Doubly Circular Linked List Basic Operation

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

// Node structure
class Node {
public:
    int data;
    Node* next;
    Node* prev;

    Node(int data) {
        this->data = data;
        this->next = nullptr;
        this->prev = nullptr;
    }
};

// Insert at Head
void InsertatHead(Node*& head, int data) {
    Node* newnode = new Node(data);
    if (head == nullptr) {
        head = newnode;
        head->next = head;
        head->prev = head;
        return;
    }
    Node* tail = head->prev;
    newnode->next = head;
    newnode->prev = tail;
    tail->next = newnode;
    head->prev = newnode;
    head = newnode; // update head
}

// Insert at Tail
void Insertattail(Node*& head, int data) {
    if (head == nullptr) {
```

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        InsertatHead(head, data);
        return;
    }
    Node* newnode = new Node(data);
    Node* tail = head->prev;
    newnode->next = head;
    newnode->prev = tail;
    tail->next = newnode;
    head->prev = newnode;
}

// Insert at Nth Position
void insertatnthposition(Node*& head, int data, int target) {
    if (target <= 0) {
        cout << "Invalid position" << endl;
        return;
    }
    if (target == 1) {
        InsertatHead(head, data);
        return;
    }
    Node* temp = head;
    for (int i = 1; i < target - 1; i++) {
        temp = temp->next;
        if (temp == head) {
            cout << "Position out of range" << endl;
            return;
        }
    }
    Node* newnode = new Node(data);
    newnode->next = temp->next;
    newnode->prev = temp;
    temp->next->prev = newnode;
    temp->next = newnode;
}

// Delete from Head
void deletefromhead(Node*& head) {
    if (head == nullptr) {
        cout << "List is empty" << endl;
```

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        return;
    }
    if (head->next == head) { // only one node
        delete head;
        head = nullptr;
        return;
    }
    Node* tail = head->prev;
    Node* todelete = head;
    head = head->next;
    head->prev = tail;
    tail->next = head;
    delete todelete;
}

// Delete from Tail
void deletefromTail(Node*& head) {
    if (head == nullptr) {
        cout << "List is empty" << endl;
        return;
    }
    if (head->next == head) { // only one node
        delete head;
        head = nullptr;
        return;
    }
    Node* tail = head->prev;
    Node* newtail = tail->prev;
    newtail->next = head;
    head->prev = newtail;
    delete tail;
}

// Delete from Nth Position
void deleteFromNthPosition(Node*& head, int target) {
    if (head == nullptr) {
        cout << "List is empty" << endl;
        return;
    }
    if (target <= 0) {
```

```
        cout << "Invalid position" << endl;
        return;
    }
    if (target == 1) {
        deletefromhead(head);
        return;
    }
    Node* temp = head;
    for (int i = 1; i < target; i++) {
        temp = temp->next;
        if (temp == head) {
            cout << "Position out of range" << endl;
            return;
        }
    }
    Node* prevNode = temp->prev;
    Node* nextNode = temp->next;
    prevNode->next = nextNode;
    nextNode->prev = prevNode;
    delete temp;
}

// Display forward
void DisplayForward(Node*& head) {
    if (head == nullptr) {
        cout << "List is empty" << endl;
        return;
    }
    Node* temp = head;
    do {
        cout << temp->data << " ";
        temp = temp->next;
    } while (temp != head);
    cout << endl;
}

// Display backward
void DisplayBackward(Node*& head) {
    if (head == nullptr) {
        cout << "List is empty" << endl;
```

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        return;
    }
    Node* tail = head->prev;
    Node* temp = tail;
    do {
        cout << temp->data << " ";
        temp = temp->prev;
    } while (temp != tail);
    cout << endl;
}

// Main function
int main() {
    Node* head = nullptr;

    // Insert at head
    InsertatHead(head, 30);
    InsertatHead(head, 50);
    InsertatHead(head, 28);
    InsertatHead(head, 38);
    InsertatHead(head, 48);

    cout << "List after InsertAtHead: ";
    DisplayForward(head);

    // Insert at tail
    Insertattail(head, 70);
    cout << "List after InsertAtTail: ";
    DisplayForward(head);

    // Delete from head
    deletefromhead(head);
    cout << "List after DeleteFromHead: ";
    DisplayForward(head);

    // Delete from tail
    deletefromTail(head);
    cout << "List after DeleteFromTail: ";
    DisplayForward(head);
```

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    // Insert at position
    insertatnthposition(head, 23, 2);
    cout << "List after InsertAtPosition (pos=2): ";
    DisplayForward(head);

    // Delete from nth position
    deleteFromNthPosition(head, 3);
    cout << "List after DeleteFromNthPosition (pos=3): ";
    DisplayForward(head);

    // Display backward
    cout << "List backward: ";
    DisplayBackward(head);

    return 0;
}
```

output-

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List after InsertAtHead: 48 38 28 50 30
List after InsertAtTail: 48 38 28 50 30 70
List after DeleteFromHead: 38 28 50 30 70
List after DeleteFromTail: 38 28 50 30
List after InsertAtPosition (pos=2): 38 23 28 50 30
List after DeleteFromNthPosition (pos=3): 38 23 50 30
List backward: 30 50 23 38
```