COMSATS University Islamabad, Vehari Campus

Department of Computer Science

Class: BCS-SP22 **Submission Deadline: 9 Oct 2023**

Subject: Data Structures and Algorithms-Lab **Instructor: Yasmeen Jana**

Max Marks: 20 **Reg. No:** SP22-BCS-102

ACTIVITY 1:

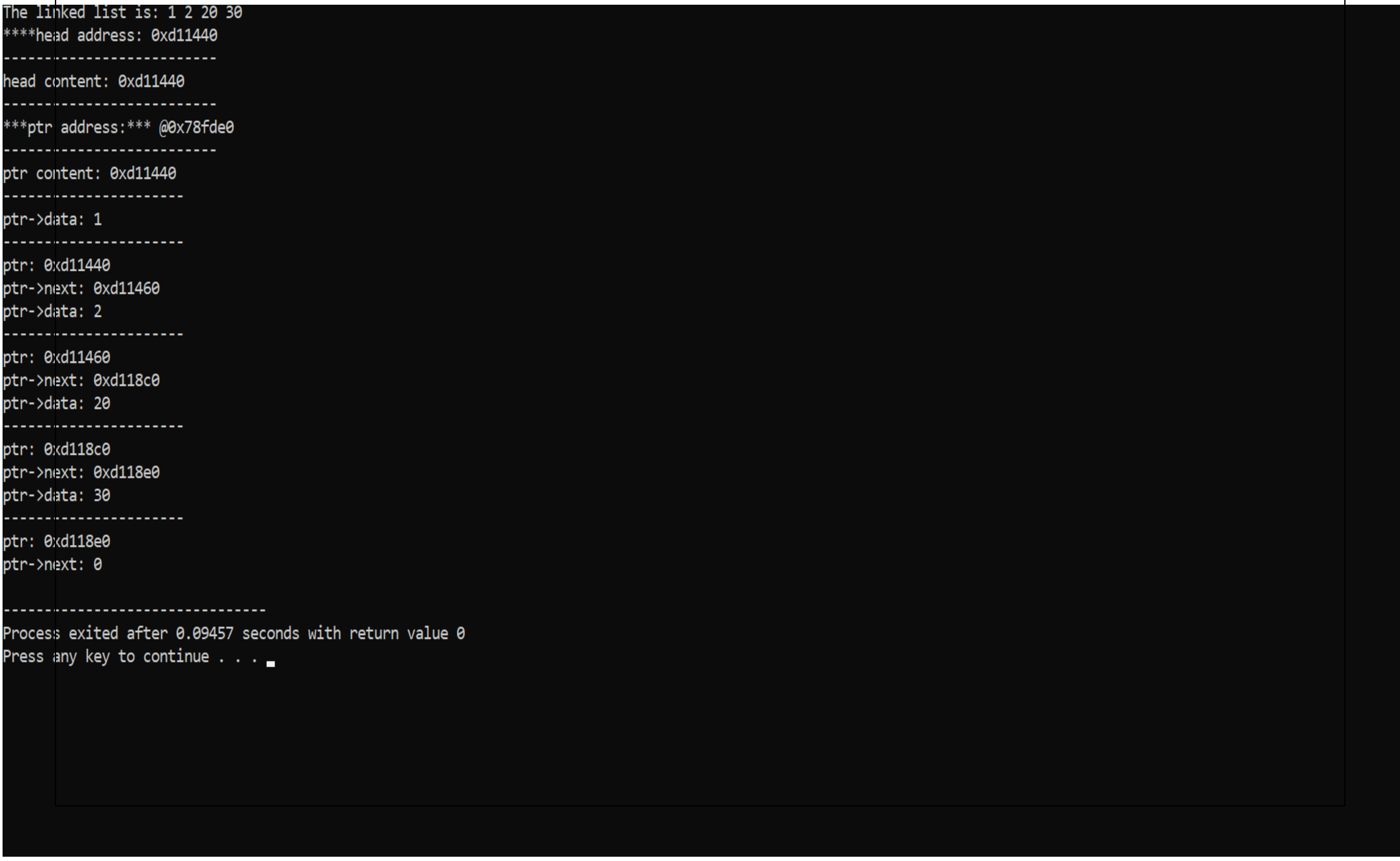
CODE:

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

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

void displayLinkedList(Node* head) {
   cout << "The linked list is: ";
   Node* ptr = head;
   while (ptr != NULL) {
      cout << ptr->data << " ";
```

```
        ptr = ptr->next;
    }
    cout << endl << "****head address: " << head << endl;
    cout << "--------------------------" << endl;
    cout << "head content: " << head<< endl;
    cout << "--------------------------" << endl;
    cout << "***ptr address:*** @" << &head << endl;
    cout << "--------------------------" << endl;
    cout << "ptr content: " << head << endl;
    cout << "----------------------" << endl;
    ptr = head;
    while (ptr != NULL) {
        cout << "ptr->data: " << ptr->data << endl;
        cout << "----------------------" << endl;
        cout << "ptr: " << ptr << endl;
        cout << "ptr->next: " << ptr->next << endl;
        ptr = ptr->next;
    }
}

int main() {
    Node* head = new Node();
    Node* second = new Node();
    Node* third = new Node();
    Node* fourth = new Node();

    head->data = 1;
    head->next = second;
```

```
second->data = 2;

second->next = third;


third->data = 20;

third->next = fourth;


fourth->data = 30;

fourth->next = NULL;


displayLinkedList(head);


return 0;

                                        }
```

OUTPUT



```
The linked list is: 1 2 20 30
****head address: 0xd11440
-------------------------
head content: 0xd11440
-------------------------
***ptr address:*** @0x78fde0
-------------------------
ptr content: 0xd11440
----------------------
ptr->data: 1
----------------------
ptr: 0xd11440
ptr->next: 0xd11460
ptr->data: 2
----------------------
ptr: 0xd11460
ptr->next: 0xd118c0
ptr->data: 20
----------------------
ptr: 0xd118c0
ptr->next: 0xd118e0
ptr->data: 30
----------------------
ptr: 0xd118e0
ptr->next: 0

--------------------------------
Process exited after 0.09457 seconds with return value 0
Press any key to continue . . .
```

ACTIVITY 2:

CODE

```
#include <iostream>
// Define a simple Node structure for the linked list
struct Node {
    int data;
    Node* next;
    Node* prev; // For doubly linked list

    Node(int val) : data(val), next(nullptr), prev(nullptr) {}
};

// Class for the linked list operations
class LinkedList {
private:
    Node* head; // Pointer to the head of the list
    Node* tail; // Pointer to the tail of the list (for doubly linked list)
    bool isCircular;

public:
    LinkedList(bool circular = false) : head(nullptr), tail(nullptr), isCircular(circular) {}

    // Function to insert a node at the beginning of the list
    void insertAtBeginning(int value) {
        Node* newNode = new Node(value);
        if (isCircular) {
            if (head == nullptr) {
```

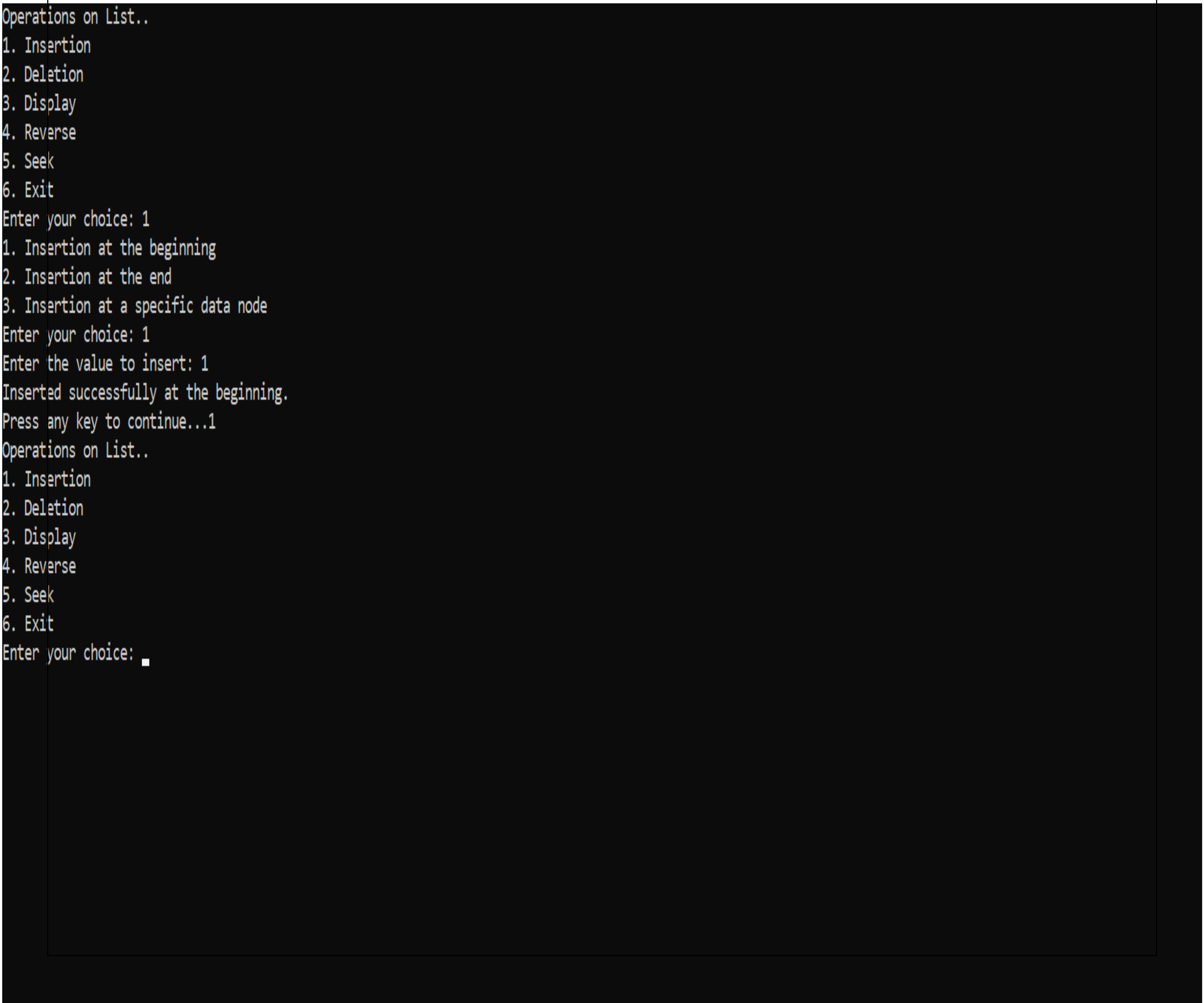
```
            newNode->next = newNode;
        } else {
            newNode->next = head;
            Node* lastNode = head;
            while (lastNode->next != head) {
                lastNode = lastNode->next;
            }
            lastNode->next = newNode;
        }
        head = newNode;
    } else {
        newNode->next = head;
        head = newNode;
    }
    std::cout << "Inserted successfully at the beginning." << std::endl;
}

// Function to insert a node at the end of the list
void insertAtEnd(int value) {
    Node* newNode = new Node(value);
    if (isCircular) {
        if (head == nullptr) {
            newNode->next = newNode;
            head = newNode;
        } else {
            newNode->next = head;
            Node* lastNode = head;
            while (lastNode->next != head) {
                lastNode = lastNode->next;
            }
            lastNode->next = newNode;
        }
    } else {
        if (head == nullptr) {
            head = newNode;
            tail = newNode;
        } else {
            tail->next = newNode;
            tail = newNode;
        }
    }
    std::cout << "Inserted successfully at the end." << std::endl;
}

// Function to insert a node after a specific data value
void insertAfterValue(int value, int target) {
    Node* newNode = new Node(value);
    Node* current = head;
    while (current != nullptr) {
        if (current->data == target) {
            newNode->next = current->next;
            current->next = newNode;
            std::cout << "Inserted successfully after " << target << "." << std::endl;
            return;
        }
        current = current->next;
    }
    std::cout << "Value " << target << " not found in the list." << std::endl;
```

```
}

// Function to display the linked list
void display() {
    Node* current = head;
    std::cout << "The items present in the list are: ";
    if (current == nullptr) {
        std::cout << "Empty";
    } else {
        if (isCircular) {
            do {
                std::cout << current->data << " ";
                current = current->next;
            } while (current != head);
        } else {
            while (current != nullptr) {
                std::cout << current->data << " ";
                current = current->next;
            }
        }
    }
    std::cout << std::endl;
}

// Function to reverse the linked list
void reverse() {
    Node* prev = nullptr;
    Node* current = head;
    Node* next = nullptr;
    while (current != nullptr) {
        next = current->next;
        current->next = prev;
        prev = current;
        current = next;
    }
    head = prev;
    std::cout << "List reversed." << std::endl;
}

// Function to seek a specific value in the linked list
void seekValue(int value) {
    Node* current = head;
    int position = 0;
    while (current != nullptr) {
        if (current->data == value) {
            std::cout << "Value " << value << " found at position " << position << "." << std::endl;
            return;
        }
        current = current->next;
        position++;
    }
    std::cout << "Value " << value << " not found in the list." << std::endl;
}

// Function to delete the entire linked list
void deleteList() {
    Node* current = head;
    while (current != nullptr) {
            Node* next = current->next;

            delete current;

            current = next;

        }

        head = nullptr;

        std::cout << "List deleted." << std::endl;

    }


    ~LinkedList() {

        deleteList();

    }

};


int main() {

    int choice;

    bool isCircular = false;

    LinkedList list(isCircular);


    do {

        std::cout << "Operations on List.." << std::endl;

        std::cout << "1. Insertion" << std::endl;

        std::cout << "2. Deletion" << std::endl;

        std::cout << "3. Display" << std::endl;

        std::cout << "4. Reverse" << std::endl;

        std::cout << "5. Seek" << std::endl;

        std::cout << "6. Exit" << std::endl;

        std::cout << "Enter your choice: ";

        std::cin >> choice;
```

```
switch (choice) {
case 1:
  int insertChoice;
  std::cout << "1. Insertion at the beginning" << std::endl;
  std::cout << "2. Insertion at the end" << std::endl;
  std::cout << "3. Insertion at a specific data node" << std::endl;
  std::cout << "Enter your choice: ";
  std::cin >> insertChoice;
  int insertValue;
  std::cout << "Enter the value to insert: ";
  std::cin >> insertValue;
  switch (insertChoice) {
  case 1:
    list.insertAtBeginning(insertValue);
    break;
  case 2:
    list.insertAtEnd(insertValue);
    break;
  case 3:
    int insertTarget;
    std::cout << "Enter the target value: ";
    std::cin >> insertTarget;
    list.insertAfterValue(insertValue, insertTarget);
    break;
  default:
    std::cout << "Invalid choice!" << std::endl;
    break;
  }
  break;
case 2:
   // Implement deletion options here (e.g., delete by value or position)
   // You can add these functions to the LinkedList class
   break;
case 3:
   list.display();
   break;
case 4:
   list.reverse();
   break;
case 5:
   int seekValue;
   std::cout << "Enter the value to seek: ";
   std::cin >> seekValue;
         list.seekValue(seekValue);
   break;
case 6:
   std::cout << "Exiting the program..." << std::endl;
   // Clean up the linked list memory
   list.deleteList();
   exit(0);
default:
   std::cout << "Invalid choice!" << std::endl;
   break;
}

std::cout << "Press any key to continue...";
std::cin.ignore();
std::cin.get();
```

```
    } while (choice != 6);

    return 0;
}
```

OUTPUT



```
Operations on List..
1. Insertion
2. Deletion
3. Display
4. Reverse
5. Seek
6. Exit
Enter your choice: 1
1. Insertion at the beginning
2. Insertion at the end
3. Insertion at a specific data node
Enter your choice: 1
Enter the value to insert: 1
Inserted successfully at the beginning.
Press any key to continue...1
Operations on List..
1. Insertion
2. Deletion
3. Display
4. Reverse
5. Seek
6. Exit
Enter your choice:
```