Activity No. 3	
Hands-on Activity 3.1 Linked Lists	
Course Code: CPE010	**Program:** Computer Engineering
Course Title: Data Structures and Algorithms	**Date Performed: 09 / 27 / 2024**
Section: CPE21S4	**Date Submitted: 09 / 27 / 2024**
Name(s):Leoj Jeam B. Tandayu	**Instructor: Ms. Maria Rizette Sayo**

6. Output

Output

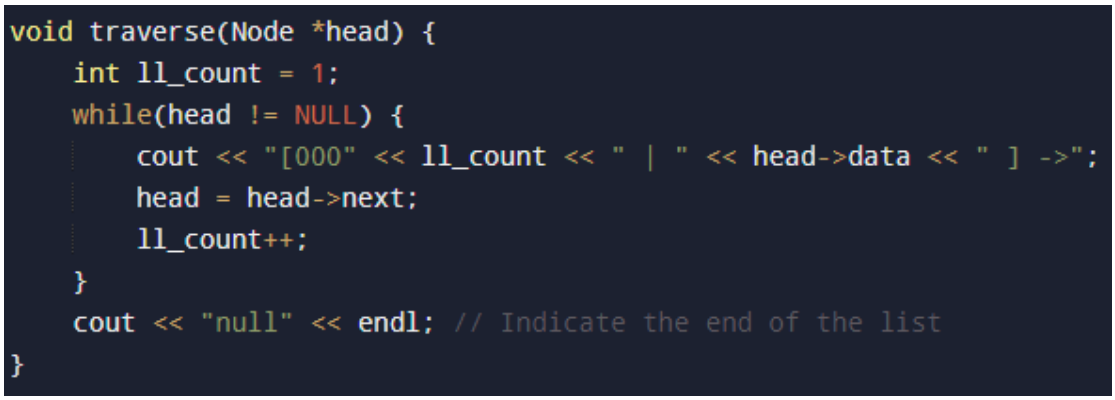
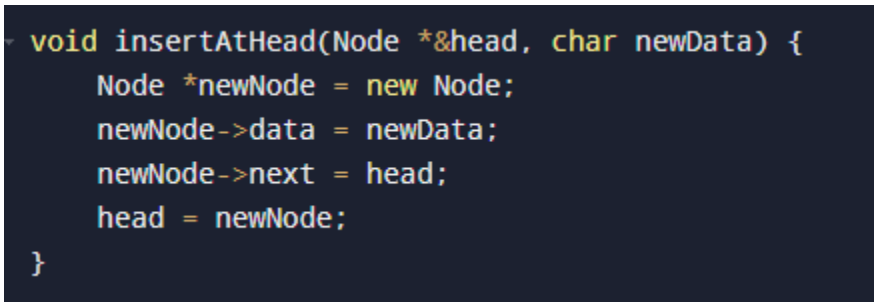
```
********************************************************************************/
#include <iostream>
#include <utility>
using namespace std;

class Node{
public:
    char data;
    Node *next;
};

int main()
{
    //step 1
    Node *head = NULL;
    Node *second = NULL;
    Node *third = NULL;
    Node *fourth = NULL;
    Node *fifth = NULL;
    Node *last = NULL;
    //step 2
    head = new Node;
    second = new Node;
    third = new Node;
    fourth = new Node;
    fifth = new Node;
    last = new Node;
    //step 3
    head->data = 'C';
    head->next = second;
    second->data = 'P';
    second->next = third;
    third->data = 'E';
    third->next = fourth;
    fourth->data = '0';
    fourth->next = fifth;
    fifth->data = '1';
    fifth->next = last;
    //step 4
    last->data = '0';
    last->next = nullptr;


    return 0;
```

input

```
..Program finished with exit code 0
ress ENTER to exit console.
```

Discussion	The code can be improved by adding an output syntax to output what is inside the linked list since the original code has no output syntax.

Table 3-1. Output of Initial/Simple Implementation

Operation	Screenshot
Traversal	
Insertion at head	
Insertion at any part of the list	

Insertion at the end	``` void insertAtTail(Node *&head, char newData) { Node *newNode = new Node; newNode->data = newData; newNode->next = nullptr; if (head == nullptr) { head = newNode; return; } Node *current = head; while (current->next != nullptr) { current = current->next; } current->next = newNode; } ```

Deletion of a node	

```
void deleteAtPosition(Node *&head, int position) {
    if (head == nullptr) {
        cout << "List is empty. No nodes to delete." << endl;
        return;
    }

    Node *temp = head;

    if (position == 0) {
        head = temp->next;
        delete temp;
        return;
    }

    for (int i = 0; temp != nullptr && i < position - 1; i++) {
        temp = temp->next;
    }

    if (temp == nullptr || temp->next == nullptr) {
        cout << "Position out of bounds." << endl;
        return;
    }


    Node *next = temp->next->next;
    delete temp->next;
    temp->next = next;
}
```

Table 3-2. Code for the List Operations

a.	**Source Code**	#include <iostream> #include <utility> using namespace std; class Node { public: char data; Node *next; }; void traverse(Node *head) { int ll_count = 1; while (head != NULL) { cout << "[000" << ll_count << "	" << head->data << "] ->"; head = head->next;

```
        ll_count++;
    }
    cout << "null" << endl;
}
int main()
{
    Node *head = new Node;
    Node *second = new Node;
    Node *third = new Node;
    Node *fourth = new Node;
    Node *fifth = new Node;
    Node *last = new Node;

    head->data = 'C';
    head->next = second;
    second->data = 'P';
    second->next = third;
    third->data = 'E';
    third->next = fourth;
    fourth->data = '0';
    fourth->next = fifth;
    fifth->data = '1';
    fifth->next = last;
    last->data = '0';
    last->next = nullptr;

    traverse(head);

    return 0;
}
```

Console

```
[0001 | C ] ->[0002 | P ] ->[0003 | E ] ->[0004 | 0 ] ->[0005 | 1 ] ->[0006 | 0 ] ->null


...Program finished with exit code 0
Press ENTER to exit console.
```

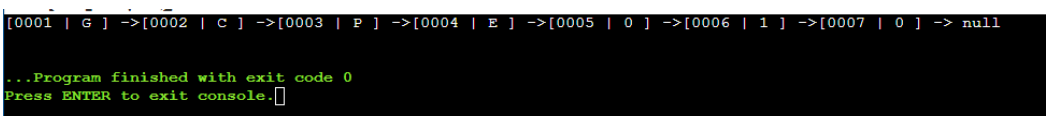
b.

Source Code

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

class Node {
public:
    char data;
    Node *next;
};

void traverse(Node *head) {
    int ll_count = 1;
    while (head != NULL) {
        cout << "[000" << ll_count << " | " << head->data << " ] ->";
```

```
        head = head->next;
        ll_count++;
    }
    cout << " null" << endl;
}

void insertAtHead(Node *&head, char newData) {
    Node *newNode = new Node;
    newNode->data = newData;
    newNode->next = head;
    head = newNode;
}

int main()
{

    Node *head = new Node;
    Node *second = new Node;
    Node *third = new Node;
    Node *fourth = new Node;
    Node *fifth = new Node;
    Node *last = new Node;

    head->data = 'C';
    head->next = second;
    second->data = 'P';
    second->next = third;
    third->data = 'E';
    third->next = fourth;
    fourth->data = '0';
    fourth->next = fifth;
    fifth->data = '1';
    fifth->next = last;
    last->data = '0';
    last->next = nullptr;

    insertAtHead(head, 'G');

    traverse(head);

    return 0;
}
```

Console



c. **Source Code**

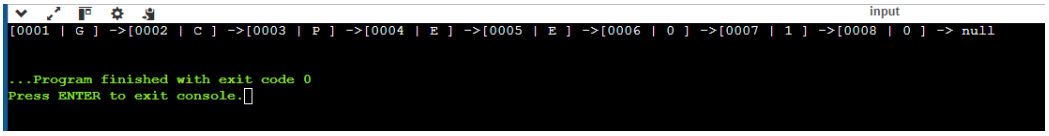
```
#include <iostream>
#include <utility>
using namespace std;
```

```
class Node {
public:
    char data;
    Node *next;
};

void traverse(Node *head) {
    int ll_count = 1;
    while (head != NULL) {
        cout << "[000" << ll_count << " | " << head->data << " ] ->";
        head = head->next;
        ll_count++;
    }
    cout << " null" << endl;
}

void insertAtHead(Node *&head, char newData) {
    Node *newNode = new Node;
    newNode->data = newData;
    newNode->next = head;
    head = newNode;
}

void deleteAtPosition(Node *&head, int position) {
    if (head == nullptr) {
        cout << "List is empty. No nodes to delete." << endl;
        return;
    }

    Node *temp = head;

    if (position == 0) {
        head = temp->next;
        delete temp;
        return;
    }

    for (int i = 0; temp != nullptr && i < position - 1; i++) {
        temp = temp->next;
    }

    if (temp == nullptr || temp->next == nullptr) {
        cout << "Position out of bounds." << endl;
        return;
    }


    Node *next = temp->next->next;
    delete temp->next;
    temp->next = next;
```

```
}

void insertAtPosition(Node *&head, char newData, int position) {
    Node *newNode = new Node;
    newNode->data = newData;

    if (position == 0) {
        newNode->next = head;
        head = newNode;
        return;
    }

    Node *current = head;
    for (int i = 0; i < position - 1 && current != nullptr; i++) {
        current = current->next;
    }

    if (current == nullptr) {
        cout << "Position out of bounds, inserting at end instead." << endl;
        delete newNode;
        return;
    }

    newNode->next = current->next;
    current->next = newNode;
}

int main()
{

    Node *head = new Node;
    Node *second = new Node;
    Node *third = new Node;
    Node *fourth = new Node;
    Node *fifth = new Node;
    Node *last = new Node;

    head->data = 'C';
    head->next = second;
    second->data = 'P';
    second->next = third;
    third->data = 'E';
    third->next = fourth;
    fourth->data = '0';
    fourth->next = fifth;
    fifth->data = '1';
    fifth->next = last;
    last->data = '0';
    last->next = nullptr;

    insertAtHead(head, 'G');
```

```
    insertAtPosition(head, 'E' , 3);

    traverse(head);

    return 0;
}
```

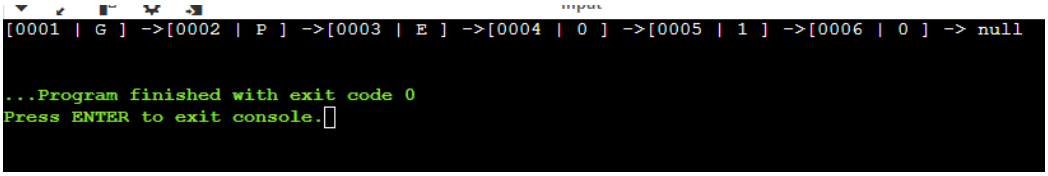
Console



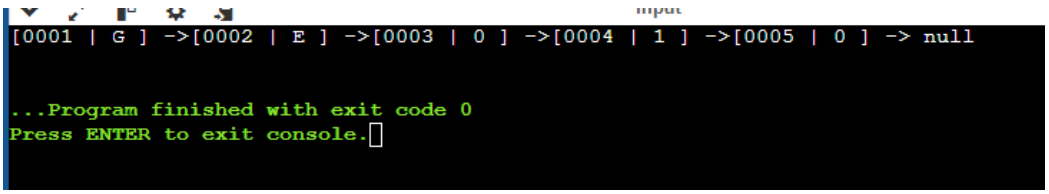
d. **Source Code**

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

class Node {
public:
    char data;
    Node *next;
};

void traverse(Node *head) {
    int ll_count = 1;
    while (head != NULL) {
        cout << "[000" << ll_count << " | " << head->data << " ] ->";
        head = head->next;
        ll_count++;
    }
    cout << " null" << endl;
}

void insertAtHead(Node *&head, char newData) {
    Node *newNode = new Node;
    newNode->data = newData;
    newNode->next = head;
    head = newNode;
}

void deleteAtPosition(Node *&head, int position) {
    if (head == nullptr) {
        cout << "List is empty. No nodes to delete." << endl;
        return;
    }

    Node *temp = head;

    if (position == 0) {
        head = temp->next;
```

```
        delete temp;
        return;
    }

    for (int i = 0; temp != nullptr && i < position - 1; i++) {
        temp = temp->next;
    }

    if (temp == nullptr || temp->next == nullptr) {
        cout << "Position out of bounds." << endl;
        return;
    }


    Node *next = temp->next->next;
    delete temp->next;
    temp->next = next;
}


int main()
{

    Node *head = new Node;
    Node *second = new Node;
    Node *third = new Node;
    Node *fourth = new Node;
    Node *fifth = new Node;
    Node *last = new Node;

    head->data = 'C';
    head->next = second;
    second->data = 'P';
    second->next = third;
    third->data = 'E';
    third->next = fourth;
    fourth->data = '0';
    fourth->next = fifth;
    fifth->data = '1';
    fifth->next = last;
    last->data = '0';
    last->next = nullptr;

    insertAtHead(head, 'G');

    deleteAtPosition(head, 1);

    traverse(head);

    return 0;
}
```

	Console	
e.	**Source Code**	#include <iostream> #include <utility> using namespace std; class Node { public: char data; Node *next; }; void traverse(Node *head) { int ll_count = 1; while (head != NULL) { cout << "[000" << ll_count << " | " << head->data << "] ->"; head = head->next; ll_count++; } cout << " null" << endl; } void insertAtHead(Node *&head, char newData) { Node *newNode = new Node; newNode->data = newData; newNode->next = head; head = newNode; } void deleteAtPosition(Node *&head, int position) { if (head == nullptr) { cout << "List is empty. No nodes to delete." << endl; return; } Node *temp = head; if (position == 0) { head = temp->next; delete temp; return; } for (int i = 0; temp != nullptr && i < position - 1; i++) { temp = temp->next;

```
    }

    if (temp == nullptr || temp->next == nullptr) {
        cout << "Position out of bounds." << endl;
        return;
    }


    Node *next = temp->next->next;
    delete temp->next;
    temp->next = next;
}


int main()
{

    Node *head = new Node;
    Node *second = new Node;
    Node *third = new Node;
    Node *fourth = new Node;
    Node *fifth = new Node;
    Node *last = new Node;

    head->data = 'C';
    head->next = second;
    second->data = 'P';
    second->next = third;
    third->data = 'E';
    third->next = fourth;
    fourth->data = '0';
    fourth->next = fifth;
    fifth->data = '1';
    fifth->next = last;
    last->data = '0';
    last->next = nullptr;

    insertAtHead(head, 'G');

    deleteAtPosition(head, 1);

    deleteAtPosition(head, 1);

    traverse(head);

    return 0;
}
```

	Console	
f.	**Source Code**	#include <iostream> #include <utility> using namespace std; class Node { public: char data; Node *next; }; void traverse(Node *head) { int ll_count = 1; while (head != NULL) { cout << "[000" << ll_count << " | " << head->data << "] ->"; head = head->next; ll_count++; } cout << " null" << endl; } void insertAtHead(Node *&head, char newData) { Node *newNode = new Node; newNode->data = newData; newNode->next = head; head = newNode; } void deleteAtPosition(Node *&head, int position) { if (head == nullptr) { cout << "List is empty. No nodes to delete." << endl; return; } Node *temp = head; if (position == 0) { head = temp->next; delete temp; return; } for (int i = 0; temp != nullptr && i < position - 1; i++) { temp = temp->next; }

```
    if (temp == nullptr || temp->next == nullptr) {
        cout << "Position out of bounds." << endl;
        return;
    }


    Node *next = temp->next->next;
    delete temp->next;
    temp->next = next;
}

void insertAtPosition(Node *&head, char newData, int position) {
    Node *newNode = new Node;
    newNode->data = newData;

    if (position == 0) {
        newNode->next = head;
        head = newNode;
        return;
    }

    Node *current = head;
    for (int i = 0; i < position - 1 && current != nullptr; i++) {
        current = current->next;
    }

    if (current == nullptr) {
        cout << "Position out of bounds, inserting at end instead." << endl;
        delete newNode;
        return;
    }

    newNode->next = current->next;
    current->next = newNode;
}

int main()
{

    Node *head = new Node;
    Node *second = new Node;
    Node *third = new Node;
    Node *fourth = new Node;
    Node *fifth = new Node;
    Node *last = new Node;

    head->data = 'C';
    head->next = second;
    second->data = 'P';
    second->next = third;
    third->data = 'E';
```

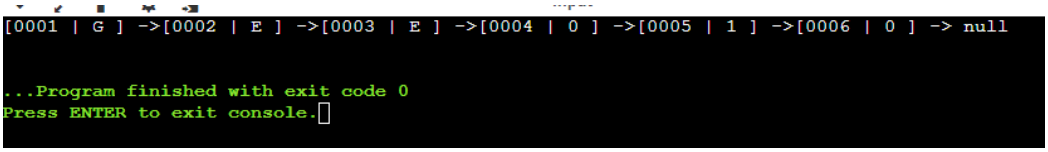
		third->next = fourth; fourth->data = '0'; fourth->next = fifth; fifth->data = '1'; fifth->next = last; last->data = '0'; last->next = nullptr; insertAtHead(head, 'G'); deleteAtPosition(head, 1); deleteAtPosition(head, 1); insertAtPosition(head, 'E' , 1); traverse(head); return 0; } S
	Console	

Table 3-3. Code and Analysis for Singly Linked List

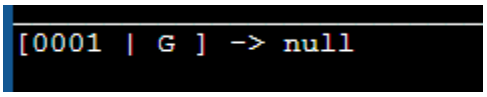
Screenshot(s)	Analysis
	When I used the traverse function, the head is now the tail which makes the code output only “G”.

Table 3-4. Modified Operations for Doubly Linked List

7. Supplementary Activity

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

class Song {
public:
    string title;
    Song* next;

    Song(string t) : title(t), next(nullptr) {}
};

class Playlist {
private:
    Song* head;

public:
    Playlist() : head(nullptr) {}

    void addSong(string title) {
        Song* newSong = new Song(title);
        if (!head) {
            head = newSong;
            newSong->next = head;
        } else {
            Song* temp = head;
            while (temp->next != head) {
                temp = temp->next;
            }
            temp->next = newSong;
            newSong->next = head;
        }
        cout << "Added: " << title << endl;
    }

    void removeSong(string title) {
        if (!head) {
            cout << "Playlist is empty." << endl;
            return;
        }

        Song* current = head;
        Song* previous = nullptr;

        do {
            if (current->title == title) {
                if (previous) {
                    previous->next = current->next;
                } else {
                    Song* last = head;
```

```
                while (last->next != head) {
                    last = last->next;
                }
                last->next = current->next;
                head = current->next;
            }
            delete current;
            cout << "Removed: " << title << endl;
            return;
        }
        previous = current;
        current = current->next;
    } while (current != head);

    cout << "Song not found: " << title << endl;
}

void playAll() {
    if (!head) {
        cout << "Playlist is empty." << endl;
        return;
    }

    Song* current = head;
    do {
        cout << "Playing: " << current->title << endl;
        current = current->next;
    } while (current != head);
}
};

int main() {
    Playlist myPlaylist;

    myPlaylist.addSong("Song 1");
    myPlaylist.addSong("Song 2");
    myPlaylist.addSong("Song 3");

    myPlaylist.playAll();

    myPlaylist.removeSong("Song 2");

    myPlaylist.playAll();

    return 0;
}
```

```
Added: Song 1
Added: Song 2
Added: Song 3
Playing: Song 1
Playing: Song 2
Playing: Song 3
Removed: Song 2
Playing: Song 1
Playing: Song 3
```

8. Conclusion

Provide the following:

• Summary of lessons learned

- There are many ways to utilize linked lists such as insertion and deletion of the data inside an existing list. We can also use a double linked list which functions in both ways of the list in a way that the head can be the tail and the tail can be the head.

• Analysis of the procedure

- The single linked list is simpler than the doubly linked list which is efficient for bidirectional traversal.

• Analysis of the supplementary activity

- It is similar to the sample activity which utilize adding and deleting items from the linked list.

• Concluding statement / Feedback: How well did you think you did in this activity? What are your areas for improvement?

- I would say I did an average job in this activity, with the help of my friends I was able to accomplish it. For improvement I would say handling larger scale of data and how to use the double linked list properly as it is a little bit confusing for me.

9. Assessment Rubric