



Experiment No.7
Implement Circular Linked List ADT.
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Date of Performance: 06/09/2023
Date of Submission: 13/09/2023
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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.



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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



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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  
#include  
#include  
  
struct node {  
    int data;  
    struct node *next;  
};  
struct node *start = NULL;
```



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```
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:
```



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```
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;

}
```



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```
{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;
```



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```
} 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);
```



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```
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;
```



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```
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;

}
```



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Output:

```
Enter the data: 4
Enter the data: -1
CIRCULAR LINKED LIST CREATED
Enter your option : 3
Enter your option : 5
Enter your option : 2
5   1   2   4
Enter your option : 9
```

```
*****MAIN MENU *****
```

```
1: Create a list
2: Display the list
3: Add a node at the beginning
-----
8: Delete the entire list
9: EXIT
Enter your option : 1
Enter -1 to end
Enter the data: 1
Enter the data: 2
```

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 for a web page node in the circular linked list
```

```
struct WebPage {
```

```
    char title[50];
```

```
    struct WebPage* next;
```

```
};
```

```
struct WebPage* current = NULL;
```



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// Function to insert a new web page

```
void insertPage(char title[]) {  
  
    struct WebPage* nextPage = (struct WebPage*)malloc(sizeof(struct WebPage));  
  
    strcpy(nextPage->title, title);  
  
    if (current == NULL) {  
  
        current = nextPage;  
  
        nextPage->next = nextPage; // Make it point to itself in a circular list.  
  
    } else {  
  
        nextPage->next = current->next;  
  
        current->next = nextPage;  
  
        current = nextPage;  
  
    }  
}
```

// Function to delete the current web page

```
void deletePage() {  
  
    if (current == NULL) {  
  
        printf("No web page to delete.\n");  
  
        return;  
  
    }  
  
    struct WebPage* nextPage = current->next;
```



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```
if (current == current->next) {  
  
    free(current);  
  
    current = NULL;  
  
} else {  
  
    current->next = nextPage->next;  
  
    free(nextPage);  
  
}  
  
}  
  
// Function to display the current web page  
  
void displayCurrentPage() {  
  
    if (current == NULL) {  
  
        printf("No current web page.\n");  
  
    } else {  
  
        printf("Current Page: %s\n", current->title);  
  
    }  
  
}  
  
int main() {  
  
    insertPage("Home Page");  
  
    insertPage("About Us");  
  
    insertPage("Contact Us");
```



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```
displayCurrentPage(); // Displays "Contact Us"
```

```
deletePage();      // Deletes "Contact Us"
```

```
displayCurrentPage(); // Displays "About Us"
```

```
deletePage();      // Deletes "About Us"
```

```
displayCurrentPage(); // Displays "Home Page"
```

```
return 0;
```

```
}
```