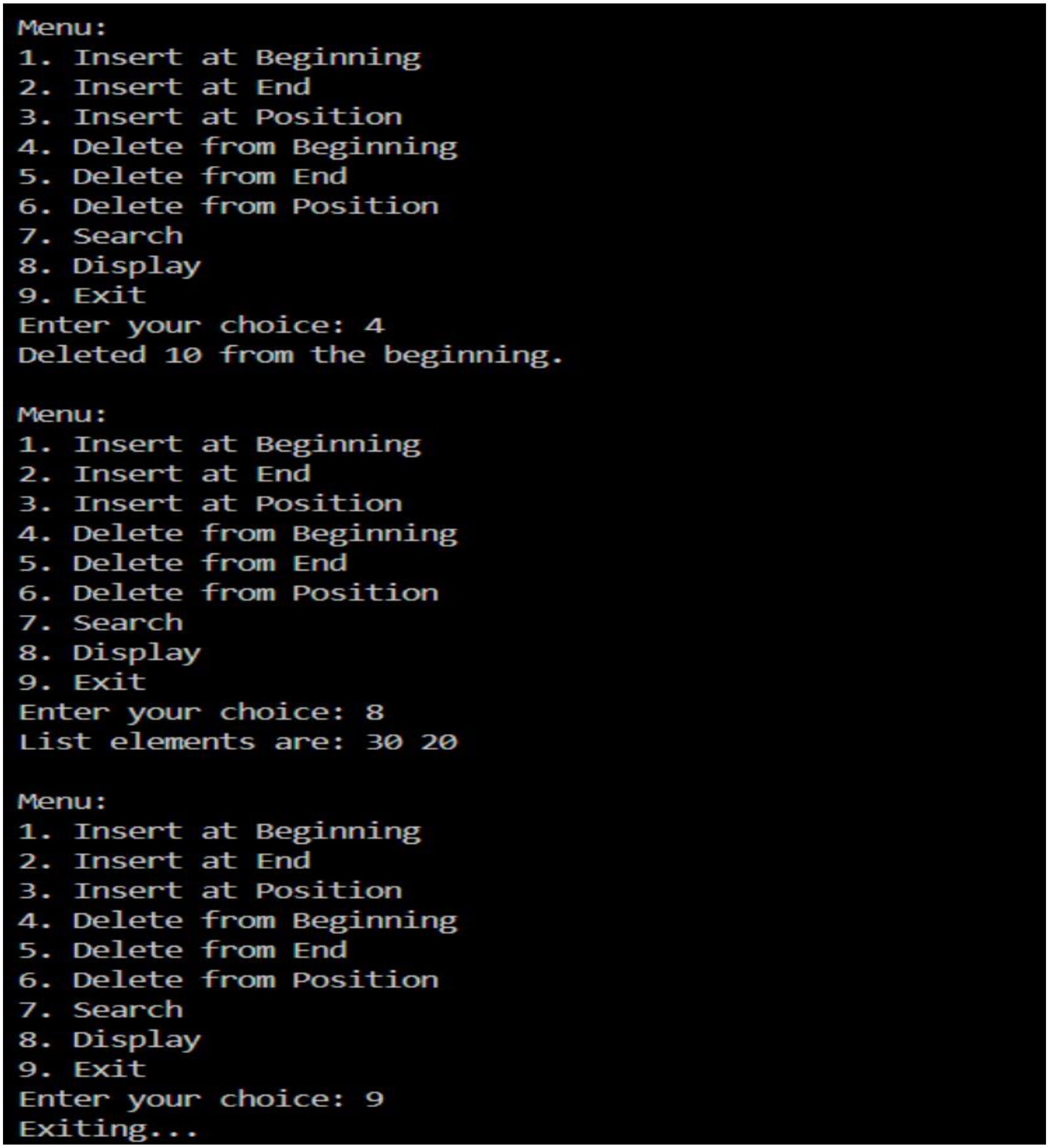
```
#include <stdio.h>
#include <stdlib.h>

struct Node {
    int data;
    struct Node *next;
};

struct Node *head = NULL;

void insertAtBeginning(int value) {
    struct Node *new_node = (struct Node *)malloc(sizeof(struct Node));
    new_node->data = value;
    new_node->next = head;
    head = new_node;
}

void insertAtEnd(int value) {
    struct Node *new_node = (struct Node *)malloc(sizeof(struct Node));
    new_node->data = value;
    new_node->next = NULL;
    if (head == NULL) {
        head = new_node;
    } else {
        struct Node *temp = head;
        while (temp->next != NULL) {
            temp = temp->next;
        }
        temp->next = new_node;
    }
}

void insertAtPosition(int value, int position) {
    struct Node *new_node = (struct Node *)malloc(sizeof(struct Node));
    new_node->data = value;
    if (position == 1) {
        new_node->next = head;
        head = new_node;
        return;
    }
    struct Node *temp = head;
    for (int i = 1; i < position - 1 && temp != NULL; i++) {
        temp = temp->next;
    }
    if (temp == NULL) {
        printf("Position out of bounds\n");
    } else {
        new_node->next = temp->next;
        temp->next = new_node;
    }
}

void deleteAtBeginning() {
    if (head == NULL) {
        printf("List is empty\n");
    } else {
        struct Node *temp = head;
        head = head->next;
        free(temp);
    }
}

void deleteAtEnd() {
    if (head == NULL) {
        printf("List is empty\n");
    } else if (head->next == NULL) {
        free(head);
        head = NULL;
    } else {
        struct Node *temp = head;
        while (temp->next->next != NULL) {
            temp = temp->next;
        }
        free(temp->next);
        temp->next = NULL;
    }
}

void deleteAtPosition(int position) {
    if (head == NULL) {
        printf("List is empty\n");
    } else if (position == 1) {
        struct Node *temp = head;
        head = head->next;
        free(temp);
    } else {
        struct Node *temp = head, *prev = NULL;
        for (int i = 1; i < position && temp != NULL; i++) {
            prev = temp;
            temp = temp->next;
        }
        if (temp == NULL) {
            printf("Position out of bounds\n");
        } else {
            prev->next = temp->next;
            free(temp);
        }
    }
}

void search(int value) {
    struct Node *temp = head;
    int position = 1;
    while (temp != NULL) {
        if (temp->data == value) {
            printf("Element found at position %d\n", position);
            return;
        }
        temp = temp->next;
        position++;
    }
    printf("Element not found\n");
}

void display() {
    if (head == NULL) {
        printf("List is empty\n");
    } else {
        struct Node *temp = head;
        while (temp != NULL) {
            printf("%d -> ", temp->data);
            temp = temp->next;
        }
        printf("NULL\n");
    }
}

int main() {
    int choice, value, position;
    while (1) {
        scanf("%d", &choice);
        switch (choice) {
            case 1:
                scanf("%d", &value);
                insertAtBeginning(value);
                break;
            case 2:
                scanf("%d", &value);
                insertAtEnd(value);
                break;
            case 3:
                scanf("%d %d", &value, &position);
                insertAtPosition(value, position);
                break;
            case 4:
                deleteAtBeginning();
                break;
            case 5:
                deleteAtEnd();
                break;
            case 6:
                scanf("%d", &position);
                deleteAtPosition(position);
                break;
            case 7:
                scanf("%d", &value);
                search(value);
                break;
            case 8:
                display();
                break;
            case 9:
                exit(0);
        }
    }
    return 0;
}
```

Output:

Testcase-1

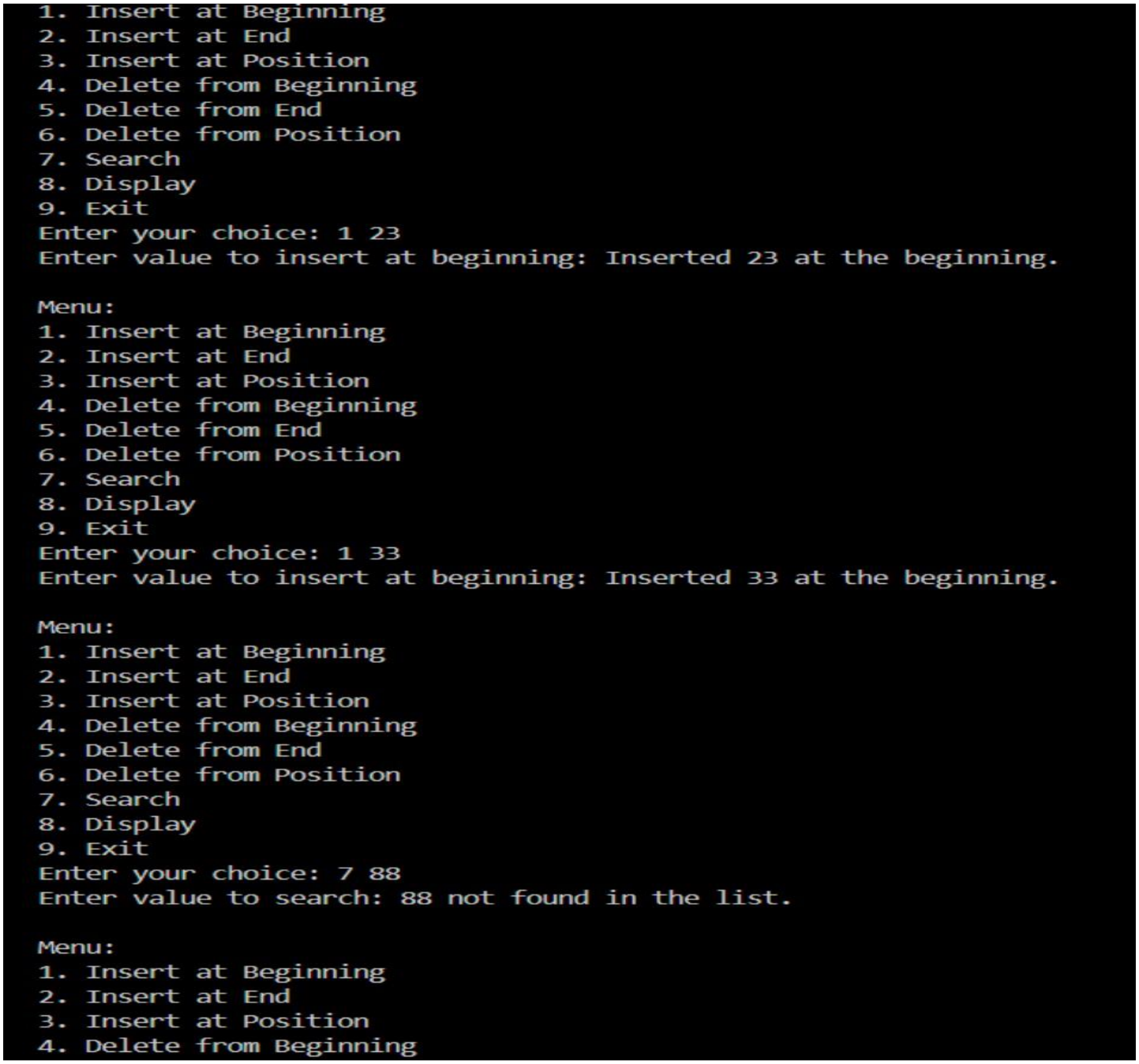


```
Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 1 10
Enter value to insert at beginning: Inserted 10 at the beginning

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 2 20
Enter value to insert at end: Inserted 20 at the end.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 3 30 2
Enter value and position to insert: Inserted 30 at position 2.
```

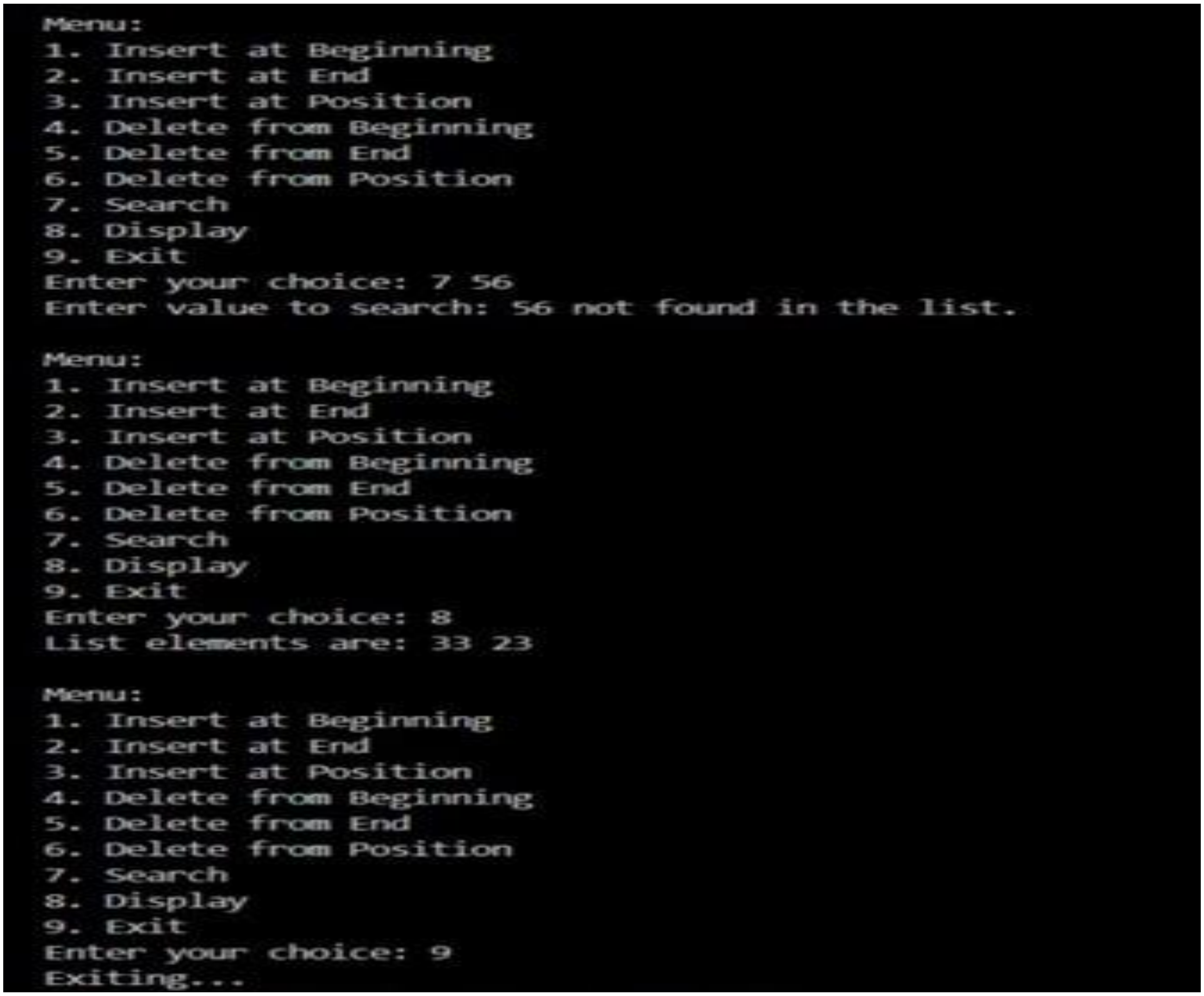


```
Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 4
Deleted 10 from the beginning.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 8
List elements are: 30 20

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 9
Exiting...
```

Testcase-2:

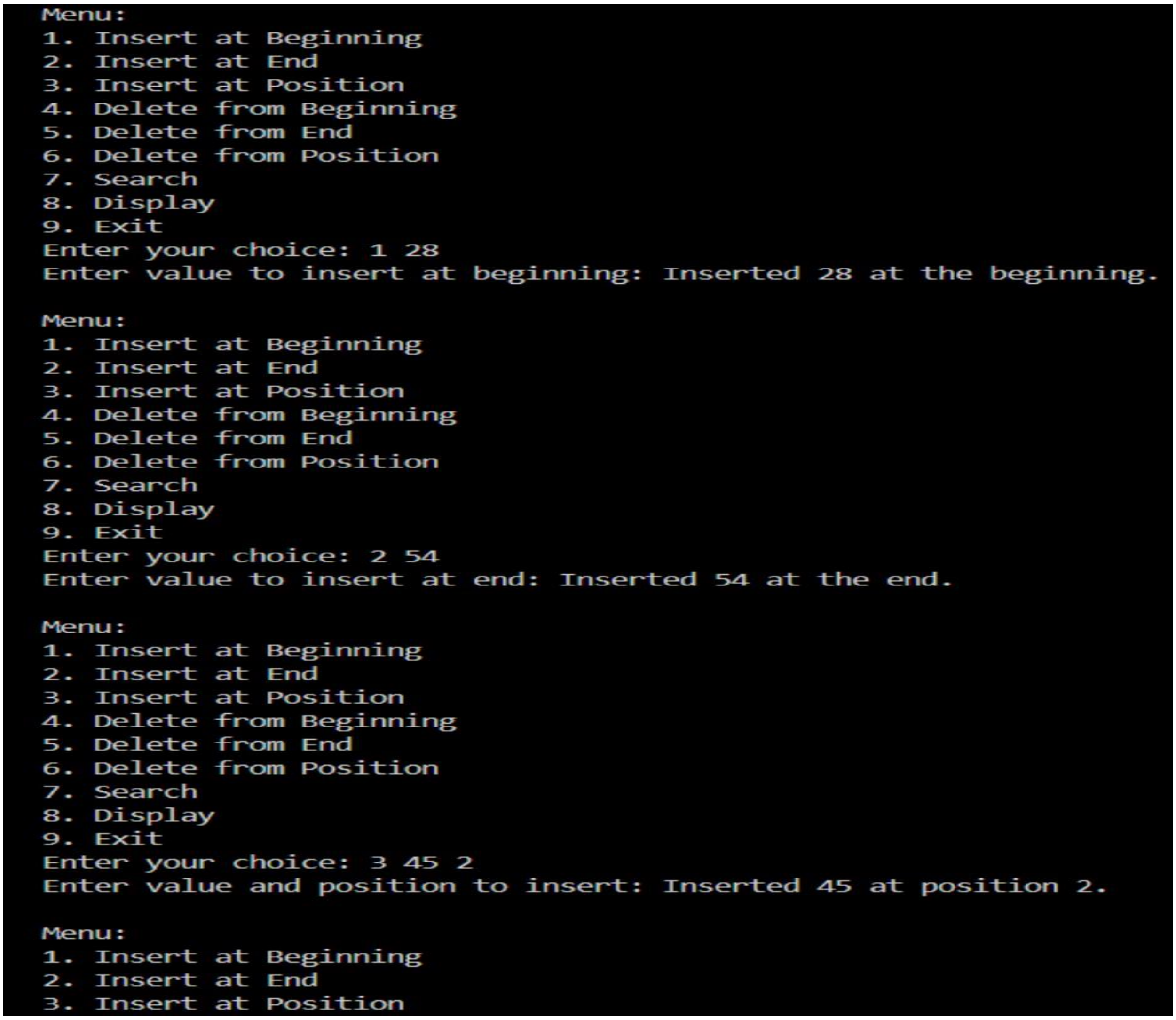


```
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 1 23
Enter value to insert at beginning: Inserted 23 at the beginning.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 1 33
Enter value to insert at beginning: Inserted 33 at the beginning.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 7 88
Enter value to search: 88 not found in the list.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
```

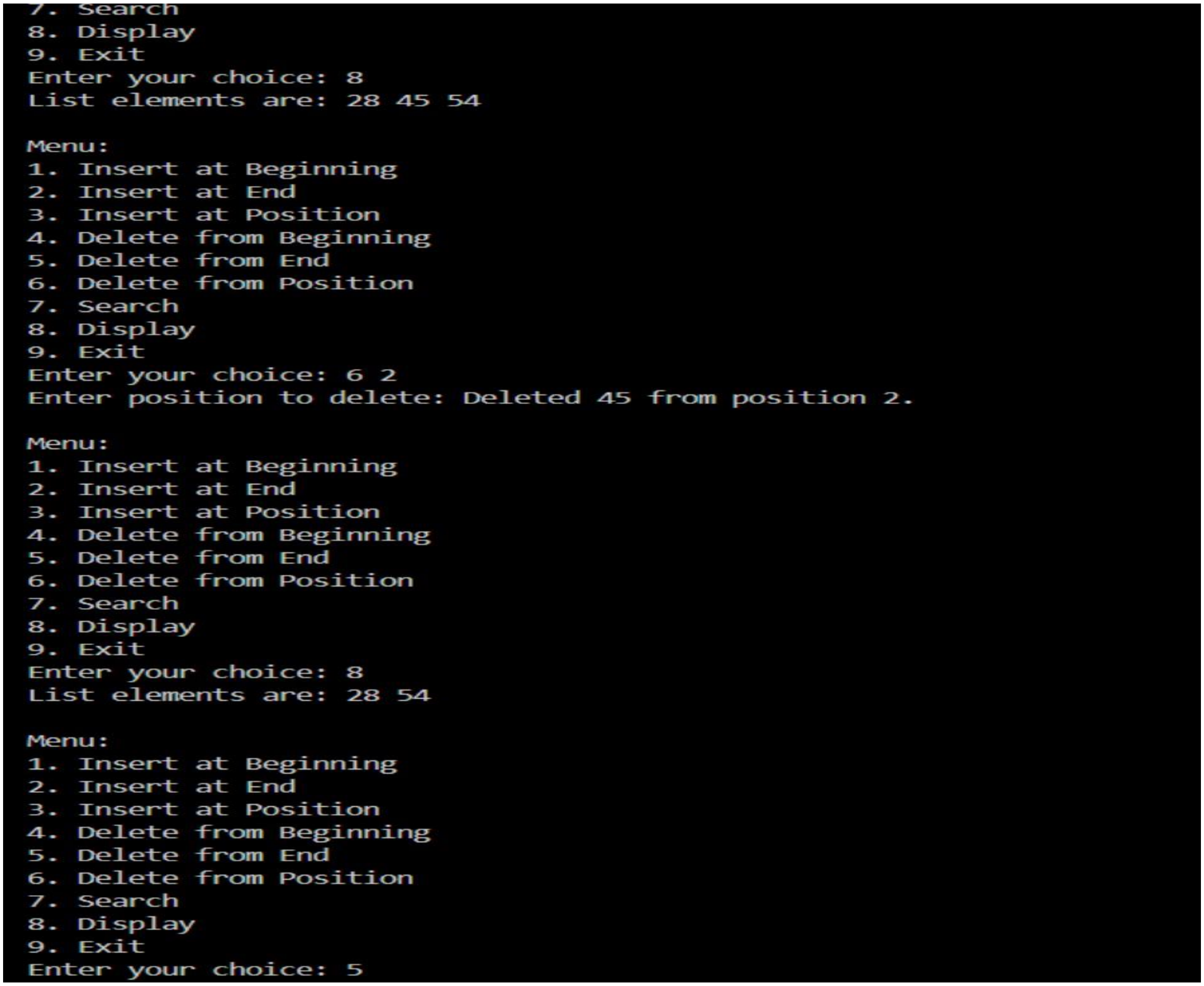


```
Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 7 56
Enter value to search: 56 not found in the list.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 8
List elements are: 33 23

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 9
Exiting...
```

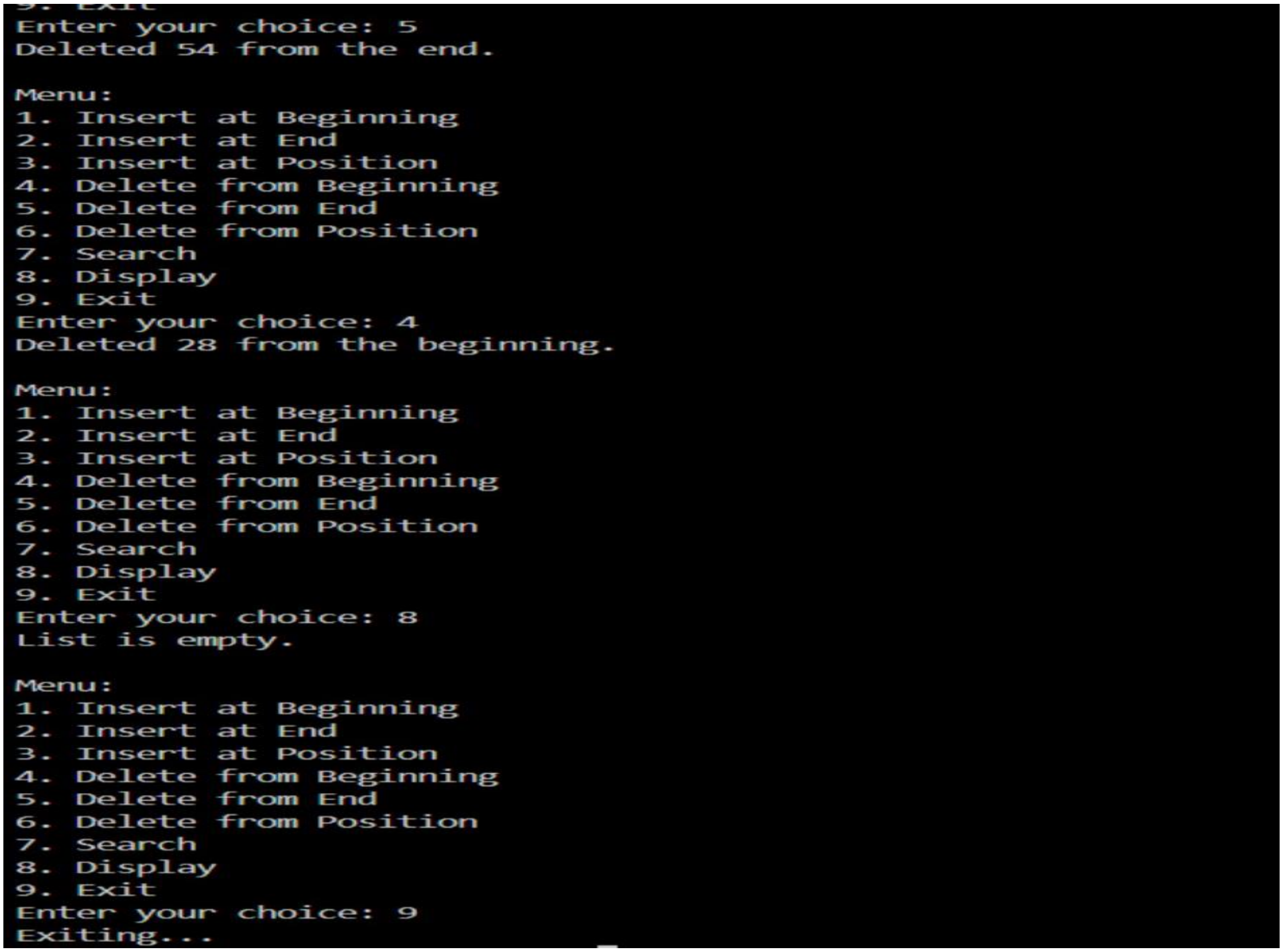
Testcase-3:



```
Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 1 28
Enter value to insert at beginning: Inserted 28 at the beginning.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 2 54
Enter value to insert at end: Inserted 54 at the end.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 3 45 2
Enter value and position to insert: Inserted 45 at position 2.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
```



```
7. Search
8. Display
9. Exit
Enter your choice: 8
List elements are: 28 45 54

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 6 2
Enter position to delete: Deleted 45 from position 2.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 8
List elements are: 28 54

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 5
```



```
9. Exit
Enter your choice: 5
Deleted 54 from the end.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 4
Deleted 28 from the beginning.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 8
List is empty.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 9
Exiting...
```

Pseudocode:

```
Initialize stack as an array
Node { data
}
prev next
Head = null
Junction insert B(mal): create new Node new Nede data-mala newNodi prev = Head is head != NULL:
head. prev = newNode
Head = newNode
```

```
print "value inserted at the beginning"

Junction insert E (value):

create new Node

newNode data

=value

new Node. next = NULL

if Head == NULL: newNode.pw = NULL

else:

Head - NewNode

set temp = head while temp. next != NULL; temp = temp next

temp. next = new Node new Node. prev = temp

print "Value inserted at the end"

Junction insert N (value, pos);

create new Node newNode.data = value if pos==1:

new, Node next = Head

new node. prev = NULL if Head != NULL ! head prev = new Node Head = newNode

else:

ret temp = Head for (int i=1; i <= pos-2; i++){

4(temp == NULL):

punt "Invalid"

 temp = temp next

3 return

 if temp == NULL:

print "Invalid"
 return

newNode next=temp next. new Node prev = temp if temp. next bonNULL: temp. next.prev = new Node

temp. node=

= new Node

quint "Value inserted at position"

Junction delete B():

if Head?

else:

== NULL !

punt "List is empty"
```

```
set temp = Head
Head = Head next
if Head != NULL ! Head prev = NULL
delete temp
print "Delete value"
function delete E():
if Head
== NULL:
print "List is Empty" else if Head next == NULL Delete head
head = NULL
punt "Deleted value from the end"
else:
set temp = Head
while temp. next != NULL; temp = temp next
temp. pr. next = NULL
Delete temp
print "Deleted value at end"

Junction delete N (pos); if head == NULL: print "List is Empty else if position == 1: set timp plead Head = Head. next
else:
Head != NULL:
Head. pew
C
NULL
Delete long
print "Deleted value from position"
sit temp = Head
for i = 1; i <= pos- 1; i++; if temp == NULL: punt "Invalid"
return
temp = temp. next
if temp == NULL: print "invalid"
```

```
return
if temp next != NULL:
temp next.prev = temp prev
is temp. prev= NULL:
temp. prev.next = limp. next
delete temp
print "Deleted from position.
Junction search (value):
set temp = Head
set pos =
= 1
while temp != NULL:
print "value found at position", pos
if temp data
==
Value!
return
temp
length time next
++ pos
print "Value not found"
function display ()!
if Head == NULL;
print "hist is empty"
else:
set temp = Head
print "elements are:"
while temp != NULL ! print temp
delete temp = temp next
Main program
while:
```

```
print menu:
1. Insert at Be start
 2. Insert at end
3. Insert at pos
4. Delete at start
 5. Delete at end
 6. Delete at pos
 7. search
8. Display
9. Exit
Input (choice)
case 1: insert B(); case 2:
case 3:
insert E();
insert
N();4:
Mott B();
case 5;
delete();
case 7:
delete N(pos);
search (value);
8: display()
case 9:
return
Default
print "Invalid"
```

Program:

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

struct Node {
    int data;
    struct Node *prev;
    struct Node *next;
};

struct Node *head = NULL;

void insertAtBeginning(int value) {
    struct Node *new_node = (struct Node *)malloc(sizeof(struct Node));
    new_node->data = value;
    new_node->prev = NULL;
    new_node->next = head;
    if (head != NULL) {
        head->prev = new_node;
    }
    head = new_node;
}
```

```
void insertAtEnd(int value) {
    struct Node *new_node = (struct Node *)malloc(sizeof(struct Node));
    new_node->data = value;
    new_node->next = NULL;
    if (head == NULL) {
        new_node->prev = NULL;
        head = new_node;
    } else {
        struct Node *temp = head;
        while (temp->next != NULL) {
            temp = temp->next;
        }
        temp->next = new_node;
        new_node->prev = temp;
    }
}

void insertAtPosition(int value, int position) {
    struct Node *new_node = (struct Node *)malloc(sizeof(struct Node));
    new_node->data = value;
    if (position == 1) {
```

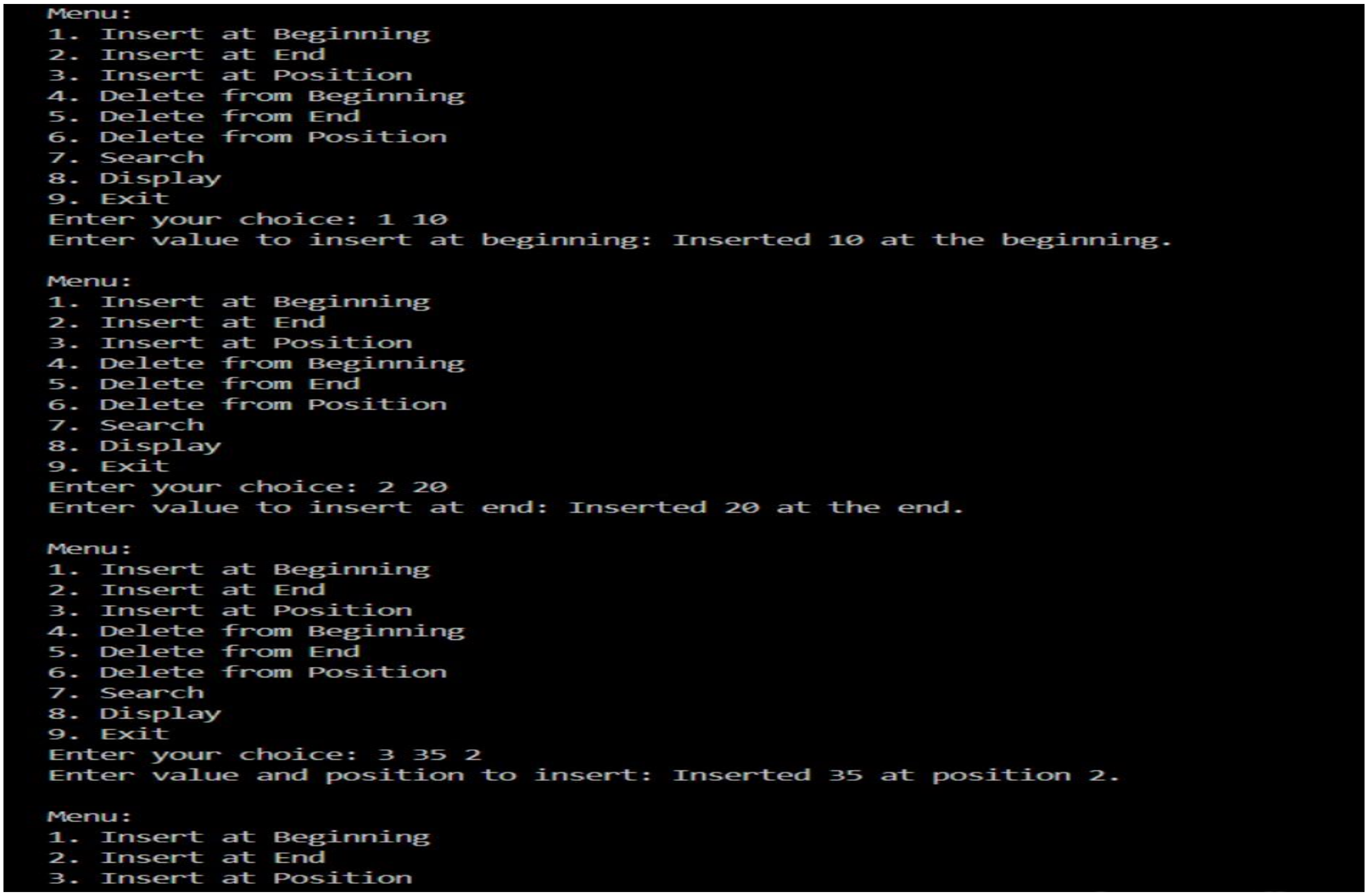
```
    new_node->prev = NULL;
    new_node->next = head;
    if (head != NULL) {
        head->prev = new_node;
    }
    head = new_node;
    return;
}
struct Node *temp = head;
for (int i = 1; i < position - 1 && temp != NULL; i++) {
    temp = temp->next;
}
if (temp == NULL) {
    printf("Position out of bounds\n");
    free(new_node);
} else {
    new_node->next = temp->next;
    if (temp->next != NULL) {
        temp->next->prev = new_node;
    }
    temp->next = new_node;
    new_node->prev = temp;
    }
}

void deleteAtBeginning() {
    if (head == NULL) {
        printf("List is empty\n");
    } else {
        struct Node *temp = head;
        head = head->next;
        if (head != NULL) {
            head->prev = NULL;
        }
        free(temp);
    }
}

void deleteAtEnd() {
    if (head == NULL) {
        printf("List is empty\n");
    } else if (head->next == NULL) {
        free(head);
        head = NULL;
    } else {
        struct Node *temp = head;
        while (temp->next != NULL) {
            temp = temp->next;
        }
        temp->prev->next = NULL;
        free(temp);
    }
}

void deleteAtPosition(int position) {
    if (head == NULL) {
        printf("List is empty\n");
    } else if (position == 1) {
        struct Node *temp = head;
        head = head->next;
        if (head != NULL) {
            head->prev = NULL;
        }
        free(temp);
    } else {
        struct Node *temp = head;
        for (int i = 1; i < position && temp != NULL; i++) {
            temp = temp->next;
        }
        if (temp == NULL) {
            printf("Position out of bounds\n");
        } else {
            if (temp->next != NULL) {
                temp->next->prev = temp->prev;
            }
            if (temp->prev != NULL) {
                temp->prev->next = temp->next;
            }
            free(temp);
        }
    }
}

void search(int value) {
    struct Node *temp = head;
    int position = 1;
    while (temp != NULL) {
        if (temp->data == value) {
            printf("Element found at position %d\n", position);
            return;
        }
        temp = temp->next;
        position++;
    }
    printf("Element not found\n");
}

void display() {
    if (head == NULL) {
        printf("List is empty\n");
    } else {
        struct Node *temp = head;
        while (temp != NULL) {
            printf("%d <-> ", temp->data);
            temp = temp->next;
        }
        printf("NULL\n");
    }
}
```

```
int main() {
    int choice, value, position;
    while (1) {
        printf("\n1. Insert at Beginning\n2. Insert at End\n3. Insert at Position\n");
        printf("4. Delete at Beginning\n5. Delete at End\n6. Delete at Position\n");
        printf("7. Search\n8. Display\n9. Exit\n");
        printf("Enter your choice: ");
        scanf("%d", &choice);
        switch (choice) {
            case 1:
                printf("Enter value to insert: ");
                scanf("%d", &value);
                insertAtBeginning(value);
                break;
            case 2:
                printf("Enter value to insert: ");
                scanf("%d", &value);
                insertAtEnd(value);
                break;
            case 3:
                printf("Enter value and position: ");
                scanf("%d %d", &value, &position);
                insertAtPosition(value, position);
                break;
            case 4:
                deleteAtBeginning();
                break;
            case 5:
                deleteAtEnd();
                break;
            case 6:
                printf("Enter position to delete: ");
                scanf("%d", &position);
                deleteAtPosition(position);
                break;
            case 7:
                printf("Enter value to search: ");
                scanf("%d", &value);
                search(value);
                break;
            case 8:
                display();
                break;
```

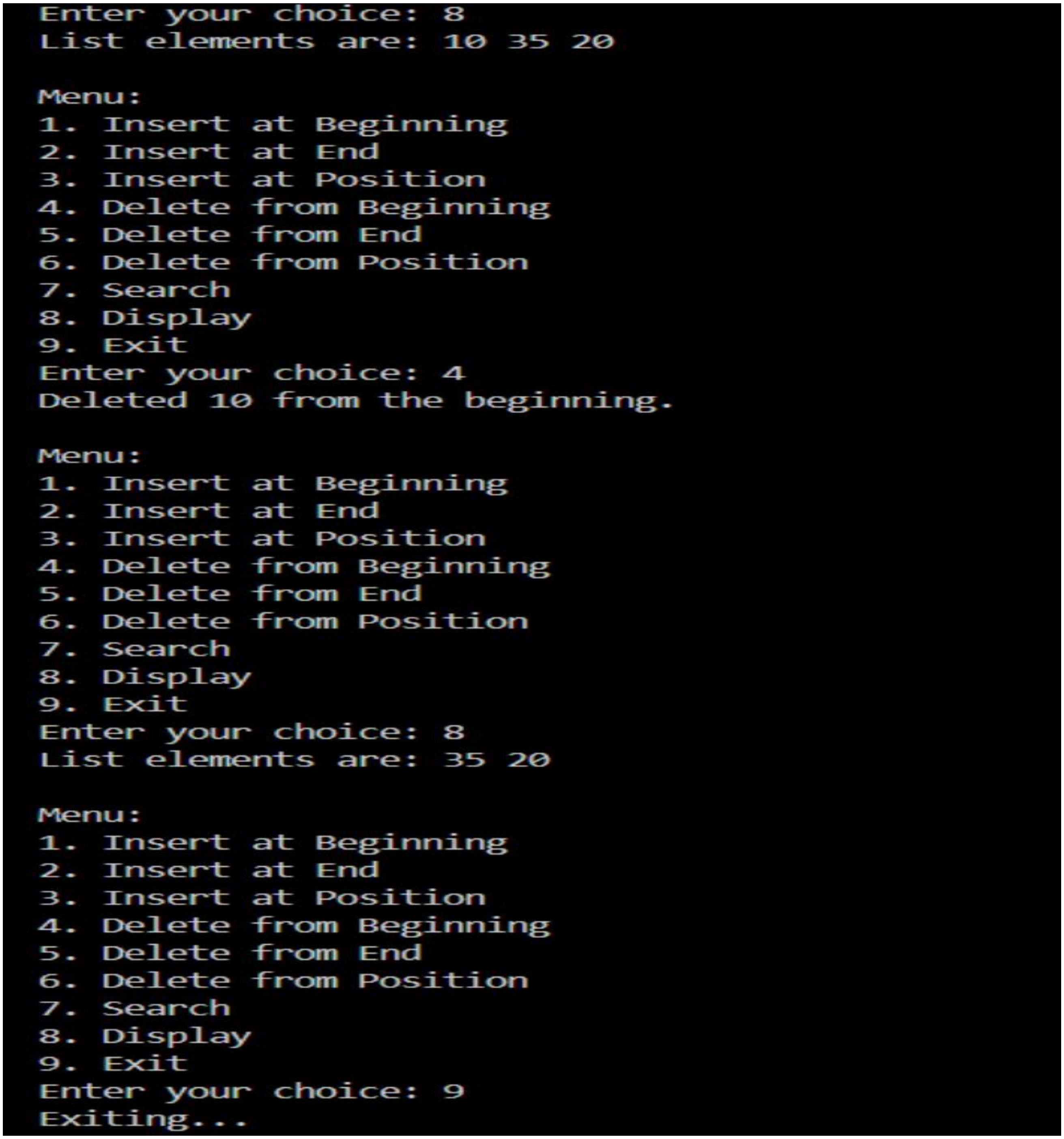
```
            case 9:
                exit(0);
            default:
                printf("Invalid choice\n");
        }
    }
    return 0;
}
```

Output:

Testcase-1:

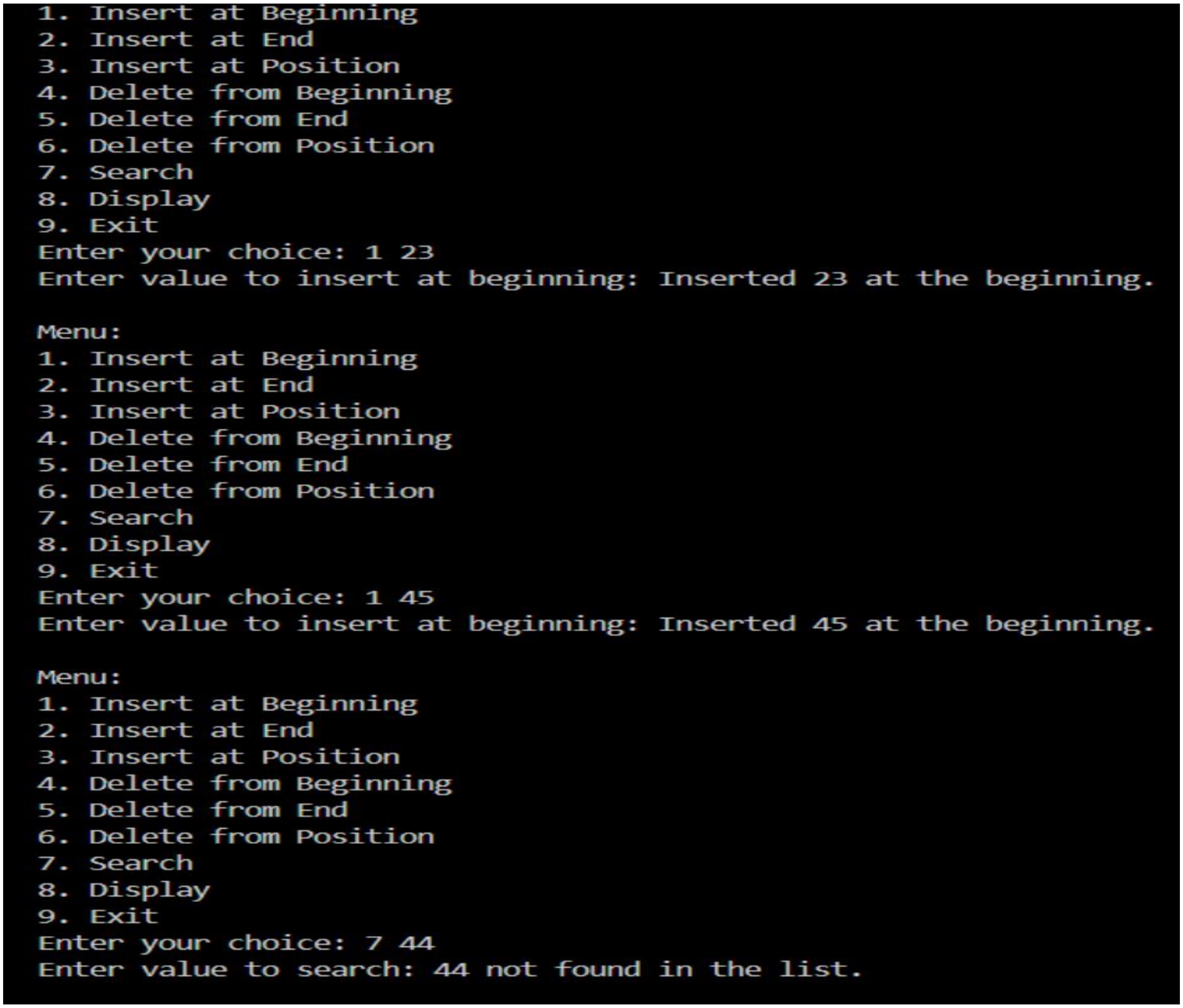


```
Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 1 10
Enter value to insert at beginning: Inserted 10 at the beginning.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 2 20
Enter value to insert at end: Inserted 20 at the end.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 3 35 2
Enter value and position to insert: Inserted 35 at position 2.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
```



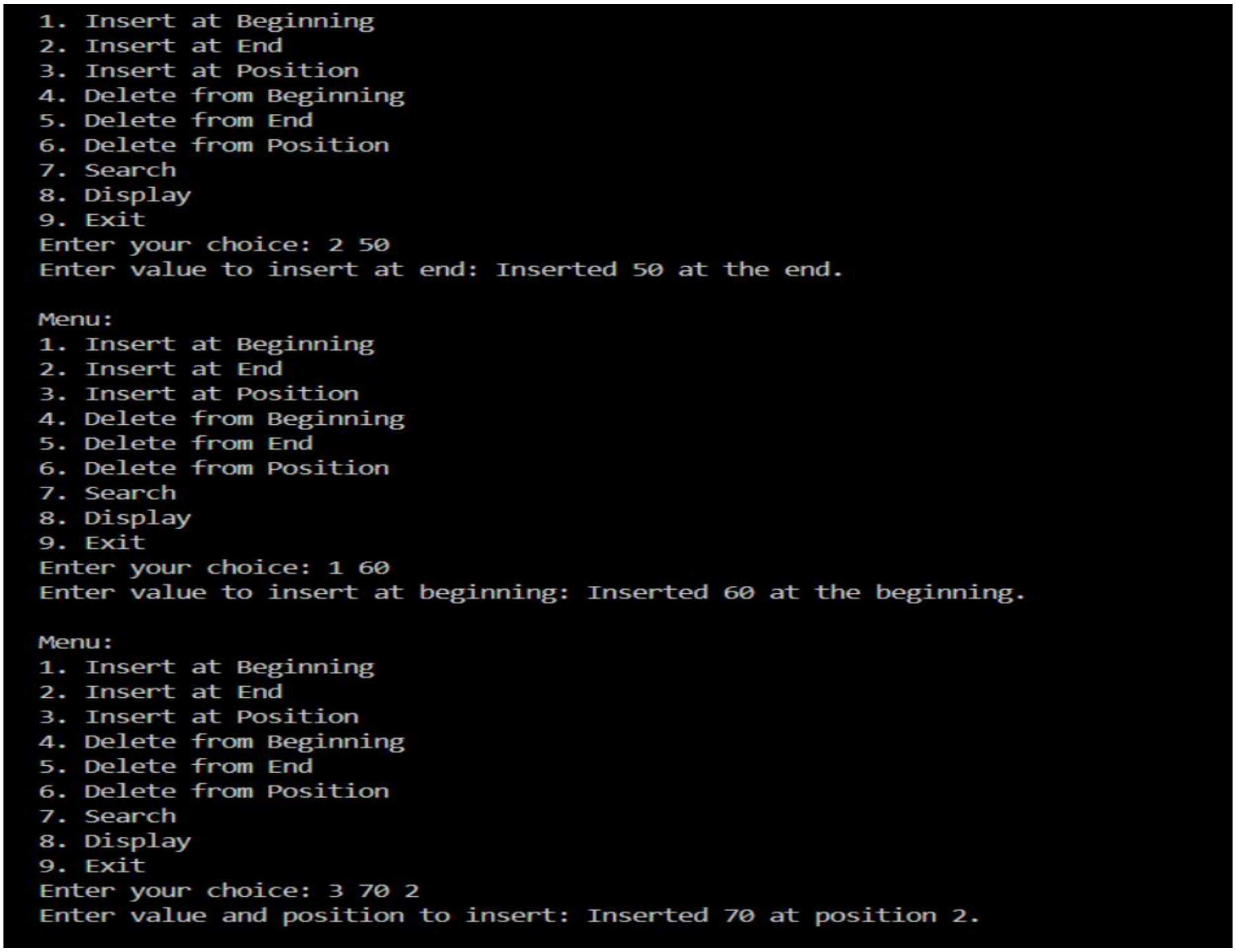
```
Enter your choice: 8
List elements are: 10 35 20

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 4
Deleted 10 from the beginning.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 8
List elements are: 35 20

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 9
Exiting...
```

Testcase-2:



```
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 1 23
Enter value to insert at beginning: Inserted 23 at the beginning.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 1 45
Enter value to insert at beginning: Inserted 45 at the beginning.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 7 44
Enter value to search: 44 not found in the list.
```

Testcase-3:



```
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 2 50
Enter value to insert at end: Inserted 50 at the end.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 1 60
Enter value to insert at beginning: Inserted 60 at the beginning.

Menu:
1. Insert at Beginning
2. Insert at End
3. Insert at Position
4. Delete from Beginning
5. Delete from End
6. Delete from Position
7. Search
8. Display
9. Exit
Enter your choice: 3 70 2
Enter value and position to insert: Inserted 70 at position 2.
```