Experiment No.7
Implement Circular Linked List ADT.
Name:Ayush Gupta
Roll No:14
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 = AVAILNEXT
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 PTRNEXT = 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);
```

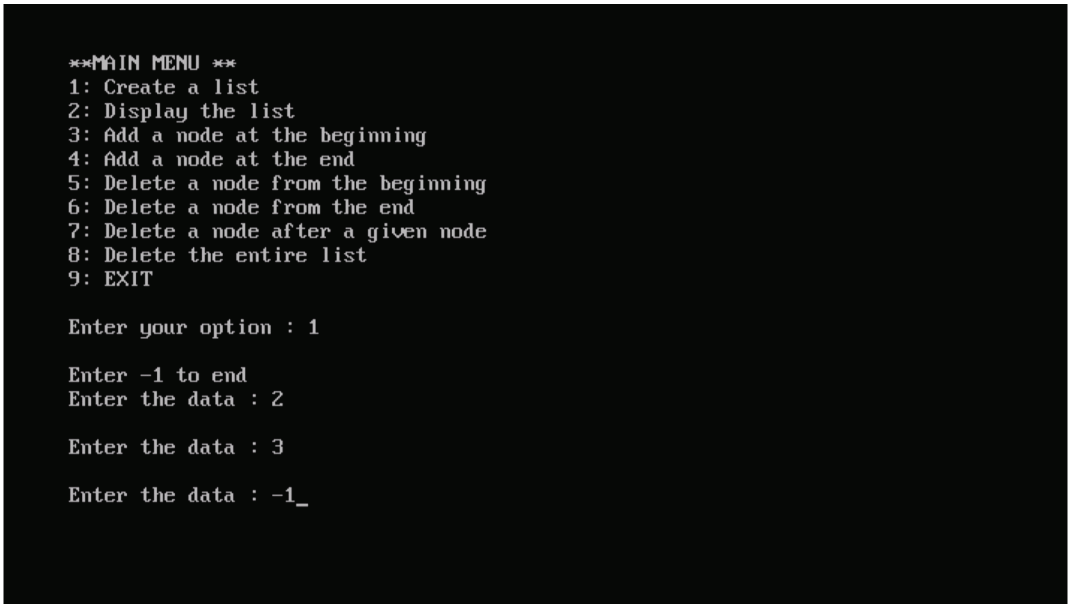
```
return start;

}

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;
```

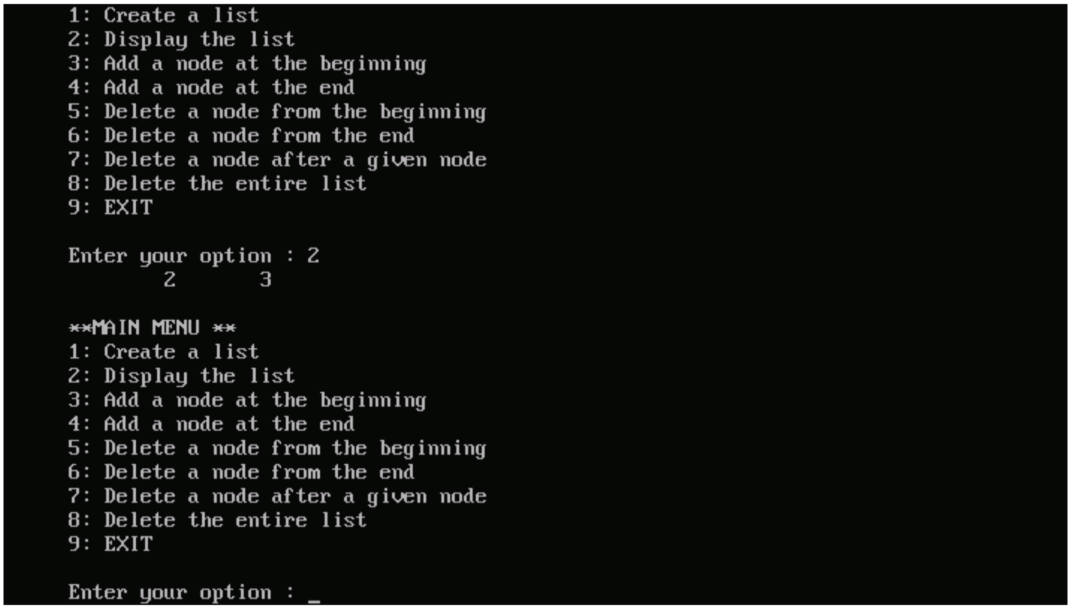
```
while(ptr -> next != start)
{
 preptr = ptr;
 ptr = ptr -> next;
}
preptr -> next = ptr -> next;
free(ptr);
return start;
}
struct node *delete_after(struct node *start)
{
struct node *ptr, *preptr;
int val;
printf("\n Enter the value after which the node has to deleted : ");
scanf("%d", &val);
ptr = 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;

}
```

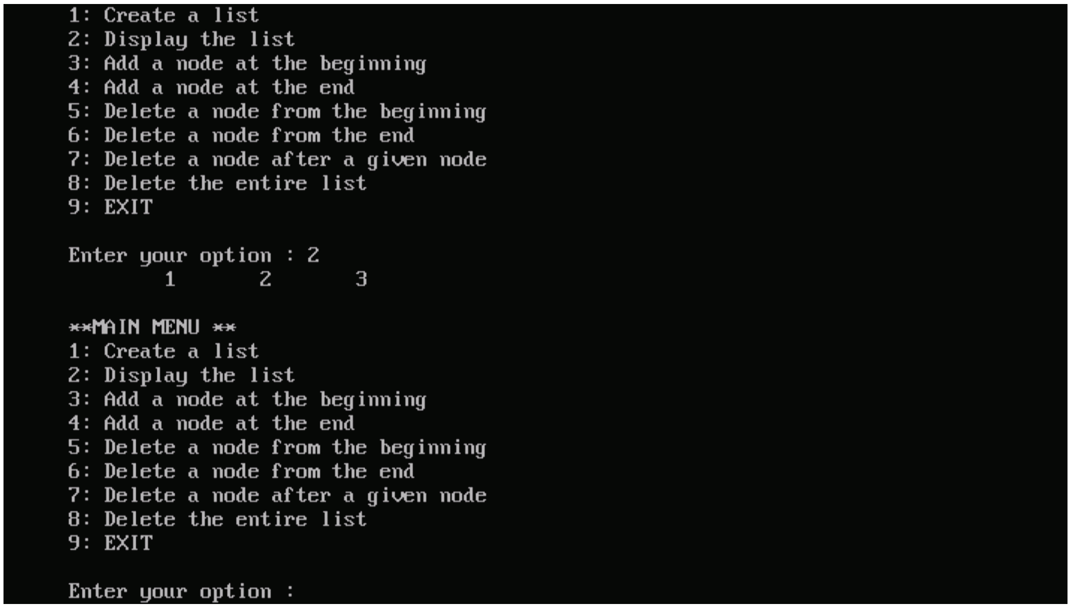
Output:



```
**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?

A circular linked list can be a suitable data structure for implementing a browser history where you traverse web pages. In this example, I'll provide a simplified version to demonstrate insertion and deletion of web pages in a circular linked list.

Here C program:-

```
#include <stdio.h>

#include <stdlib.h>

#include <string.h>

// Define the structure for a web page node in the circular linked list

struct WebPage {
    char title[50];
    char url[100];
    struct WebPage* next;
};
// Initialize an empty circular linked list
struct WebPage* initializeWebHistory() {
    return NULL;
}
// Create a new web page node
struct WebPage* createWebPage(const char* title, const char* url) {
    struct WebPage* newPage = (struct WebPage*)malloc(sizeof(struct WebPage));
    strcpy(newPage->title, title);
    strcpy(newPage->url, url);
    newPage->next = newPage; // Point to itself initially
    return newPage;
}
// Insert a web page at the end of the circular linked list
void insertWebPage(struct WebPage** history, const char* title, const char* url) {
    struct WebPage* newPage = createWebPage(title, url);
    if (*history == NULL) {
        *history = newPage;
    } else {
        newPage->next = (*history)->next;
        (*history)->next = newPage;
        *history = newPage; // Update the history pointer to the newly inserted page
    }
}
// Delete the current web page from the circular linked list
void deleteCurrentWebPage(struct WebPage** history) {
    if (*history == NULL) {
        printf("Web history is empty.\n");
        return;
    }
    struct WebPage* currentPage = (*history)->next;
    struct WebPage* previousPage = *history;

    if (currentPage == *history) {
        // Only one page in history
        free(currentPage);
        *history = NULL;
    } else {
        previousPage->next = currentPage->next;
        if (currentPage == *history) {
            *history = previousPage; // Update the history pointer if the last page is deleted
        }
        free(currentPage);
    }
}
// Traverse and display the web page history
void traverseWebHistory(struct WebPage* history) {
    if (history == NULL) {
        printf("Web history is empty.\n");
        return;
    }
    struct WebPage* current = history->next;

    printf("Web Page History:\n");
    do {
        printf("Title: %s\n", current->title);
        printf("URL: %s\n", current->url);
        printf("-------------\n");

        current = current->next;

    } while (current != history->next);

}

int main() {

    struct WebPage* webHistory = initializeWebHistory();

    insertWebPage(&webHistory, "Google", "http://www.google.com");

    insertWebPage(&webHistory, "Yahoo", "http://www.yahoo.com");

    insertWebPage(&webHistory, "OpenAI", "http://www.openai.com");

    traverseWebHistory(webHistory);

    printf("Deleting current page...\n");

    deleteCurrentWebPage(&webHistory);

    traverseWebHistory(webHistory);

    return 0;

}
```

In this example, we create a circular linked list to represent a web page history. You can insert new web pages and delete the current page while traversing the history. The circular nature ensures that the most recent page is always at the front, making it convenient for browser history.