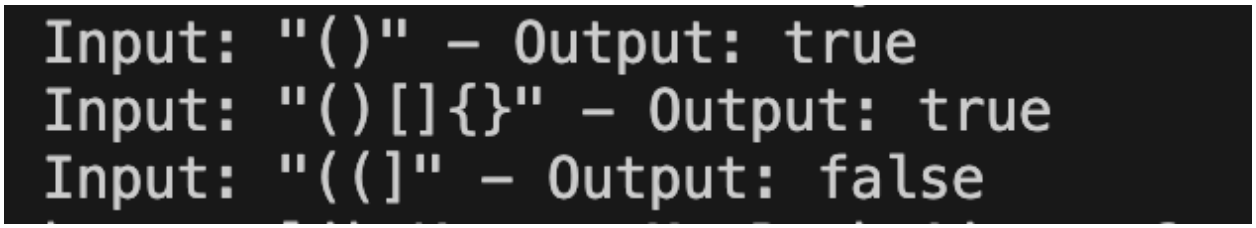
15B17CI371 – Data Structures Lab
ODD 2024
Week 2-LAB B
Practice Lab
[CO: C270.1]

Q1.

```
#include <iostream>
#include <string>
using namespace std;
bool isValid(const string& s) {
    char stack[100];
    int top = -1;
    char opening[] = "({[";
    char closing[] = ")}]";
    for (int i = 0; i < s.length(); ++i) {
        char c = s[i];
        bool isOpening = false;
        for (int j = 0; j < 3; ++j) {
            if (c == opening[j]) {
                stack[++top] = c;
                isOpening = true;
                break;
            }
        }
        if (!isOpening) {
            bool isValid = false;
            for (int j = 0; j < 3; ++j) {
                if (c == closing[j]) {
                    if (top == -1 || stack[top] != opening[j]) {
                        return false;
                    }
                    top--;
                    isValid = true;
                    break;
                }
            }
            if (!isValid) {
                return false;
            }
        }
    }
    return top==-1;
}
int main()
{
```

```
    string s1 = "()";
    string s2 = "()[]{}";
    string s3 = "(()";

    cout << boolalpha;
    cout << "Input: \"" << s1 << "\" - Output: " << isValid(s1) << endl;
    cout << "Input: \"" << s2 << "\" - Output: " << isValid(s2) << endl;
    cout << "Input: \"" << s3 << "\" - Output: " << isValid(s3) << endl;
    return 0;
}
```



2.

```
#include <iostream>
using namespace std;
struct Node {
    int data;
    int index;
    Node* next;
};
class LinkedListStack {
private:
    Node* top;
public:
    LinkedListStack() : top(nullptr) {}
    void push(int value, int index) {
        Node* newNode = new Node();
        newNode->data = value;
        newNode->index = index;
        newNode->next = top;
        top = newNode;
    }
    Node* pop() {
        if (isEmpty()) {
            return nullptr;
        }
        Node* temp = top;
        top = top->next;
        return temp;
```

```
    }
    bool isEmpty() const {
        return top == nullptr;
    }
    Node* peek() const {
        if (isEmpty()) {
            return nullptr;
        }
        return top;
    }
    ~LinkedListStack() {
        while (!isEmpty()) {
            Node* temp = pop();
            delete temp;
        }
    }
};
int findNextGreaterElementPosition(const int arr[], int size, int element) {
    LinkedListStack stack;
    int nextGreater[size];
    int elementIndex = -1;
    for (int i = 0; i < size; ++i) {
        nextGreater[i] = -1;
    }
    for (int i = size - 1; i >= 0; --i) {
        while (!stack.isEmpty() && stack.peek()->data <= arr[i]) {
            stack.pop();
        }
        if (!stack.isEmpty()) {
            nextGreater[i] = stack.peek()->index;
        }
        stack.push(arr[i], i);
    }
    for (int i = 0; i < size; ++i) {
        if (arr[i] == element) {
            elementIndex = i;
            break;
        }
    }
    if (elementIndex == -1) {
        return -1;
    }
    int nextGreaterIndex = nextGreater[elementIndex];
    if (nextGreaterIndex != -1) {
        return nextGreaterIndex - elementIndex - 1;
    } else {
        return -1;
    }
}
```

```
int main() {
    int arr1[] = {1, 4, 2, 5, 0, 6, 7};
    int size1 = sizeof(arr1) / sizeof(arr1[0]);
    int element1 = 4;
    int result1 = findNextGreaterElementPosition(arr1, size1, element1);
    if (result1 != -1) {
        cout << "Output: " << result1 << endl;
    } else {
        cout << "Output: Not found" << endl;
    }
    int arr2[] = {1, 4, 2, 5, 0, 6, 7};
    int size2 = sizeof(arr2) / sizeof(arr2[0]);
    int element2 = 2;
    int result2 = findNextGreaterElementPosition(arr2, size2, element2);
    if (result2 != -1) {
        cout << "Output: " << result2 << endl;
    } else {
        cout << "Output: Not found" << endl;
    }
    int arr3[] = {10, 4, 2, 5, 0, 6, 7};
    int size3 = sizeof(arr3) / sizeof(arr3[0]);
    int element3 = 7;
    int result3 = findNextGreaterElementPosition(arr3, size3, element3);
    if (result3 != -1) {
        cout << "Output: " << result3 << endl;
    } else {
        cout << "Output: Not found" << endl;
    }
    int arr4[] = {10, 6, 7, 2, 5, 1, 0, 4};
    int size4 = sizeof(arr4) / sizeof(arr4[0]);
    int element4 = 7;
    int result4 = findNextGreaterElementPosition(arr4, size4, element4);
    if (result4 != -1) {
        cout << "Output: " << result4 << endl;
    } else {
        cout << "Output: Not found" << endl;
    }
    return 0;
}
```

```
Output: 1
Output: 0
Output: Not found
Output: Not found
```

3.

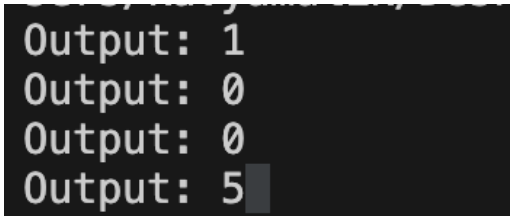
```
#include <iostream>
using namespace std;
struct Node {
    int data;
    int index;
    Node* next;
};
class CircularLinkedListStack {
private:
    Node* top;
    Node* tail;
public:
    CircularLinkedListStack() : top(nullptr), tail(nullptr) {}
    void push(int value, int index) {
        Node* newNode = new Node();
        newNode->data = value;
        newNode->index = index;
        if (top == nullptr) {
            top = newNode;
            tail = newNode;
            newNode->next = top;
        } else {
            newNode->next = top;
            top = newNode;
            tail->next = top;
        }
    }
    Node* pop() {
        if (isEmpty()) {
            return nullptr;
        }
        Node* temp = top;
        if (top == tail) {
            top = nullptr;
            tail = nullptr;
        } else {
            tail->next = top->next;
            top = top->next;
        }
        return temp;
    }
    bool isEmpty() const {
        return top == nullptr;
    }
    Node* peek() const {
        if (isEmpty()) {
            return nullptr;
```

```
        }
        return top;
    }
    ~CircularLinkedListStack() {
        while (!isEmpty()) {
            Node* temp = pop();
            delete temp;
        }
    }
};
int findNextGreaterElementPosition(const int arr[], int size, int element) {
    CircularLinkedListStack stack;
    int nextGreater[size];
    int elementIndex = -1;
    for (int i = 0; i < size; ++i) {
        nextGreater[i] = -1;
    }

    for (int i = size - 1; i >= 0; --i) {
        while (!stack.isEmpty() && stack.peek()->data <= arr[i]) {
            stack.pop();
        }
        if (!stack.isEmpty()) {
            nextGreater[i] = stack.peek()->index;
        }
        stack.push(arr[i], i);
    }

    for (int i = size - 1; i >= 0; --i) {
        if (nextGreater[i] == -1) {
            int j = (i + size - 1) % size;
            while (j != i) {
                if (arr[j] > arr[i]) {
                    nextGreater[i] = j;
                    break;
                }
                j = (j + size - 1) % size;
            }
        }
    }
    for (int i = 0; i < size; ++i) {
        if (arr[i] == element) {
            elementIndex = i;
            break;
        }
    }
    if (elementIndex == -1) {
        return -1;
    }
```

```
    int nextGreaterIndex = nextGreater[elementIndex];
    if (nextGreaterIndex != -1) {
        return (nextGreaterIndex - elementIndex + size) % size - 1;
    } else {
        return -1;
    }
}
int main() {
    int arr1[] = {1, 4, 2, 5, 0, 6, 7};
    int size1 = sizeof(arr1) / sizeof(arr1[0]);
    int element1 = 4;
    int result1 = findNextGreaterElementPosition(arr1, size1, element1);
    if (result1 != -1) {
        cout << "Output: " << result1 << endl;
    } else {
        cout << "Output: Not found" << endl;
    }
    int arr2[] = {1, 4, 2, 5, 0, 6, 7};
    int size2 = sizeof(arr2) / sizeof(arr2[0]);
    int element2 = 2;
    int result2 = findNextGreaterElementPosition(arr2, size2, element2);
    if (result2 != -1) {
        cout << "Output: " << result2 << endl;
    } else {
        cout << "Output: Not found" << endl;
    }
    int arr3[] = {10, 4, 2, 5, 0, 6, 7};
    int size3 = sizeof(arr3) / sizeof(arr3[0]);
    int element3 = 7;
    int result3 = findNextGreaterElementPosition(arr3, size3, element3);
    if (result3 != -1) {
        cout << "Output: " << result3 << endl;
    } else {
        cout << "Output: Not found" << endl;
    }
    int arr4[] = {10, 6, 7, 2, 5, 1, 0, 4};
    int size4 = sizeof(arr4) / sizeof(arr4[0]);
    int element4 = 7;
    int result4 = findNextGreaterElementPosition(arr4, size4, element4);
    if (result4 != -1) {
        cout << "Output: " << result4 << endl;
    } else {
        cout << "Output: Not found" << endl;
    }
    return 0;
}
```



4.

```
#include <iostream>
#include <string>
using namespace std;
const int MAX_CHARS = 256;
struct Queue {
    char data[MAX_CHARS];
    int front = 0;
    int rear = 0;
    void enqueue(char c) {
        if (rear < MAX_CHARS) {
            data[rear++] = c;
        }
    }

    char dequeue() {
        if (front == rear) {
            return '\0';
        }
        return data[front++];
    }

    bool isEmpty()  {
        return front == rear;
    }

    char peek()  {
        if (isEmpty()) {
            return '\0';
        }
        return data[front];
    }
};
int findFirstNonRepeatingCharacter(string& s) {
    int frequency[MAX_CHARS] = {0};
    Queue q;

    for (int i = 0; i < s.length(); ++i) {
        char c = s[i];
        frequency[c]++;
```

```
        q.enqueue(c);
    }

    for (int i = 0; i < s.length(); ++i) {
        char c = q.dequeue();
        if (frequency[c] == 1) {
            return i;
        }
    }

    return -1;
}
int main() {
    string s1 = "thisisDSlab";
    string s2 = "CodeForDSlabClass";
    string s3 = "The quick brown fox jumps over a lazy dog";

    cout << "Input: \"" << s1 << "\" - ";
    int index1 = findFirstNonRepeatingCharacter(s1);
    if (index1 != -1) {
        cout << "Character: " << s1[index1] << ", Index: " << index1 << endl;
    } else {
        cout << "Character: None, Index: -1" << endl;
    }
    cout << "Input: \"" << s2 << "\" - ";
    int index2 = findFirstNonRepeatingCharacter(s2);
    if (index2 != -1) {
        cout << "Character: " << s2[index2] << ", Index: " << index2 << endl;
    } else {
        cout << "Character: None, Index: -1" << endl;
    }
    cout << "Input: \"" << s3 << "\" - ";
    int index3 = findFirstNonRepeatingCharacter(s3);
    if (index3 != -1) {
        cout << "Character: " << s3[index3] << ", Index: " << index3 << endl;
    } else {
        cout << "Character: None, Index: -1" << endl;
    }
    return 0;
}
```

```
Input: "thisisDSlab" - Character: t, Index: 0
Input: "CodeForDSlabClass" - Character: d, Index: 2
Input: "The quick brown fox jumps over a lazy dog" - Character: T, Index: 0
```