Experiment No.7
Implement Circular Linked List ADT.
Name:Tejashree Anand Karekar
Roll No:20
Date of Performance:
Date of Submission:
Marks:
Sign:

Experiment No. 7: Circular Linked List Operations

Aim: Implementation of Circular Linked List ADT

Objective:

In circular linked list last node is connected to first node. On other hand circular linked list can be used to implement traversal along web pages.

Theory:

In a circular linked list, the last node contains a pointer to the first node of the list. We can have a circular singly linked list as well as a circular doubly linked list. While traversing a circular linked list, we can begin at any node and traverse the list in any one direction, forward or backward, until we reach the same node where we started. Thus, a circular linked list has no beginning and no ending.

Inserting a New Node in a Circular Linked List

Case 1: The new node is inserted at the beginning.

Case 2: The new node is inserted at the end.

Deleting a Node from a Circular Linked List

Case 1: The first node is deleted.

Case 2: The last node is deleted.

Insertion and Deletion after or before a given node is same as singly linked list.

Algorithm

Algorithm to insert a new node at the beginning

```
Step 1: IF AVAIL = NULL
            Write OVERFLOW
            Go to Step 9 [END OF IF]
Step 2: SET NEW_NODE = AVAIL
Step 3: SET AVAIL = AVAIL□NEXT
Step 4: SET NEW_NODE-->DATA = VAL
Step 5: SET PTR=START
Repeat Step 6 while PTR NEXT != START
Step 6: SET PTR = PTR NEXT [END OF LOOP]

Step 7: SET NEW_NODE--> NEXT= START
Step 8: SET PTR-->NEXT = START
Step 9: SET START = NEW_NODE
Step 10: EXIT
```

Algorithm to insert a new node at the end

```
Step 1: IF AVAIL = NULL
            Write OVERFLOW
            Go to Step 11 [END OF IF]
Step 2: SET NEW_NODE = AVAIL
Step 3: SET AVAIL = AVAIL--> NEXT
Step 4: SET NEW_NODE -->DATA = VAL
Step 5: SET NEW_NODE-->NEXT = START
Step 6: SET PTR = START
Step 7: Repeat Step 8 while PTR--> NEXT != START
Step 8: SET PTR = PTR -->NEXT [END OF LOOP]
Step 9: SET PTR -->NEXT = NEW_NODE
Step 10: EXIT
```

Algorithm to delete the first node

```
Step 1: IF START = NULL
        Write UNDERFLOW
        Go to Step 6 [END OF IF]
Step 2: SET PTR = START
Step 3: Repeat Step 4 while PTR--> NEXT != START
Step 4: SET PTR = PTR -->NEXT [END OF LOOP]
Step 4: SET PTR□NEXT = START -->NEXT
Step 5: FREE START
Step 6: EXIT
```

Algorithm to delete the last node

```
Step 1: IF START = NULL
        Write UNDERFLOW
        Go to Step 7 [END OF IF]
Step 2: SET PTR = START [END OF LOOP]
Step 3: Repeat Step 4 and Step 5 while PTR -->NEXT != START
Step 4: SET PREPTR = PTR
Step 5: SET PTR = PTR -->NEXT
Step 6: SET PREPTR-->NEXT = START
Step 7: FREE PTR
```

Step 8: EXIT

Code:

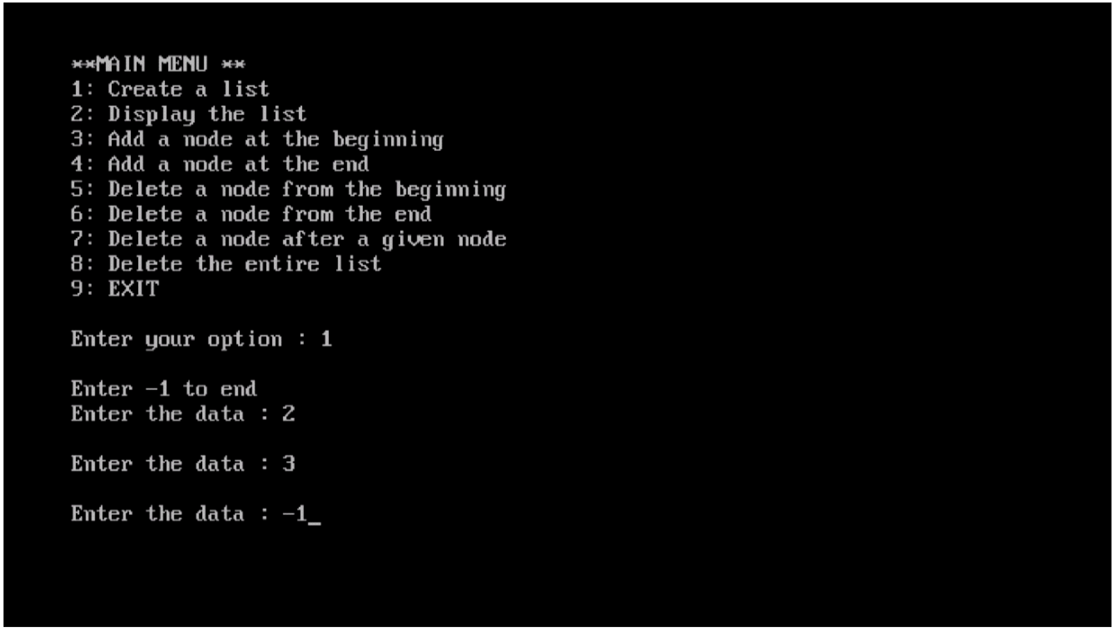
```
#include <stdio.h>
#include <conio.h>
#include <malloc.h>
struct node
{
 int data;
 struct node *next;
};
struct node *start = NULL;
struct node *create_cll(struct node *);
struct node *display(struct node *);
struct node *insert_beg(struct node *);
struct node *insert_end(struct node *);
struct node *delete_beg(struct node *);
struct node *delete_end(struct node *);
struct node *delete_after(struct node *);
struct node *delete_list(struct node *);
int main()
{
 int option;
 clrscr();
 do
 {
printf("\n\n **MAIN MENU **");
printf("\n 1: Create a list");
printf("\n 2: Display the list");
printf("\n 3: Add a node at the beginning");
printf("\n 4: Add a node at the end");
printf("\n 5: Delete a node from the beginning");
printf("\n 6: Delete a node from the end");
printf("\n 7: Delete a node after a given node");
printf("\n 8: Delete the entire list");
printf("\n 9: EXIT");
printf("\n\n Enter your option : ");
scanf("%d", &option);
switch(option)
{
 case 1: start = create_cll(start);
 printf("\n CIRCULAR LINKED LIST CREATED");
 break;
 case 2: start = display(start);
 break;
 case 3: start = insert_beg(start);
 break;
 case 4: start = insert_end(start);
 break;
 case 5: start = delete_beg(start);
 break;
 case 6: start = delete_end(start);
 break;
 case 7: start = delete_after(start);
 break;
 case 8: start = delete_list(start);
 printf("\n CIRCULAR LINKED LIST DELETED");
 break;
}
 }while(option !=9);
 getch();
       return 0;
}
struct node *create_cll(struct node *start)
{
 struct node *new_node, *ptr;
int num;
printf("\n Enter –1 to end");
printf("\n Enter the data : ");
scanf("%d", &num);
while(num!=–1)
{
 new_node = (struct node*)malloc(sizeof(struct node));

 new_node -> data = num;

 if(start == NULL)

 {

 new_node -> next = new_node;

start = new_node;

 }

 else

 { ptr = start;

 while(ptr -> next != start)

 ptr = ptr -> next;

 ptr -> next = new_node;

 new_node -> next = start;

 }

 printf("\n Enter the data : ");

 scanf("%d", &num);

}

return start;

}

struct node *display(struct node *start)

{

struct node *ptr;

ptr=start;

while(ptr -> next != start)
```

```
{

 printf("\t %d", ptr -> data);

 ptr = ptr -> next;

}

printf("\t %d", ptr -> data);

return start;

}

struct node *insert_beg(struct node *start)

{

struct node *new_node, *ptr;

int num;

printf("\n Enter the data : ");

scanf("%d", &num);

new_node = (struct node *)malloc(sizeof(struct node));

new_node -> data = num;

ptr = start;

while(ptr -> next != start)

 ptr = ptr -> next;

ptr -> next = new_node;

new_node -> next = start;

start = new_node;

return start;

}

struct node *insert_end(struct node *start)
```

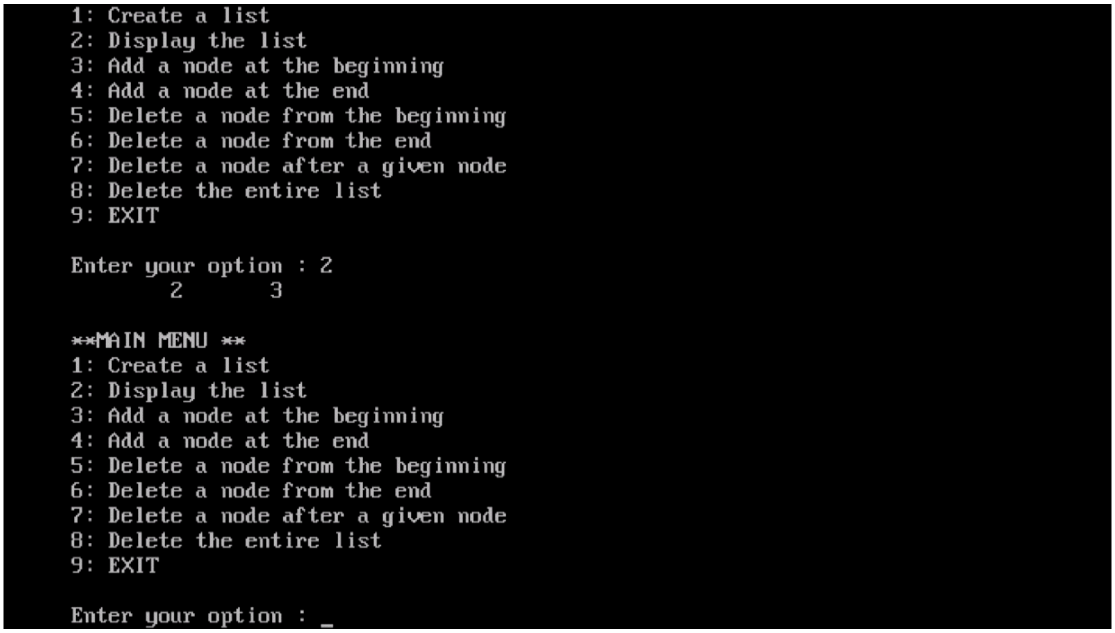
```
{

struct node *ptr, *new_node;

int num;

printf("\n Enter the data : ");

scanf("%d", &num);

new_node = (struct node *)malloc(sizeof(struct node));

new_node -> data = num;

ptr = start;

while(ptr -> next != start)

 ptr = ptr -> next;

ptr -> next = new_node;

new_node -> next = start;

return start;

}

struct node *delete_beg(struct node *start)

{

struct node *ptr;

ptr = start;

while(ptr -> next != start)

 ptr = ptr -> next;

ptr -> next = start -> next;

free(start);

start = ptr -> next;

return start;
```

```
}

struct node *delete_end(struct node *start)

{

struct node *ptr, *preptr;

ptr = start;

while(ptr -> next != start)

{

 preptr = ptr;

 ptr = ptr -> next;

}

preptr -> next = ptr -> next;

free(ptr);

return start;

}

struct node *delete_after(struct node *start)

{

struct node *ptr, *preptr;

int val;

printf("\n Enter the value after which the node has to deleted : ");

scanf("%d", &val);

ptr = start;

preptr = ptr;

while(preptr -> data != val)

{
 preptr = ptr;
 ptr = ptr -> next;
}
preptr -> next = ptr -> next;
if(ptr == start)
 start = preptr -> next;
free(ptr);
return start;
}
struct node *delete_list(struct node *start)
{
struct node *ptr;
ptr = start;
while(ptr -> next != start)
 start = delete_end(start);
free(start);
return start;
}
```

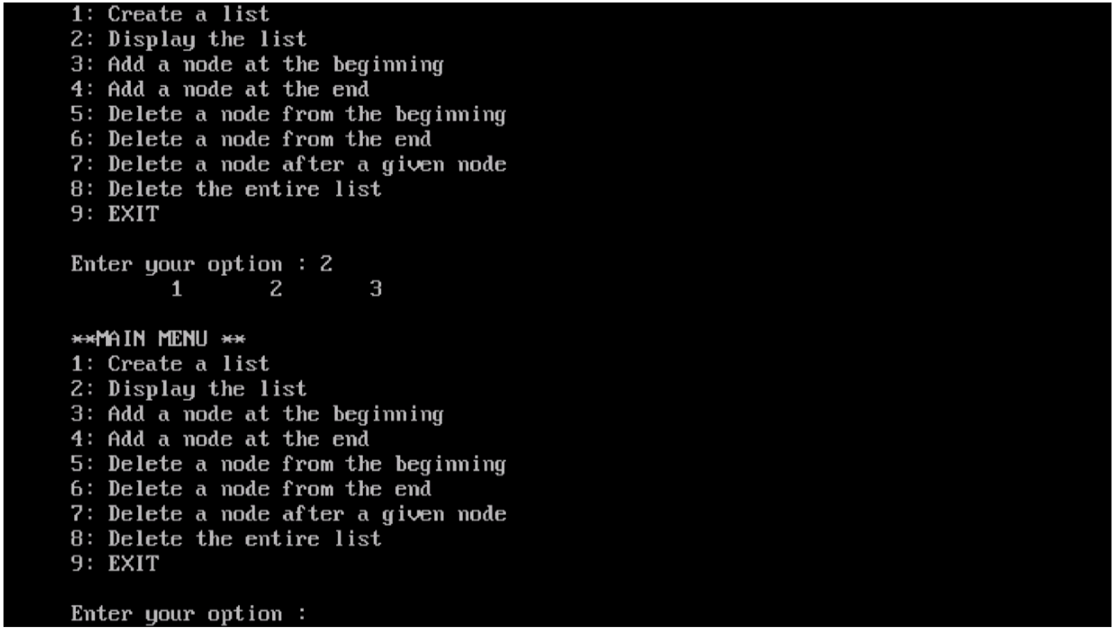
Output:



```
**MAIN MENU **
1: Create a list
2: Display the list
3: Add a node at the beginning
4: Add a node at the end
5: Delete a node from the beginning
6: Delete a node from the end
7: Delete a node after a given node
8: Delete the entire list
9: EXIT

Enter your option : 1

Enter -1 to end
Enter the data : 2

Enter the data : 3

Enter the data : -1_
```



```
1: Create a list
2: Display the list
3: Add a node at the beginning
4: Add a node at the end
5: Delete a node from the beginning
6: Delete a node from the end
7: Delete a node after a given node
8: Delete the entire list
9: EXIT

Enter your option : 2
        2       3

**MAIN MENU **
1: Create a list
2: Display the list
3: Add a node at the beginning
4: Add a node at the end
5: Delete a node from the beginning
6: Delete a node from the end
7: Delete a node after a given node
8: Delete the entire list
9: EXIT

Enter your option : _
```



```
     1: Create a list
     2: Display the list
     3: Add a node at the beginning
     4: Add a node at the end
     5: Delete a node from the beginning
     6: Delete a node from the end
     7: Delete a node after a given node
     8: Delete the entire list
     9: EXIT

     Enter your option : 2
             1       2       3

     **MAIN MENU **
     1: Create a list
     2: Display the list
     3: Add a node at the beginning
     4: Add a node at the end
     5: Delete a node from the beginning
     6: Delete a node from the end
     7: Delete a node after a given node
     8: Delete the entire list
     9: EXIT

     Enter your option :
```

Conclusion:

Write an example of insertion and deletion in the circular linked list while traversing the web pages?

```
#include <stdio.h>

include <stdlib.h>

#include <string.h>



// Structure to represent a web page node

struct WebPage {

   char url[100];

   struct WebPage* next;

};
```

```
// Function to create a new web page node
struct WebPage* createWebPage(char* url) {
    struct WebPage* newPage = (struct WebPage*)malloc(sizeof(struct WebPage));
    if (newPage == NULL) {
        printf("Memory allocation failed.\n");
        return NULL;
    }
    strcpy(newPage->url, url);
    newPage->next = NULL;
    return newPage;
}


// Function to insert a web page after the current page
void insertPage(struct WebPage* current, char* url) {
    if (current == NULL) {
        printf("Invalid current page.\n");
        return;
    }
    struct WebPage* newPage = createWebPage(url);
    if (newPage == NULL) {
        return;
    }
    newPage->next = current->next;
    current->next = newPage;
}


// Function to delete the current web page
void deletePage(struct WebPage* current) {
    if (current == NULL) {
        printf("Invalid current page.\n");
        return;
    }
    struct WebPage* nextPage = current->next;
    if (nextPage == current) {
        // If there is only one page, reset the list to empty
        free(current);
        current = NULL;
        return;
    }
    current->next = nextPage->next;
    free(nextPage);
}


// Function to display the web pages in the circular linked list
void displayPages(struct WebPage* start) {
    if (start == NULL) {
        printf("No web pages to display.\n");
        return;
    }
    struct WebPage* current = start;
    do {
        printf("Web Page: %s\n", current->url);
        current = current->next;
    } while (current != start);
}


int main() {
    struct WebPage* currentPage = NULL;
    // Insert initial page

    currentPage = createWebPage("https://www.example.com");

    currentPage->next = currentPage;  // Circular reference to itself



    // Insert and display more pages

    insertPage(currentPage, "https://www.google.com");

    insertPage(currentPage, "https://www.openai.com");

    displayPages(currentPage);



    // Delete the current page and display the updated list

    deletePage(currentPage);

    displayPages(currentPage);



    return 0;

}
```