Ex -no : 2
Date: 16-11-22

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SSN College of Engineering

Department of Computer Science and Engineering

UCS2312 – Data Structures Lab

II Year CSE - B Section (III Semester)

Academic Year 2022-23

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Exercise 2: Exercises on Circular Linked List

Aim:

To implement basic C programs by using Circular Linked List.

Basic

Implement a circular linked list abstract data type (ADT) with Create, print, search, insert (at the middle, head), delete (at the middle, head) functions.

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Pseudocode:

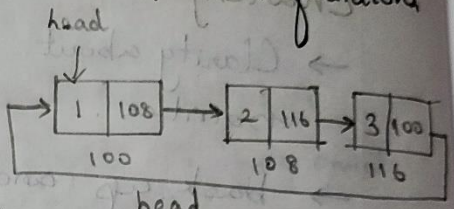
16.11.2022

2. Exercises on Circular Linked List.

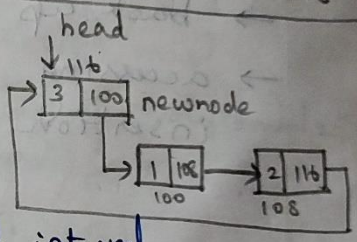
Basic.

Implement a circular linked list abstract data type (ADT) with create, search, print, insert (at the middle, head), delete (at the middle, head) functions

Pseudocode:-




```
struct node
{
    int data;
    struct node *next;
};
```




```
Begin_insert()
Input: struct node *head, int val
Output: struct node * head.
newnode = (struct node *) malloc(sizeof(struct node))
if(newnode == NULL)
    print "Cannot allocate memory"
end if
else if(head == NULL)
    newnode -> data = val
    head = newnode
    newnode -> next = head
    print "Node inserted successfully..."
end else if
```

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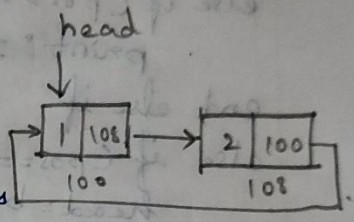
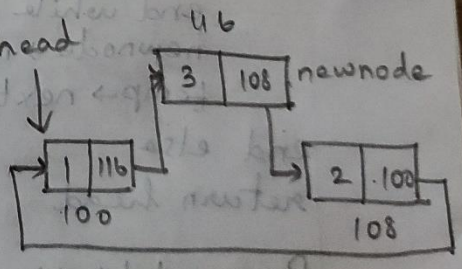
```
else
    newnode -> data = val
    while (temp -> next != head)
        temp = temp -> next
    end while
    temp -> next = newnode
    newnode -> next = head
    head = newnode
end else
return head
```




```
Create()
Input: head, num_nodes
Output: head
i=0, val=0
while (i<num_nodes)
    INPUT val
    head=begin_insert (head, val)
    i = i+1
end while
return head
```




```
pos_insert()
Input: head, val, pos
Output: head
struct node *temp, *check = head, *newnode
newnode = (struct node *) malloc (sizeof (struct node));
newnode -> data = val
l = 0, i = 0
```

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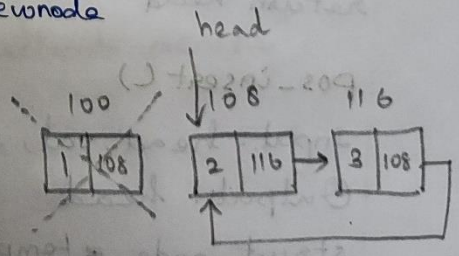
```
while (check -> next != head)
    l=l+1;
    check=check -> next
end while
if (head==NULL)
    print "List is empty"
end if
else if (pos > l+1)
    print "Invalid position...."
end else if
else if (pos==0)
    head = begin_insert(head, val)
end else if
else
    temp = head
    while (i< pos-1)
        temp = temp->next
        i=i+1
    end while
    newnode->next = temp->next
    temp-> next = newnode
end else
return head
```

Begin_delete()
Input: head
Output: head



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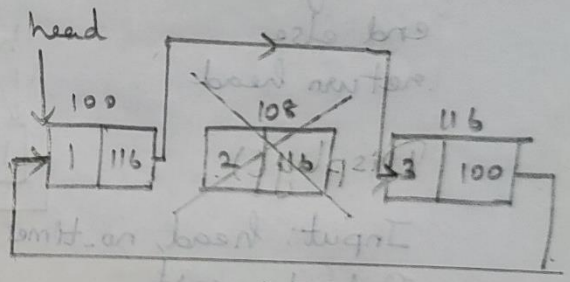
```
if (temp == NULL)
    print "List is empty"
end if
else if (temp→next == temp)
    free (temp)
    head = NULL
end else if
else
    while (temp→next != head)
        temp = temp→next
    temp→next = head→next
    free (head)
    head = temp→next
end else
return head
```



Delete pos()

Input : head, pos

Output: head

```
struct node *temp1, *temp2, *check = head
l = 0, i = 0
if (head == NULL)
    return head
end if
while (check→next != head)
    check = check→next
    l = l + 1
end while
if (pos > l)
    print "Invalid"
end if
```

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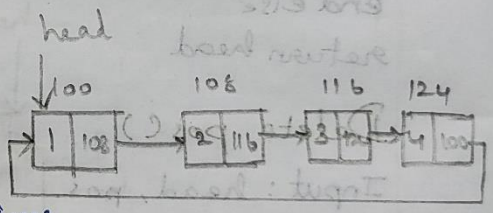
```
else if (pos==0)
    head = begin_delete(head)
end else if
else
    temp1 = head
    while (temp1→next != head)
        temp2 = temp1
        temp1 = temp1→next
        if (i==pos-1)
            break
        end if
        i = i+1
    end while
    temp2→next = temp1→next
    free(temp1)
end else
return head
```




```
Display().
Input: head, no_times
Output: void
struct node *ptr = head
if (ptr == NULL)
    print "Nothing to print..."
end if
else
    for(int i=0; i<no_times; i++)
        ptr = head
        while (ptr→next != head)
            print the Datas
            ptr = ptr→next
        end while
    end for
end else
```

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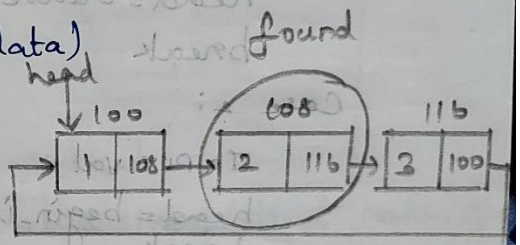
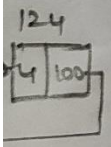
```
Search()
Input: head, val
Output: void
struct node *temp=head
i=0, count=0
if (temp==NULL)
    print "List is Empty"
end if
else
    if (temp->next == head)
        if (val==temp->data)
            count++
        end if
    end if
    else
        if (val==temp->data)
            count++
        end if
        i++
        temp=temp->next
        while (temp!=head
            if (val==temp->data)
                count=count+1
            end if
            i=i+1
            temp=temp->next
        end while
    end else
    if (count=0)
        print " No. of times value found"
    end if
end else
```





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Main()

Variables: choice=0, val=0, pos=0
struct node *head = NULL

Output: void.

```
INPUT choice
switch (choice)
case 1:
    head = NULL
    INPUT val
    head = create(head, val)
    break
case 2:
    INPUT val
    head = begin_insert(head, val)
    break
case 3:
    INPUT val
    INPUT pos
    head = pos_insert(head, val, pos)
    break
case 4:
    head = begin_delete(head)
    break
case 5:
    INPUT pos
    head = delete_pos(head, pos)
    break
case 6:
    INPUT val
    Search(head, val)
case 7:
    INPUT val
    display(head, val)
case 8:
    exit
end switch
```

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Program Code:

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

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

struct node* begin_insert(struct node *head,int val)
{
    struct node *newnode,*temp=head;
    newnode=(struct node*)malloc(sizeof(struct node));
    if(newnode==NULL)
    {
        printf("\nCannot allocate new memory...\n");
    }
    else if(head==NULL)
        {
            newnode->data=val;
            head=newnode;
            newnode->next=head;
            printf("\nNode inserted successfully...\n");
        }
    else
    {
        newnode->data=val;
            while(temp->next!=head)
                    temp=temp->next;
            temp->next=newnode;
        newnode->next=head;
        head=newnode;
        printf("\nNode inserted successfully\n");
    }
    return head;
}

struct node* create(struct node *head,int num_nodes)
{
    int i=0,val=0;
    while(i<num_nodes)
    {
        printf("\nEnter the value to insert: ");
        scanf("%d",&val);
        head=begin_insert(head,val);
        i++;
    }
```

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```
    return head;
}

struct node* pos_insert(struct node *head,int val,int pos)
{

    struct node *temp,*check=head,*newnode;
    newnode=(struct node *)malloc(sizeof(struct node));
    newnode->data=val;
    int l=0,i=0;
    while(check->next!=head)
    {
        l++;
        check=check->next;
    }
    if(head==NULL)
    {
        printf("\nList is empty...\n");
    }
    else if(pos>l+1)
        printf("\nInvalid position...\n");
    else if(pos==0)
        head=begin_insert(head,val);
    else
    {
        temp=head;
        while(i<pos-1)
        {
            temp=temp->next;
            i++;
        }
        newnode->next=temp->next;
        temp->next=newnode;
        printf("\nNode inserted at the position successfully...\n");
    }
    return head;

}

struct node* begin_delete(struct node* head)
{
    struct node *temp=head;
    if(temp==NULL)
    {
        printf("\nList is empty...\n");
    }
    else if(temp->next==temp)
    {
```

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```
        free(temp);
        head=NULL;
        printf("\nOnly node in the list is deleted...\n");
    }
    else
    {
        while(temp->next!=head)
                    temp=temp->next;
            temp->next=head->next;
            free(head);
            head=temp->next;
        printf("\nNode deleted successfully...\n");
    }
    return head;
}

struct node* delete_pos(struct node *head,int pos)
{
    struct node *temp1,*temp2,*check=head;
    int l=0,i=0;
    if(head==NULL)
    {
        printf("\nNothing to delete...\n");
        return head;
    }
    while(check->next!=head)
    {
        check=check->next;
        l++;
    }
    if(pos>l)
        printf("\nInvalid position...\n");
    else if(pos==0)
        head=begin_delete(head);
    else
    {
        temp1=head;
        while(temp1->next!=head)
        {
            temp2=temp1;
            temp1=temp1->next;
            if(i==pos-1)
                break;
            i++;
        }
        temp2->next=temp1->next;
        free(temp1);
        printf("\nNode deleted successfully...\n");
```

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```
    }
        return head;
}

void display(struct node *head,int no_times)
{
    struct node *ptr;
    ptr=head;
    if(ptr==NULL)
    {
        printf("\nNothing to print...\n");
        }
    else
    {
        printf("\nDisplaying values...");
        for(int i=0;i<no_times;i++)
        {
            ptr=head;
            while(ptr->next!=head)
            {
                printf("\nMemory=%p\tData=%d\tNext=%p",ptr,ptr->data,ptr-
>next);
                ptr=ptr->next;
            }
            printf("\nMemory=%p\tData=%d\tNext=%p",ptr,ptr->data,ptr->next);
        }
        printf("\n");
    }
}

void search(struct node *head,int val)
{
    struct node *temp=head;
        int i=0,count=0;
        if(temp==NULL)
            printf("\nList is Empty");
        else
        {
            if(temp->next==head)
            {
                if(val==temp->data)
                    {
                        count++;
                        printf("\nValue %d is found at the index %d",val,i);
                    }
            }
        else
        {
```

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```
                if(val==temp->data)
                {
                    count++;
                    printf("\nValue %d is found at the index %d",val,i);
                }
        i++;
                temp=temp->next;
                while(temp!=head)
                {
                    if(val==temp->data)
                    {
                            count++;
                            printf("\nValue %d is found at the position
%d",val,i);
                    }
                    i++;
                    temp=temp->next;
                }
        }
        if(count==0)
            printf("\nThe Value %d is not found in the List",val);
        else
            printf("\nThe Value is found %d time(s)",count);
    }
}

void main()
{
    int choice=0,val=0,pos=0;
    struct node *head=NULL;
    do
    {
        printf("\nChoices :\n1.Create a Circularly linked list\n2.Insert at
the head\n3.Insert at the specified position\n4.Delete at the head\n5.Delete
at the specified position\n6.Search\n7.Display\n8.Exit\n");
        printf("\nEnter your choice: ");
        scanf("%d",&choice);
        switch (choice)
        {
            case 1:
                head=NULL;
                printf("\nEnter the no. of nodes to create: ");
                scanf("%d",&val);
                head=create(head,val);
                break;
            case 2:
                printf("\nEnter the value you want to insert at the beginning:
");
```

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```
                scanf("%d",&val);
                head=begin_insert(head,val);
                break;
            case 3:
                printf("\nEnter the value you want to insert: ");
                scanf("%d",&val);
                printf("\nEnter the index at which you want to insert: ");
                scanf("%d",&pos);
                head=pos_insert(head,val,pos);
                break;
            case 4:
                head=begin_delete(head);
                break;
            case 5:
                printf("\nEnter the index you want to delete: ");
                scanf("%d",&pos);
                head=delete_pos(head,pos);
                break;
            case 6:
                printf("\nEnter the element to search: ");
                scanf("%d",&val);
                search(head,val);
                break;
            case 7:
                printf("\nEnter the no. of spin: ");
                scanf("%d",&val);
                display(head,val);
                break;
            case 8:
                exit(0);
            default:
                printf("\nInvalid choice!!!\n");
        }
    }while(choice!=8);
}
```

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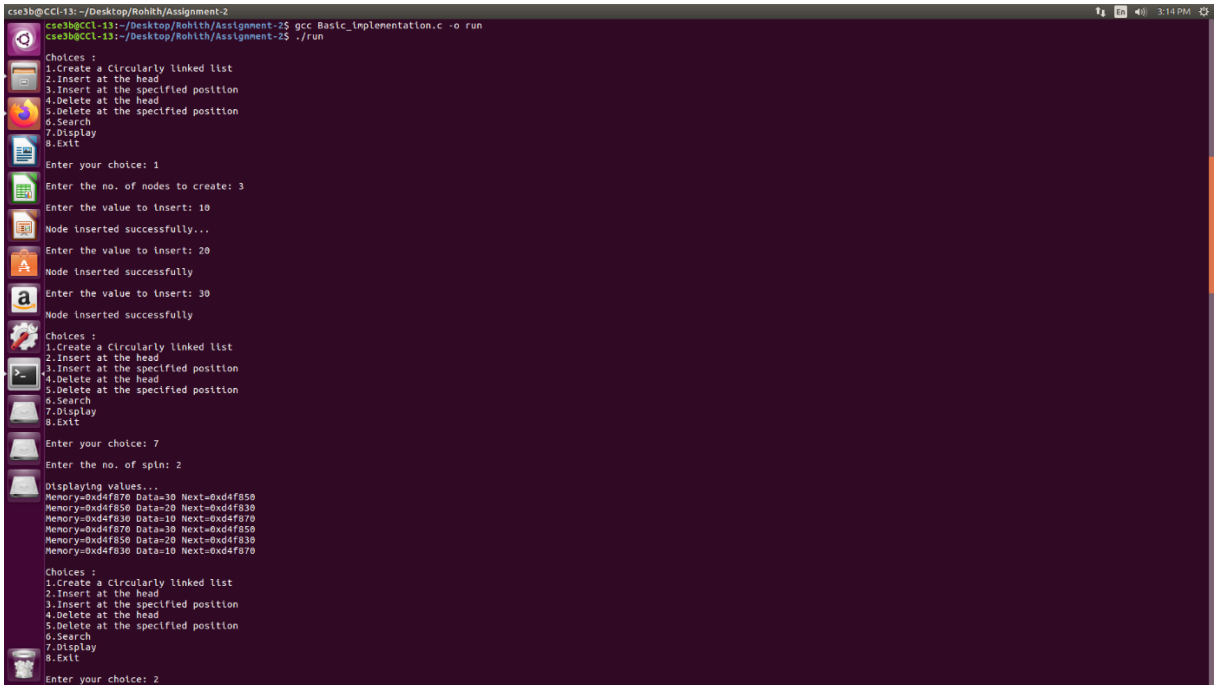
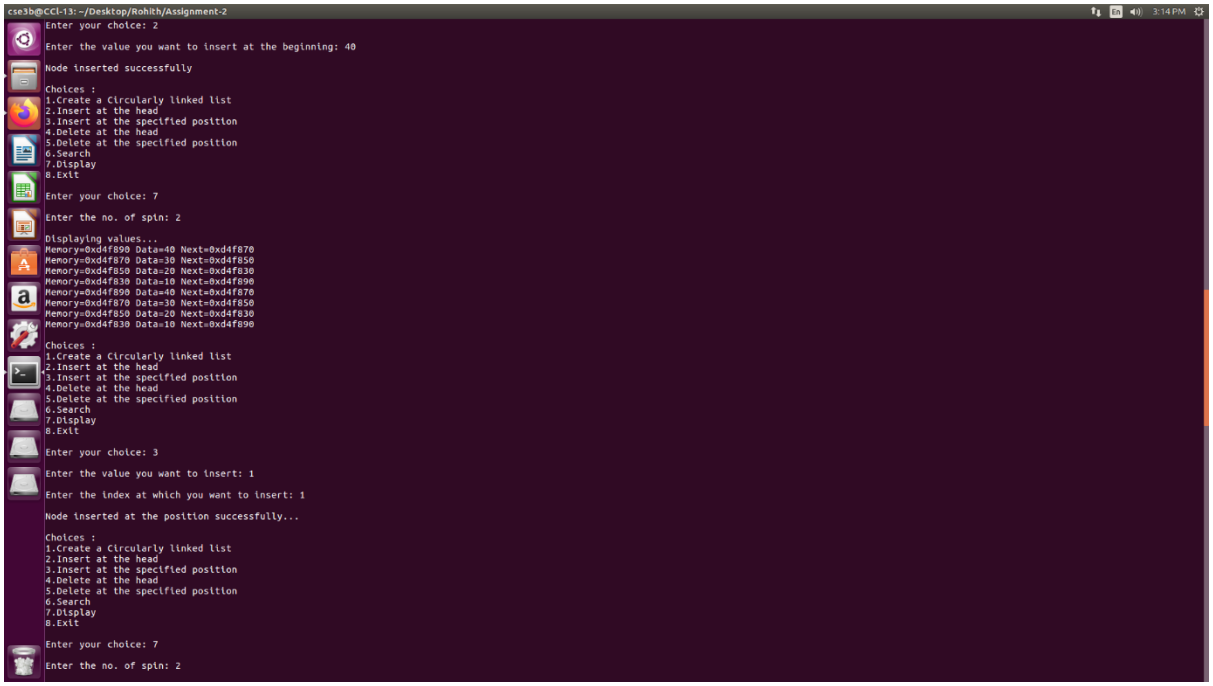
Output:





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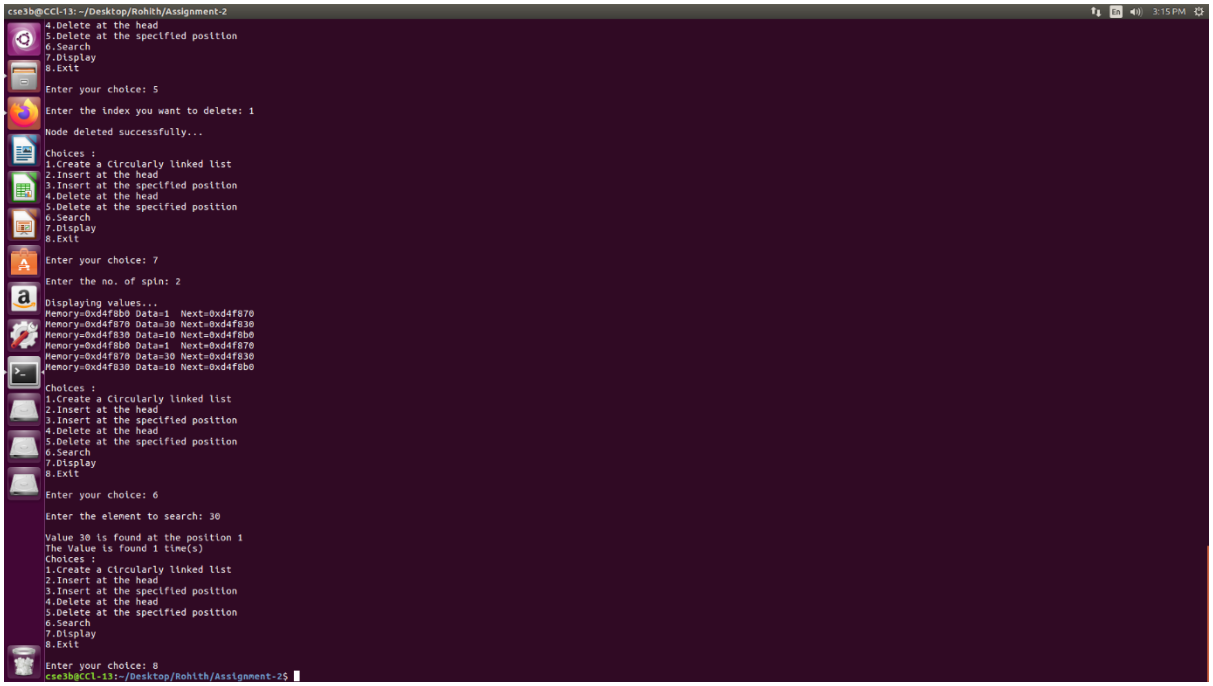

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Application

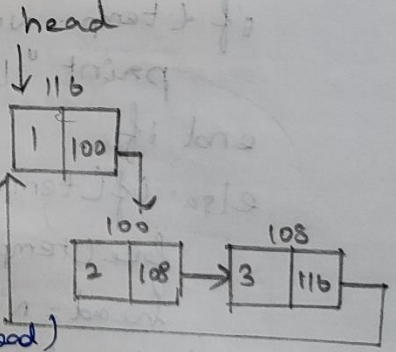
Implement spinning wheel. Rotate the wheel and delete the node at the position in which the wheel stops. Repeat the process until only one node is left

Pseudocode:

Application:-
Implement spinning wheel. Rotate the wheel and delete the node at the position in which the wheel stops. Repeat the process until only one node is left.

```
struct node
{
    int data
    struct node *next
}

begin_insert()
Input: head, val
Output: head
Struct node *newnode *temp=head
newnode=(struct node*)malloc sizeof(struct node));
if (head==NULL)
    newnode->data=val
    head=newnode
    newnode->next=head
end if
else
    newnode->data=val.
    while (temp->next != head)
        temp=temp->next
    end while
    temp->next=newnode
    newnode->next=head
    head=newnode
end else
return head
```



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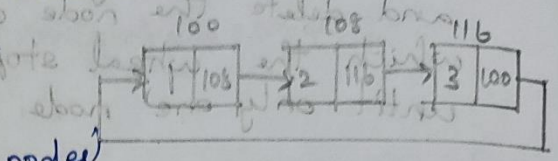
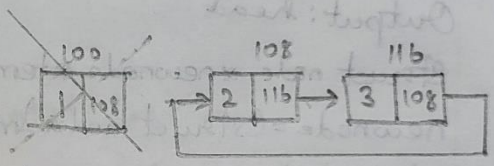
```
Create ()
Input: head, num_nodes
Output: head
i = 0, val = 0
while(i < num_nodes)
    INPUT val
    head = begin_insert(head, val)
    i = i + 1
end while
return head
```




```
begin_delete ()
Input: head
Output: head
if (temp == NULL)
    print "List is empty"
end if
else if(temp -> next == temp)
    free(temp)
    head = NULL
end else if
else
  while (temp -> next != head)
      temp = temp -> next
  end while
  temp -> next = head -> next
  free (head)
  head = temp -> next
end else
return head
```



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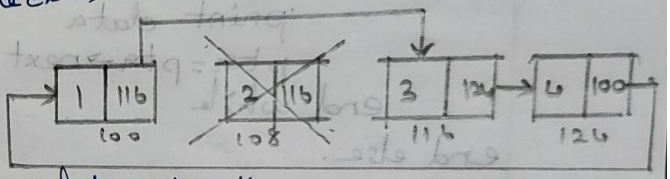
```
Delete_pos()
Input: struct node *head, int pos
Output : struct node *head
Variables : struct node *temp1, *temp2, *check=head;
            int  l=0, i=0

if (head==NULL)
    return head
end if
while(check->next != head)
    check= check->next
    l=l+1
end while
if (pos > l)
    print "Invalid position"
end if
else if (pos==0)
    head = begin_delete(head)
end else if
else
    temp1 = head
    while(temp1->next != head)
        temp2 = temp1
        temp1 = temp1->next
        if(i == pos-1)
            break
        end if
        i = i+1
    end while
    temp2-> next = temp1-> next
    head= temp1->next
    free(temp1)
end else
return head
```



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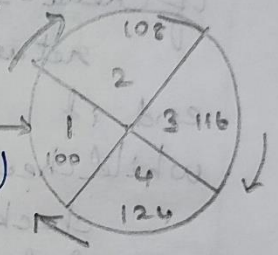
Display()

Input: struct node *head

Output: void

Variables: struct node *ptr = head

```
if (ptr==NULL)
    print "Nothing to print"
end if
else
    ptr=head
    while(ptr->next != head)
        print data
        ptr=ptr->next
    end while
end else.
```



Main().

Variables: struct node *head=NULL, int num, index

```
INPUT num
head = create(head, num)
print the spinning wheel, display(head)
while(num>1)
    if(num==1)
        break
    end if
    index = rand()%(num-1)
    head = delete_pos(head,index)
    display(head)
    num = num-1
end while
print "The data of spinning wheel"
display(head)
```

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Date: 16-11-22

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Program Code:

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

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

struct node* begin_insert(struct node *head,int val)
{
    struct node *newnode,*temp=head;
    newnode=(struct node*)malloc(sizeof(struct node));
    if(newnode==NULL)
    {
        printf("\nCannot allocate new memory...\n");
    }
    else if(head==NULL)
    {
        newnode->data=val;
        head=newnode;
        newnode->next=head;
    }
    else
    {
        newnode->data=val;
        while(temp->next!=head)
            temp=temp->next;
        temp->next=newnode;
        newnode->next=head;
        head=newnode;
    }
    return head;
}

struct node* create(struct node *head,int num_nodes)
{
    int i=0,val=0;
    while(i<num_nodes)
    {
        printf("\nEnter the value to insert: ");
        scanf("%d",&val);
        head=begin_insert(head,val);
        i++;
    }
```

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```
    return head;
}

struct node* begin_delete(struct node* head)
{
    struct node *temp=head;
    if(temp==NULL)
    {
        printf("\nList is empty...\n");
    }
    else if(temp->next==temp)
    {
        free(temp);
        head=NULL;
        printf("\nOnly node in the list is deleted...\n");
    }
    else
    {
        while(temp->next!=head)
            temp=temp->next;
        temp->next=head->next;
        free(head);
        head=temp->next;
        // printf("\nNode deleted successfully...\n");
        printf("\nSpinning wheel starts at data %d\n",head->data);
    }
    return head;
}

struct node* delete_pos(struct node *head,int pos)
{
    struct node *temp1,*temp2,*check=head;
    int l=0,i=0;
    if(head==NULL)
    {
        printf("\nNothing to delete...\n");
        return head;
    }
    while(check->next!=head)
    {
        check=check->next;
        l++;
    }
    if(pos>l)
        printf("\nInvalid position...\n");
    else if(pos==0)
        head=begin_delete(head);
    else
```

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```
    {
        temp1=head;
        while(temp1->next!=head)
        {
            temp2=temp1;
            temp1=temp1->next;
            if(i==pos-1)
                break;
            i++;
        }
        temp2->next=temp1->next;
        head=temp1->next;
        free(temp1);
        printf("\nSpinnning wheel starts from data %d\n",head->data);
    }
    return head;
}

void display(struct node *head)
{
    struct node *ptr;
    ptr=head;
    if(ptr==NULL)
    {
        printf("\nNothing to print...\n");
        }
    else
    {
        ptr=head;
        while(ptr->next!=head)
        {
            printf("\nData=%d",ptr->data);
            ptr=ptr->next;
        }
        printf("\nData=%d",ptr->data);
        printf("\n");
    }
}

void main()
{
    struct node *head=NULL;
    int num,index;
    printf("\nEnter the number of nodes you want to insert: ");
    scanf("%d",&num);
    head=create(head,num);
    printf("\n*** AT THE BEGINNING ***\n");
    printf("Spinning wheel data :");
```

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```
    display(head);
    while(num>1)
    {
        printf("\n*********************************\n");
        printf("\nSpinning the wheel...\n");
        if(num==1)
            break;
        index=rand()%(num-1);
        printf("\nThe wheel stopped at index %d\n",index);
        head=delete_pos(head,index);
        printf("\nSpinning wheel data :\n");
        display(head);
        num--;
        printf("\n*********************************\n");
    }
    printf("\n*** AT THE END ***\n");
    printf("Spinning wheel data :");
    display(head);
    printf("\n");
}
```

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Output:

```
Enter the number of nodes you want to insert: 5

Enter the value to insert: 10

Enter the value to insert: 20

Enter the value to insert: 30

Enter the value to insert: 40

Enter the value to insert: 50

*** AT THE BEGINNING ***
Spinning wheel data :
Data=50
Data=40
Data=30
Data=20
Data=10
```

```
**********************************

Spinning the wheel...

The wheel stopped at index 1

Spinnning wheel starts from data 30

Spinning wheel data :

Data=30
Data=20
Data=10
Data=50

**********************************

**********************************

Spinning the wheel...

The wheel stopped at index 2

Spinnning wheel starts from data 50

Spinning wheel data :

Data=50
Data=30
Data=20

**********************************
```

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```
**********************************

Spinning the wheel...

The wheel stopped at index 0

Spinning wheel starts at data 30

Spinning wheel data :

Data=30
Data=20

**********************************

**********************************

Spinning the wheel...

The wheel stopped at index 0

Spinning wheel starts at data 20

Spinning wheel data :

Data=20

**********************************

*** AT THE END ***
Spinning wheel data :
Data=20
```

Results:

Thus C program using Circular linked List in data structures as well as the spinning wheel using circular linked list have been implemented and executed successfully.