Experiment No.7
Implement Circular Linked List ADT.
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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.

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;
```

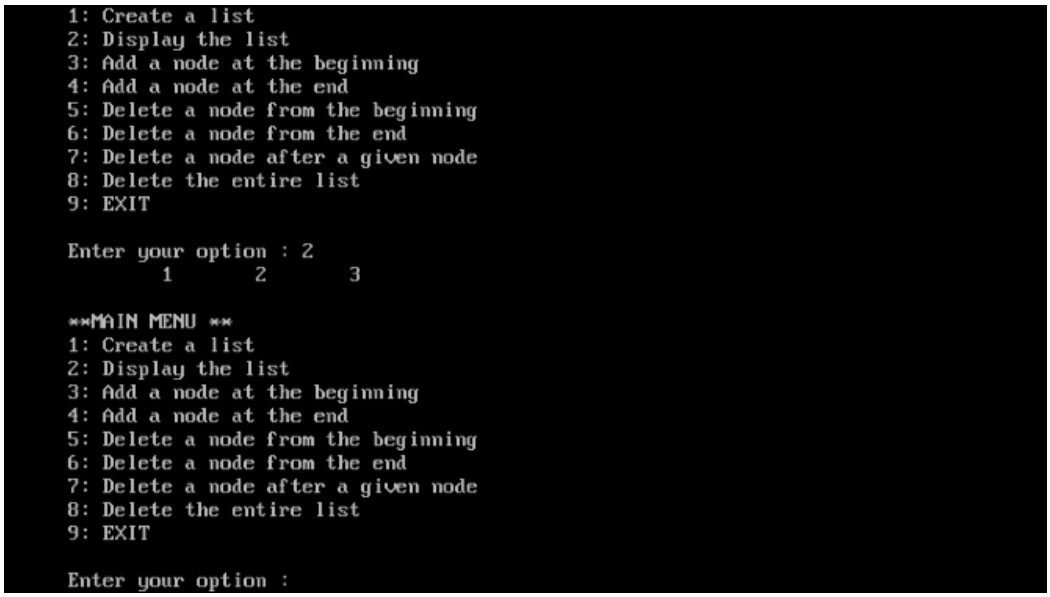
```
ptr = start;
while(ptr -> next != start)
 ptr = ptr -> next;
ptr -> next = start -> next;
free(start);
start = ptr -> next;
return start;
}
struct node *delete_end(struct node *start)
{
struct node *ptr, *preptr;
ptr = start;
while(ptr -> next != start)
{
 preptr = ptr;
 ptr = ptr -> next;
}
preptr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



Conclusion:

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

- The provided C code serves as a menu-driven program for managing a circular linked list. It offers a range of options for creating, displaying, inserting, and deleting nodes within the circular linked list. Users can interact with the list through the menu.

Nevertheless, there is a notable concern with the code due to its reliance on 'clrscr()' and 'getch()' functions, which are artifacts from the older Borland C compiler and may not seamlessly integrate with modern compilers or development environments. Furthermore, the code utilizes the `<conio.h>` and `<malloc.h>` headers, which are non-standard and specific to certain compilers, rather than conforming to the standard C library.

As for your inquiry regarding a conceptual example of using a circular linked list for web page traversal, consider the following scenario:

Imagine you are tasked with implementing a web browser's history feature using a circular linked list. In this context, each node within the list corresponds to a web

page, and the 'next' pointer establishes a connection from the current page to the next page you visit.

1. **Insertion**: When you navigate to a new web page, you can insert it into the circular linked list. The 'insert_end' function from the code could be employed for this purpose. It effectively adds the new page to the end of the list, making it the next page in your browsing history.

2. **Deletion**: When you wish to revisit a previously viewed page, you can delete the most recently visited page. The 'delete_end' function in the code is suitable for this operation. It removes the last page you visited, allowing you to navigate backward in your browsing history.

By using this circular linked list, you can seamlessly traverse forward and backward through the web pages you've explored, making it an apt data structure for managing web browser history. Nevertheless, in a real-world web browser, additional information such as page URLs, titles, and timestamps would be stored for each web page to provide a more comprehensive browsing history. The code you provided primarily addresses the 'data' field within the nodes, but this can be expanded to encompass more extensive information for a practical browser history implementation.