13
NOV
2023

LAB # 04 - ASSIGNMENT

DATA STRUCTURES ALGORITHMS AND APPLICATIONS (CT – 159)

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GROUP 16

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EXERCISE

QUESTION 1:

```
/*
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Question 1


1. Create a doubly link list and perform the mentioned tasks.
a. Insert a new node at the end of the list.
b. Insert a new node at the beginning of list.
c. Insert a new node at given position.
d. Delete any node.
e. Print the complete doubly link list.


*/


#include<iostream>
#include<cstdlib>
using namespace std;


struct Node{
    int data;
    struct Node* prev;
    struct Node* next;
```
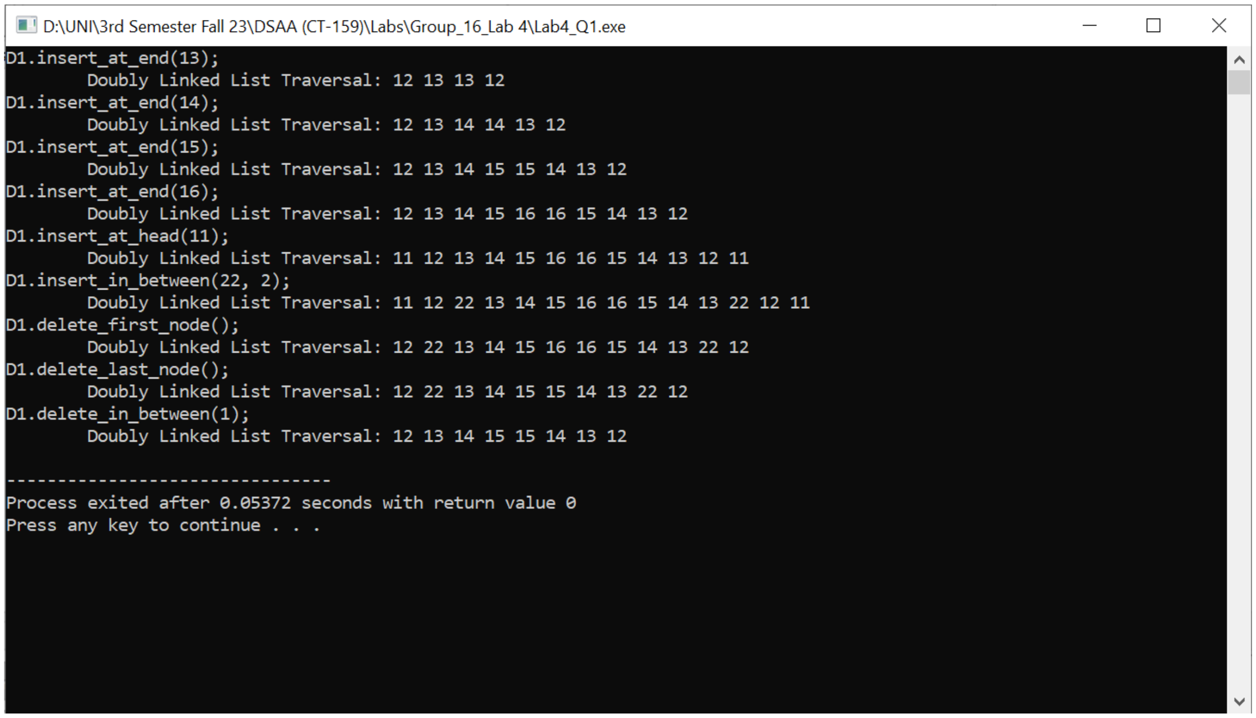

```
};

class DoublyLL{
    Node* head;

    public:
    DoublyLL(int data){
        Node* newNode = (struct Node*) malloc (sizeof(struct Node));
        newNode->data = data;
        newNode->prev = NULL;
        newNode->next = NULL;
        head = newNode;
    }

    void insert_at_head(int data){
        Node* newNode = (struct Node*) malloc (sizeof(struct Node));
        newNode->data = data;
        newNode->prev = NULL;
        newNode->next = head;
        head->prev = newNode;
        head = newNode;
    }

    void insert_at_end(int data){
        Node* newNode = (struct Node*) malloc (sizeof(struct Node));
        newNode->data = data;
        newNode->next = NULL;
        Node* temp = head;
        while(temp->next != NULL){
            temp = temp->next;
        }
        newNode->prev = temp;
        temp->next = newNode;
    }

    void insert_in_between(int data, int position){
        Node* newNode = (struct Node*) malloc (sizeof(struct Node));
        newNode->data = data;
        Node *temp = head;
        int i = 0;
        while(i != position-1){
            temp = temp->next;
            i++;
        }
        newNode->next = temp->next;
        newNode->prev = temp;
        Node* temp2 = temp->next;
        temp2->prev = newNode;
        temp->next = newNode;
    }

    void delete_first_node(){
        Node* temp = head;
        head = head->next;
        head->prev = NULL;
        free(temp);
    }

    void delete_last_node(){
        Node* temp = head;
        while(temp->next != NULL){
            temp = temp->next;
        }
        Node *temp2 = temp->prev;
        temp->prev = NULL;
        temp2->next = NULL;
        free(temp);
    }

    void delete_in_between(int position){
        Node* temp = head;
        int i = 0;
        while(i != position-1){
            temp = temp->next;
            i++;
        }
        Node* temp2 = temp->next;
        Node* temp3 = temp->next = temp2->next;
        temp3->prev = temp;
        free(temp2);
    }
```

```
    void doubleLLTraversal(){
        Node* temp = head, *temp2;
        cout << "Doubly Linked List Traversal: ";
        while(temp != NULL){
            cout << temp->data << " ";
            if(temp->next == NULL){
                temp2 = temp;
            }
            temp = temp->next;
        }
        while(temp2 != NULL){
            cout << temp2->data << " ";
            temp2 = temp2->prev;
        }
        cout << endl;
    }
};

int main(){
    DoublyLL D1(12);
    D1.insert_at_end(13);
    cout << "D1.insert_at_end(13);\n\t";
    D1.doubleLLTraversal();
    D1.insert_at_end(14);
    cout << "D1.insert_at_end(14);\n\t";
    D1.doubleLLTraversal();
    D1.insert_at_end(15);
    cout << "D1.insert_at_end(15);\n\t";
    D1.doubleLLTraversal();
    D1.insert_at_end(16);
    cout << "D1.insert_at_end(16);\n\t";
    D1.doubleLLTraversal();
    D1.insert_at_head(11);
    cout << "D1.insert_at_head(11);\n\t";
    D1.doubleLLTraversal();
    D1.insert_in_between(22, 2);
    cout << "D1.insert_in_between(22, 2);\n\t";
    D1.doubleLLTraversal();
    D1.delete_first_node();
    cout << "D1.delete_first_node();\n\t";
    D1.doubleLLTraversal();
    D1.delete_last_node();
    cout << "D1.delete_last_node();\n\t";
    D1.doubleLLTraversal();
    D1.delete_in_between(1);
    cout << "D1.delete_in_between(1);\n\t";
    D1.doubleLLTraversal();
    return 0;
}
```

OUTPUT:


D:\UNI\3rd Semester Fall 23\DSAA (CT-159)\Labs\Group_16_Lab 4\Lab4_Q1.exe

```
D1.insert_at_end(13);
        Doubly Linked List Traversal: 12 13 13 12
D1.insert_at_end(14);
        Doubly Linked List Traversal: 12 13 14 14 13 12
D1.insert_at_end(15);
        Doubly Linked List Traversal: 12 13 14 15 15 14 13 12
D1.insert_at_end(16);
        Doubly Linked List Traversal: 12 13 14 15 16 16 15 14 13 12
D1.insert_at_head(11);
        Doubly Linked List Traversal: 11 12 13 14 15 16 16 15 14 13 12 11
D1.insert_in_between(22, 2);
        Doubly Linked List Traversal: 11 12 22 13 14 15 16 16 15 14 13 22 12 11
D1.delete_first_node();
        Doubly Linked List Traversal: 12 22 13 14 15 16 16 15 14 13 22 12
D1.delete_last_node();
        Doubly Linked List Traversal: 12 22 13 14 15 15 14 13 22 12
D1.delete_in_between(1);
        Doubly Linked List Traversal: 12 13 14 15 15 14 13 12

--------------------------------
Process exited after 0.05372 seconds with return value 0
Press any key to continue . . .
```

QUESTION 2:

```
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Question 2


2. Create two doubly link lists, say L and M . List L should contain all even elements
from 2 to
10 and list M should contain all odd elements from 1 to 9. Create a new list N by
concatenating list L and M.


*/


#include <iostream>
#include <cstdlib>
using namespace std;


void swap(int *a, int*b){
    *a = *a + *b;
    *b = *a - *b;
    *a = *a - *b;
}


struct Node{
    int data;
    struct Node* prev;
    struct Node* next;
};

class DoublyLL{
    struct Node* head;

    public:
    DoublyLL(int data){
        Node* newnode = (struct Node*)malloc(sizeof(struct Node));
        newnode->data = data;
        newnode->next = NULL;
        newnode->prev = NULL;
        head = newnode;
    }

    void insert_at_head(int data){
        Node* newnode = (struct Node*)malloc(sizeof(struct Node));
        newnode->data = data;
        newnode->next = head;
        newnode->prev = NULL;
        head->prev = newnode;
        head = newnode;
    }

    void insert_at_end(int data){
        Node* newnode = (struct Node*)malloc(sizeof(struct Node));
        newnode->data = data;
        newnode->next = NULL;
        Node *temp = head;

        while(temp->next != NULL){
            temp = temp->next;
        }
        newnode->prev = temp;
        temp->next = newnode;
    }

    void concatenateLL(DoublyLL List){
        Node* temp = head;
        while(temp->next != NULL){
            temp = temp->next;
        }
        temp->next = List.head;
        List.head->prev = temp;
    }

    void DoublyTraversal(){
        Node* temp = head;
        cout << "Doubly Linked List: ";
        while(temp->next != NULL){
            cout << temp->data << " ";
            temp = temp->next;
        }
```
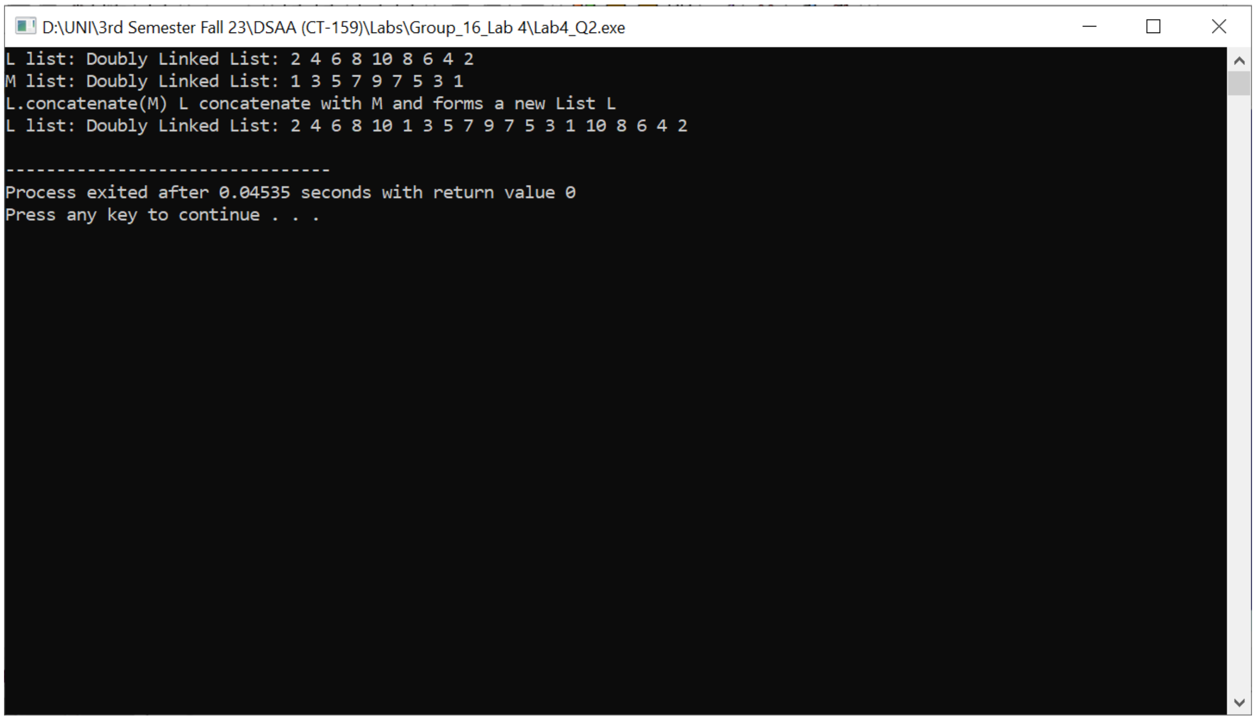

```
        cout << temp->data << " ";
        while(temp != head){
            temp = temp->prev;
            cout << temp->data << " ";
        }
        cout << endl;
    }
};

int main() {
    DoublyLL L(2), M(1);
    for(int i = 4; i <= 10; i+=2){
        L.insert_at_end(i);
    }
    for(int i = 3; i <= 9; i+=2){
        M.insert_at_end(i);
    }
    cout << "L list: ";
    L.DoublyTraversal();
    cout << "M list: ";
    M.DoublyTraversal();

    L.concatenateLL(M);
    cout << "L.concatenate(M) L concatenate with M and forms a new List L\nL list: ";
    L.DoublyTraversal();
    return 0;
}
```

OUTPUT:



```
D:\UNI\3rd Semester Fall 23\DSAA (CT-159)\Labs\Group_16_Lab 4\Lab4_Q2.exe
L list: Doubly Linked List: 2 4 6 8 10 8 6 4 2
M list: Doubly Linked List: 1 3 5 7 9 7 5 3 1
L.concatenate(M) L concatenate with M and forms a new List L
L list: Doubly Linked List: 2 4 6 8 10 1 3 5 7 9 7 5 3 1 10 8 6 4 2

--------------------------------
Process exited after 0.04535 seconds with return value 0
Press any key to continue . . .
```

QUESTION 3:

```
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Question 3


3. Using the above created list N, sort the contents of list N is descending order.


*/


#include <iostream>
#include <cstdlib>
using namespace std;

void swap(int *a, int*b){
    *a = *a + *b;
    *b = *a - *b;
    *a = *a - *b;
}

struct Node{
    int data;
    struct Node* prev;
    struct Node* next;
```
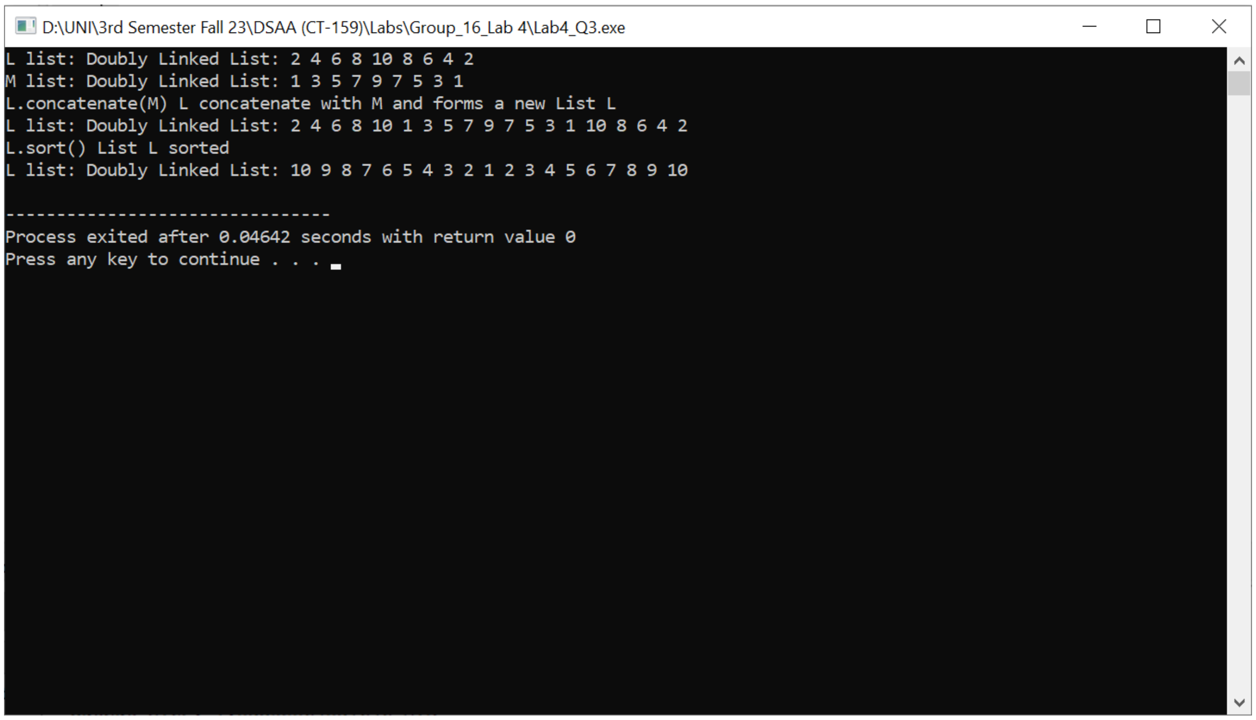

```
};

class DoublyLL{
    struct Node* head;

    public:
    DoublyLL(int data){
        Node* newnode = (struct Node*)malloc(sizeof(struct Node));
        newnode->data = data;
        newnode->next = NULL;
        newnode->prev = NULL;
        head = newnode;
    }

    void insert_at_head(int data){
        Node* newnode = (struct Node*)malloc(sizeof(struct Node));
        newnode->data = data;
        newnode->next = head;
        newnode->prev = NULL;
        head->prev = newnode;
        head = newnode;
    }

    void insert_at_end(int data){
        Node* newnode = (struct Node*)malloc(sizeof(struct Node));
        newnode->data = data;
        newnode->next = NULL;
        Node *temp = head;

        while(temp->next != NULL){
            temp = temp->next;
        }
        newnode->prev = temp;
        temp->next = newnode;
    }

    void concatenateLL(DoublyLL List){
        Node* temp = head;
        while(temp->next != NULL){
            temp = temp->next;
        }
        temp->next = List.head;
        List.head->prev = temp;
    }

    void sort(){
        Node* temp = head, *temp2, *temp3 = head;
        while(temp3->next != NULL){
            while(temp->next != NULL){
                temp2 = temp;
                temp = temp->next;
                if(temp->data > temp2->data){
                    swap(temp->data, temp2->data);
                }
            }
            temp = head;
            temp3 = temp3->next;
        }
    }

    void DoublyTraversal(){
        Node* temp = head;
        cout << "Doubly Linked List: ";
        while(temp->next != NULL){
            cout << temp->data << " ";
            temp = temp->next;
        }
        cout << temp->data << " ";
        while(temp != head){
            temp = temp->prev;
            cout << temp->data << " ";
        }
        cout << endl;
    }
};

int main() {
    DoublyLL L(2), M(1);
    for(int i = 4; i <= 10; i+=2){
        L.insert_at_end(i);
    }
    for(int i = 3; i <= 9; i+=2){
        M.insert_at_end(i);
    }
    cout << "L list: ";
    L.DoublyTraversal();
    cout << "M list: ";
    M.DoublyTraversal();

    L.concatenateLL(M);
    cout << "L.concatenate(M) L concatenate with M and forms a new List L\nL list: ";
    L.DoublyTraversal();

    L.sort();
    cout << "L.sort() List L sorted\nL list: ";
    L.DoublyTraversal();
    return 0;
}
```

OUTPUT:



D:\UNI\3rd Semester Fall 23\DSAA (CT-159)\Labs\Group_16_Lab 4\Lab4_Q3.exe

```
L list: Doubly Linked List: 2 4 6 8 10 8 6 4 2
M list: Doubly Linked List: 1 3 5 7 9 7 5 3 1
L.concatenate(M) L concatenate with M and forms a new List L
L list: Doubly Linked List: 2 4 6 8 10 1 3 5 7 9 7 5 3 1 10 8 6 4 2
L.sort() List L sorted
L list: Doubly Linked List: 10 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 10

--------------------------------
Process exited after 0.04642 seconds with return value 0
Press any key to continue . . .
```

QUESTION 4:

```
/*
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Question 4


4.  Create a circular link list and perform the mentioned tasks.
a. Insert a new node at the end of the list.
b. Insert a new node at the beginning of list.
c. Insert a new node at given position.
d. Delete any node.
e. Print the complete circular link list.


*/


#include<iostream>
#include<cstdlib>
using namespace std;


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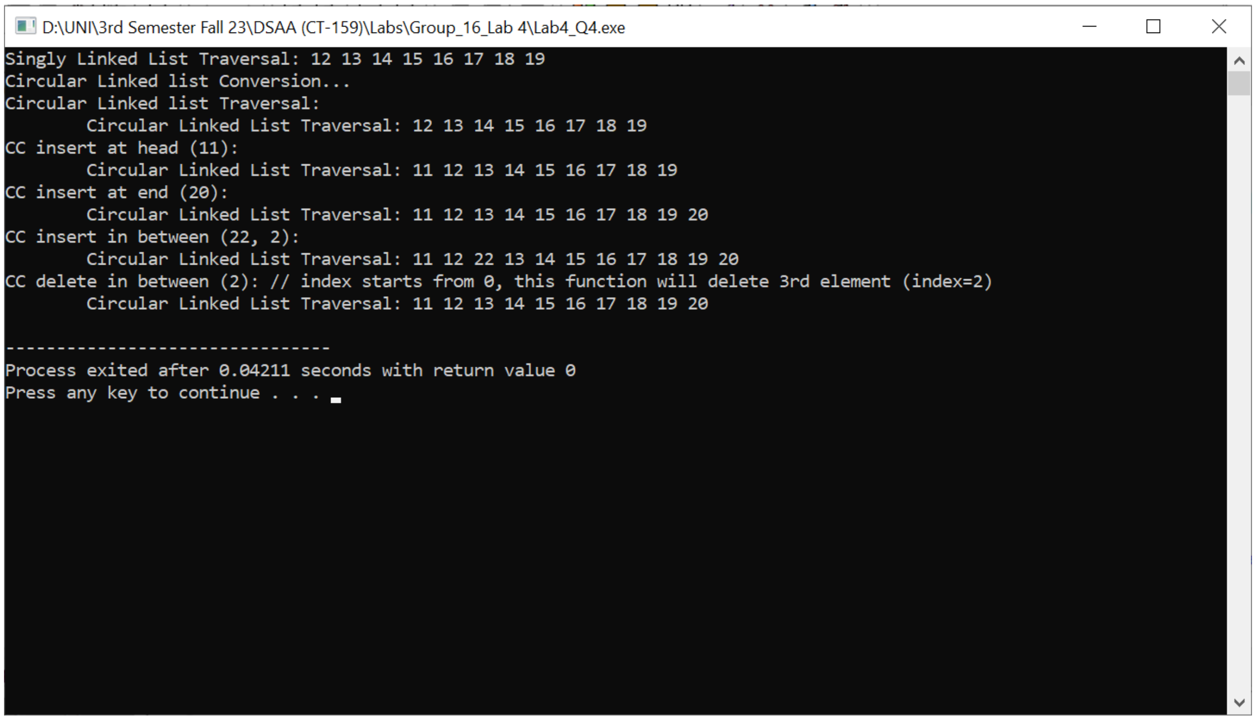

```
class LinkedList{
    struct Node* head;

    public:
    LinkedList(int data){
        Node *newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        newNode->next = NULL;
        head = newNode;
    }

    void insert_at_head(int data){
        Node *newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        newNode->next = head;
        head = newNode;
    }

    void insert_at_end(int data){
        Node *newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        newNode->next = NULL;
        Node *temp = head;
        while(temp->next != NULL){
            temp = temp->next;
        }
        temp->next = newNode;
    }

    void insert_in_between(int data, int position){
        Node *newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        Node *temp = head;
        int i = 0;
        while(i != position-1){
            temp = temp->next;
            i++;
        }
        newNode->next = temp->next;
        temp->next = newNode;
    }

    void insert_after_node(int data, struct Node* node){
        Node *newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        newNode->next = node->next;
        node->next = newNode;
    }

    void delete_first_node(){
        Node* temp = head;
        head = head->next;
        free(temp);
    }
```

```
void delete_last_node(){
    Node* temp = head;
    while(temp->next->next != NULL){
        temp = temp->next;
    }
    Node *temp2 = temp->next;
    temp->next = NULL;
    free(temp2);
}

void delete_middle_node(int position){
    Node* temp = head;
    int i = 0;
    while(i != position - 1){
        temp = temp->next;
        i++;
    }
    Node* temp2 = temp->next;
    temp->next = temp2->next;
    free(temp2);
}

void delete_given_value_node(int data){
    Node* temp = head, *temp2;
    while((temp->data != data) && (temp->next != NULL)){
        temp2 = temp;
        temp = temp->next;
    }
    if(temp->data == data){
        temp2->next = temp->next;
        free(temp);
    }
}

void singlyLinkedListTraversal(){
    Node* temp = head;
    cout << "Singly Linked List Traversal: ";
    while(temp != NULL){
        cout << temp->data << " ";
        temp = temp->next;
    }
    cout << endl;
}

void circularLLConversion(){
    Node *temp = head;
    while(temp->next != NULL){
        temp = temp->next;
    }
    temp->next = head;
}

void circularLinkedListTraversal(){
    Node *temp = head;
    cout << "Circular Linked List Traversal: ";
    do{
        cout << temp->data << " ";
        temp = temp->next;
    }while(temp != head);
    cout << endl;
}

void CCinsert_at_head(int data){
    Node *newNode = (struct Node*)malloc (sizeof(struct Node));
    newNode->data = data;
    newNode->next = head;
    Node *ptr = head;
    while(ptr->next != head){
        ptr = ptr->next;
    }
    ptr->next = newNode;
    head = newNode;
}

void CCinsert_at_end(int data){
    Node *newNode = (struct Node*)malloc (sizeof(struct Node));
    newNode->data = data;
    newNode->next = head;
    Node *ptr = head;
    while(ptr->next != head){
        ptr = ptr->next;
    }
    ptr->next = newNode;
}

void CCinsert_in_between(int data, int position){
    Node *newNode = (struct Node*) malloc (sizeof(struct Node));
    newNode->data = data;
    Node* temp = head;
    for(int i = 0; i < position-1; i++){
        temp = temp->next;
    }
    newNode->next = temp->next;
    temp->next = newNode;
}

void CCinsert_after_node(int data, struct Node* node){
    Node *newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = node->next;
    node->next = newNode;
}

void CCdelete_first_node(){
    Node* temp = head;
    while(temp->next != head){
        temp = temp->next;
    }
    Node *temp2 = head;
    temp->next = temp2->next;
    head = temp->next;
    free(temp2);
}

void CCdelete_end_node(){
    Node *temp = head, *temp2;
    while(temp->next != head){
        temp2 = temp;
        temp = temp->next;
    }
    temp2->next = head;
    free(temp);
}

void CCdelete_in_between(int position){
    Node *temp = head;
    int i = 0;
    while(i != position-1){
        temp = temp->next;
        i++;
    }
    Node* temp2 = temp->next;
    temp->next = temp2->next;
    free(temp2);
    }
};


int main(){
    LinkedList L1(12);
    L1.insert_at_end(13);
    L1.insert_at_end(14);
    L1.insert_at_end(15);
    L1.insert_at_end(16);
    L1.insert_at_end(17);
    L1.insert_at_end(18);
    L1.insert_at_end(19);
    L1.singlyLinkedListTraversal();
    cout << "Circular Linked list Conversion...\n";
    L1.circularLLConversion();
    cout << "Circular Linked list Traversal:\n\t";
    L1.circularLinkedListTraversal();
    L1.CCinsert_at_head(11);
    cout << "CC insert at head (11):\n\t";
    L1.circularLinkedListTraversal();
    L1.CCinsert_at_end(20);
    cout << "CC insert at end (20):\n\t";
    L1.circularLinkedListTraversal();
    L1.CCinsert_in_between(22, 2);
    cout << "CC insert in between (22, 2):\n\t";
    L1.circularLinkedListTraversal();
    L1.CCdelete_in_between(2);          // index starts from 0, will delete 3rd element
    cout << "CC delete in between (2): // index starts from 0, this function will delete
3rd element (index=2)\n\t";

    L1.circularLinkedListTraversal();

    return 0;

}
```

OUTPUT:



D:\UNI\3rd Semester Fall 23\DSAA (CT-159)\Labs\Group_16_Lab 4\Lab4_Q4.exe

```
Singly Linked List Traversal: 12 13 14 15 16 17 18 19
Circular Linked list Conversion...
Circular Linked list Traversal:
        Circular Linked List Traversal: 12 13 14 15 16 17 18 19
CC insert at head (11):
        Circular Linked List Traversal: 11 12 13 14 15 16 17 18 19
CC insert at end (20):
        Circular Linked List Traversal: 11 12 13 14 15 16 17 18 19 20
CC insert in between (22, 2):
        Circular Linked List Traversal: 11 12 22 13 14 15 16 17 18 19 20
CC delete in between (2): // index starts from 0, this function will delete 3rd element (index=2)
        Circular Linked List Traversal: 11 12 13 14 15 16 17 18 19 20

--------------------------------
Process exited after 0.04211 seconds with return value 0
Press any key to continue . . .
```

QUESTION 5:

```
/*
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Question 5


5. Break the above-created circular linked list into two halves.
*/


#include<iostream>
#include<cstdlib>
using namespace std;


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


class LinkedList{
    struct Node* head;


    public:
    LinkedList(int data){
        Node *newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        newNode->next = NULL;
        head = newNode;
    }

    void insert_at_head(int data){
        Node *newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        newNode->next = head;
        head = newNode;
    }

    void insert_at_end(int data){
        Node *newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        newNode->next = NULL;
        Node *temp = head;
        while(temp->next != NULL){
            temp = temp->next;
        }
        temp->next = newNode;
    }

    void insert_in_between(int data, int position){
        Node *newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        Node *temp = head;
        int i = 0;
        while(i != position-1){
            temp = temp->next;
            i++;
        }
        newNode->next = temp->next;
        temp->next = newNode;
    }

    void insert_after_node(int data, struct Node* node){
        Node *newNode = (struct Node*)malloc(sizeof(struct Node));
        newNode->data = data;
        newNode->next = node->next;
        node->next = newNode;
    }

    void delete_first_node(){
        Node* temp = head;
        head = head->next;
        free(temp);
    }

    void delete_last_node(){
        Node* temp = head;
        while(temp->next->next != NULL){
            temp = temp->next;
        }
        Node *temp2 = temp->next;
        temp->next = NULL;
        free(temp2);
    }

    void delete_middle_node(int position){
        Node* temp = head;
        int i = 0;
        while(i != position - 1){
            temp = temp->next;
            i++;
        }
        Node* temp2 = temp->next;
        temp->next = temp2->next;
        free(temp2);
    }

    void delete_given_value_node(int data){
        Node* temp = head, *temp2;
        while((temp->data != data) && (temp->next != NULL)){
            temp2 = temp;
            temp = temp->next;
        }
        if(temp->data == data){
            temp2->next = temp->next;
            free(temp);
        }
```
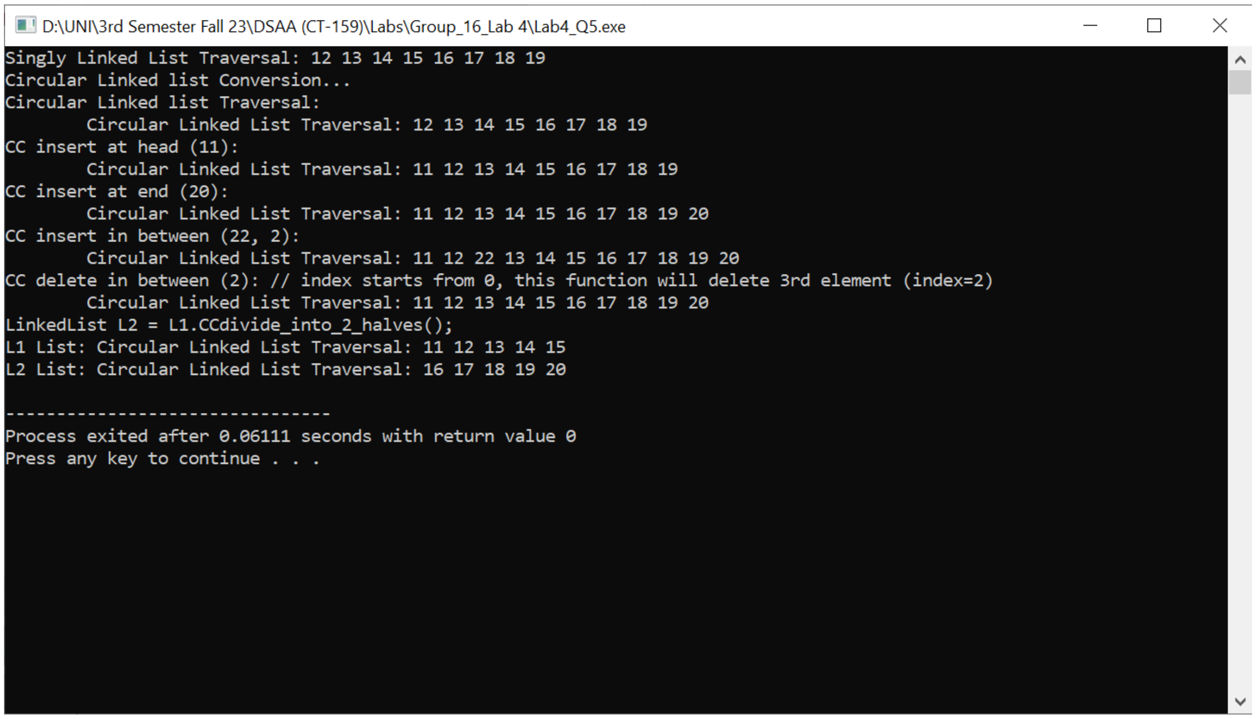

```
}

void singlyLinkedListTraversal(){
    Node* temp = head;
    cout << "Singly Linked List Traversal: ";
    while(temp != NULL){
        cout << temp->data << " ";
        temp = temp->next;
    }
    cout << endl;
}

void circularLLConversion(){
    Node *temp = head;
    while(temp->next != NULL){
        temp = temp->next;
    }
    temp->next = head;
}

void circularLinkedListTraversal(){
    Node *temp = head;
    cout << "Circular Linked List Traversal: ";
    do{
        cout << temp->data << " ";
        temp = temp->next;
    }while(temp != head);
    cout << endl;
}

void CCinsert_at_head(int data){
    Node *newNode = (struct Node*)malloc (sizeof(struct Node));
    newNode->data = data;
    newNode->next = head;
    Node *ptr = head;
    while(ptr->next != head){
        ptr = ptr->next;
    }
    ptr->next = newNode;
    head = newNode;
}

void CCinsert_at_end(int data){
    Node *newNode = (struct Node*)malloc (sizeof(struct Node));
    newNode->data = data;
    newNode->next = head;
    Node *ptr = head;
    while(ptr->next != head){
        ptr = ptr->next;
    }
    ptr->next = newNode;
}

void CCinsert_in_between(int data, int position){
}
```

```
    Node *newNode = (struct Node*) malloc (sizeof(struct Node));
    newNode->data = data;
    Node* temp = head;
    for(int i = 0; i < position-1; i++){
        temp = temp->next;
    }
    newNode->next = temp->next;
    temp->next = newNode;
}

void CCinsert_after_node(int data, struct Node* node){
    Node *newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->next = node->next;
    node->next = newNode;
}

void CCdelete_first_node(){
    Node* temp = head;
    while(temp->next != head){
        temp = temp->next;
    }
    Node *temp2 = head;
    temp->next = temp2->next;
    head = temp->next;
    free(temp2);
}
```

```
void CCdelete_end_node(){
    Node *temp = head, *temp2;
    while(temp->next != head){
        temp2 = temp;
        temp = temp->next;
    }
    temp2->next = head;
    free(temp);
}

void CCdelete_in_between(int position){
    Node *temp = head;
    int i = 0;
    while(i != position-1){
        temp = temp->next;
        i++;
    }
    Node* temp2 = temp->next;
    temp->next = temp2->next;
    free(temp2);
}

LinkedList CCdivide_into_2_halves(){
    Node *temp = head;
    int count = 0;
    while(temp->next != head){
            temp = temp->next;
            count++;
        }
        temp->next = NULL;

        temp = head;

        int i = 0;
        while(i != (count/2)){
            temp = temp->next;
            i++;
        }
        Node* temp2 = temp->next;
        temp->next = head;

        LinkedList newCC(temp2->data);
        newCC.head = temp2;
        while(temp2->next != NULL){
            temp2 = temp2->next;
        }
        temp2->next = newCC.head;
        return newCC;
    }
};

int main(){
    LinkedList L1(12);
    L1.insert_at_end(13);
    L1.insert_at_end(14);
    L1.insert_at_end(15);
    L1.insert_at_end(16);
    L1.insert_at_end(17);
    L1.insert_at_end(18);
    L1.insert_at_end(19);
    L1.singlyLinkedListTraversal();
    cout << "Circular Linked list Conversion...\n";
    L1.circularLLConversion();
    cout << "Circular Linked list Traversal:\n\t";
    L1.circularLinkedListTraversal();
    L1.CCinsert_at_head(11);
    cout << "CC insert at head (11):\n\t";
    L1.circularLinkedListTraversal();
    L1.CCinsert_at_end(20);
    cout << "CC insert at end (20):\n\t";
    L1.circularLinkedListTraversal();
    L1.CCinsert_in_between(22, 2);
    cout << "CC insert in between (22, 2):\n\t";
    L1.circularLinkedListTraversal();
    L1.CCdelete_in_between(2);          // index starts from 0, will delete 3rd element
    cout << "CC delete in between (2): // index starts from 0, this function will delete
3rd element (index=2)\n\t";
    L1.circularLinkedListTraversal();


    LinkedList L2 = L1.CCdivide_into_2_halves();
    cout << "LinkedList L2 = L1.CCdivide_into_2_halves();\n";
    cout << "L1 List: ";
    L1.circularLinkedListTraversal();
    cout << "L2 List: ";
    L2.circularLinkedListTraversal();


    return 0;
}
```

OUTPUT:



D:\UNI\3rd Semester Fall 23\DSAA (CT-159)\Labs\Group_16_Lab 4\Lab4_Q5.exe

```
Singly Linked List Traversal: 12 13 14 15 16 17 18 19
Circular Linked list Conversion...
Circular Linked list Traversal:
        Circular Linked List Traversal: 12 13 14 15 16 17 18 19
CC insert at head (11):
        Circular Linked List Traversal: 11 12 13 14 15 16 17 18 19
CC insert at end (20):
        Circular Linked List Traversal: 11 12 13 14 15 16 17 18 19 20
CC insert in between (22, 2):
        Circular Linked List Traversal: 11 12 22 13 14 15 16 17 18 19 20
CC delete in between (2): // index starts from 0, this function will delete 3rd element (index=2)
        Circular Linked List Traversal: 11 12 13 14 15 16 17 18 19 20
LinkedList L2 = L1.CCdivide_into_2_halves();
L1 List: Circular Linked List Traversal: 11 12 13 14 15
L2 List: Circular Linked List Traversal: 16 17 18 19 20

--------------------------------
Process exited after 0.06111 seconds with return value 0
Press any key to continue . . .
```