DAY 4

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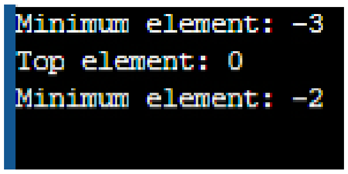
Date of Performance:24/12/24

Problem 1

1. Aim: Design a stack that supports push, pop, top, and retrieving the minimum element in constant time.
2. Code:

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

class MinStack {
private:
    stack<int> dataStack;
    stack<int> minStack;
public:
    MinStack() {
    }
    void push(int val) {
        dataStack.push(val);
        if (minStack.empty() || val <= minStack.top()) {
            minStack.push(val);
        }
    }
    void pop() {
        if (!dataStack.empty()) {
            if (dataStack.top() == minStack.top()) {
                minStack.pop();
            }
            dataStack.pop();
        }
    }
    int top() {
        if (!dataStack.empty()) {
            return dataStack.top();
        }
        return -1;
    }
    int getMin() {
        if (!minStack.empty()) {
            return minStack.top();
        }
        return -1;
    }
};
int main() {
    MinStack minStack;
    minStack.push(-2);
    minStack.push(0);
    minStack.push(-3);
    cout << "Minimum element: " << minStack.getMin() << endl;
    minStack.pop();
    cout << "Top element: " << minStack.top() << endl;
    cout << "Minimum element: " << minStack.getMin() << endl;
    return 0;
}
```

3. Output:



```
Minimum element: -3
Top element: 0
Minimum element: -2
```

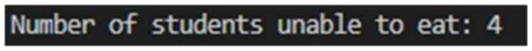
Problem 2

1. Aim: The school cafeteria offers circular and square sandwiches at lunch break, referred to by numbers 0 and 1 respectively. All students stand in a queue. Each student either prefers square or circular sandwiches

2. Code:

```
#include <iostream>
#include    <vector>    #include    <queue>    using    namespace    std;    int
countStudentsUnableToEat(vector<int>&         students,         vector<int>&
sandwiches) {      queue<int> studentQueue;      for (int student : students) {
studentQueue.push(student);
    }
    int sandwichIndex = 0;     int n = sandwiches.size();
while (!studentQueue.empty() && sandwichIndex < n) {
int currentStudent = studentQueue.front();
studentQueue.pop();        if (currentStudent ==
sandwiches[sandwichIndex]) {            sandwichIndex++;
        } else {
studentQueue.push(currentStudent);
        }
        if (studentQueue.size() == students.size()) {
break;
        }
    }
    return studentQueue.size();
} int main()
{
    vector<int> students = {1, 1, 0, 0};     vector<int> sandwiches
= {0, 1, 0, 1};     int result = countStudentsUnableToEat(students,
sandwiches);     cout << "Number of students unable to eat: " <<
result << endl;     return 0;
}
```

3. Output:



```
Number of students unable to eat: 4
```

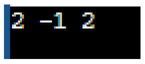
Problem 3

1. Aim: Given a circular integer array nums (i.e., the next element of nums[nums.length - 1] is nums[0]), return the next greater number for every element in nums.

2. Code:

```
#include <iostream>
#include <vector>
#include <stack>
std::vector<int> nextGreaterElements(std::vector<int>& nums) {
int n = nums.size();
    std::vector<int> result(n, -1);
     std::stack<int> s;
     for (int i = 0; i < 2 * n; ++i) {
       int currentIndex = i % n;
        while (!s.empty() && nums[currentIndex] > nums[s.top()])
{
    int index = s.top();
           s.pop();
           result[index] = nums[currentIndex];
       }
      if (i < n) {
          s.push(currentIndex);
       }
}
  return result;
}
int main() {
    std::vector<int> nums = {1, 2, 1};
    std::vector<int> result =
nextGreaterElements(nums);
    for (int num : result) {
      std::cout << num << " ";
    }
 std::cout << std::endl;
return 0;
}
```

3. Output:



```
2 -1 2
```

Problem 4

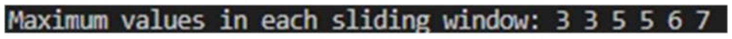
1. Aim: You are given an array of integers nums, there is a sliding window of size k which is moving from the very left of the array to the very right. You can only see the k numbers in the window. Each time the sliding window moves right by one position.

2. Code:

```
#include <iostream>
```

```
#include <vector> #include <deque> using namespace std;
vector<int> maxSlidingWindow(const vector<int>& nums, int k)
{     vector<int> result;     if (nums.empty() || k <= 0) return result;

    deque<int> dq;
    for (int i = 0; i < nums.size(); i++) {         if
(!dq.empty() && dq.front() < i - k + 1) {
            dq.pop_front();
        }
        while (!dq.empty() && nums[dq.back()] < nums[i]) {
dq.pop_back();
        }
        dq.push_back(i);         if (i >= k - 1) {
result.push_back(nums[dq.front()]);
        }
}
    return result;
} int main() {     vector<int> nums =
{1,3,-1,-3,5,3,6,7};
    int k = 3;
    vector<int> result = maxSlidingWindow(nums, k);
cout << "Maximum values in each sliding window: ";
    for (int maxVal : result) {
        cout << maxVal << " ";
    }
    cout << endl;
return 0;
}
```

3. Output:



```
Maximum values in each sliding window: 3 3 5 5 6 7
```

Problem 5

1. Aim: WAP to implement a stack using array and linked list include operations like push pop peak isempty and isfully

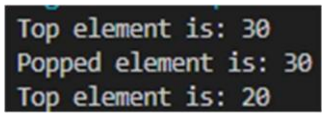
2. Code:

```
class ArrayStack {
private:     int top;
int maxSize;
int* stackArray;
public:
   ArrayStack(int size) {
maxSize = size;         stackArray =
new int[maxSize];         top = -1;
   }
   ~ArrayStack() {
delete[] stackArray;
   }
   void push(int value) {         if (isFull()) {              cout <<
"Stack is full. Cannot push " << value << endl;              return;
      }
      stackArray[++top] = value;
   }     int pop() {         if (isEmpty()) {              cout <<
"Stack is empty. Cannot pop." << endl;              return -
1; // or throw an exception
      }
      return stackArray[top--];
   }     int
peek() {
if (isEmpty())
{            cout
<< "Stack is
empty.
Cannot
peek." <<
endl;
return -1; //
or throw an
exception
        }
        return stackArray[top];
    }
    bool isEmpty() {
return top == -1;
    }     bool
isFull() {
        return top == maxSize - 1;
    } }; int main() {     ArrayStack stack(5);
stack.push(10);     stack.push(20);     stack.push(30);
cout << "Top element is: " << stack.peek() << endl;
cout << "Popped element is: " << stack.pop() << endl;
cout << "Top element is: " << stack.peek() << endl;
return 0; } class Node { public:     int data;
    Node* next;
Node(int value) {
data = value;
next = nullptr;
    }
};                          class
LinkedListStack         {
private:     Node* top;
public:
    LinkedListStack() {
top = nullptr;
    }
```

```
   ~LinkedListStack()    {
while     (!isEmpty())     {
pop();
        }
    }
    void push(int value) {
        Node* newNode = new
Node(value);         newNode->next = top;
top = newNode;
    }     int pop() {         if (isEmpty()) {             cout <<
"Stack is empty. Cannot pop." << endl;             return -
1; // or throw an exception
        }
        Node* temp = top;         int
poppedValue = top->data;
top = top->next;         delete temp;
return poppedValue;
    }     int peek() {
if (isEmpty()) {
            cout << "Stack is empty. Cannot peek." << endl;
return -1; // or throw an exception
        }
        return top->data;
    }
    bool isEmpty() {
return top == nullptr;
    }
}; int
main() {
    LinkedListStack stack;     stack.push(10);
stack.push(20);     stack.push(30);     cout << "Top element
is: " << stack.peek() << endl; // 30     cout << "Popped
element is: " << stack.pop() << endl; // 30     cout << "Top
element is: " << stack.peek() << endl; // 20     return 0;
```

```
}
```

3. Output:



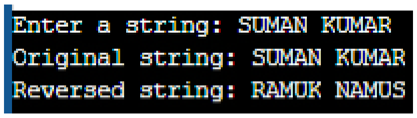
```
Top element is: 30
Popped element is: 30
Top element is: 20
```

Problem 6

1. Aim: given a string use the stack to reverse the string
2. Code:

```
#include <iostream>
#include <stack>
#include <string>
using namespace std;
string reverseString(string s) {
    stack<char> charStack;
    for (char c : s) {
        charStack.push(c);
    }
    string reversedString = "";
    while (!charStack.empty()) {
        reversedString += charStack.top();
        charStack.pop();
    }
    return reversedString;
}
int main() {
    string str;
    cout << "Enter a string: ";
    getline(cin, str);
    string reversedStr = reverseString(str);
    cout << "Original string: " << str << endl;
    cout << "Reversed string: " << reversedStr << endl;
    return 0;
}
```

3. Output:



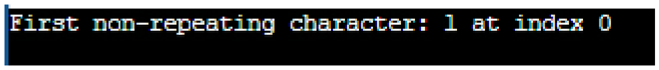
```
Enter a string: SUMAN KUMAR
Original string: SUMAN KUMAR
Reversed string: RAMUK NAMUS
```

Problem 7

1. Aim: implementation of stack using two queue
2. Code:

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

class Stack {
private:
    queue<int> q1;
    queue<int> q2;

public:
    void push(int x) {
        q1.push(x);
    }
    int pop() {
        if (q1.empty()) {
            return -1;
        }
        while (q1.size() > 1) {
            q2.push(q1.front());
            q1.pop();
        }
    int top = q1.front();
        q1.pop();
        swap(q1, q2);
        return top;
    }
    int top() {
        if (q1.empty()) {
            return -1;
        }
        while (q1.size() > 1) {
            q2.push(q1.front());
            q1.pop();
        }
        int top = q1.front();
        q2.push(q1.front());
        q1.pop();
        swap(q1, q2);
        return top;
    }

    bool empty() {
        return q1.empty();
    }
};

int main() {
    Stack s;
    s.push(1);
    s.push(2);
    s.push(3);
    cout << "Popped element: " << s.pop() << endl; // Output: 3
    cout << "Top element: " << s.top() << endl;    // Output: 2
    cout << "Popped element: " << s.pop() << endl; // Output: 2
    return 0;
}
```

3. Output:



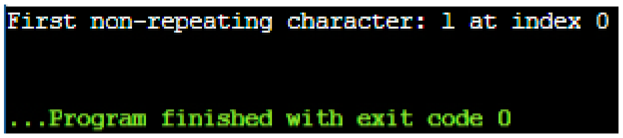
```
First non-repeating character: l at index 0
```

Problem 8

1. Aim: Given a string find the first non-repeating character and return its index value, if it does not exist return -1 value
2. Code:

```
#include <iostream>

#include <unordered_map>

#include <string>

using namespace std;


int firstUniqChar(string s) {

    unordered_map<char, int> charCount;

    for (char c : s) {

        charCount[c]++;

    }

    for (int i = 0; i < s.size(); i++) {

        if (charCount[s[i]] == 1) {
            return i;
        }
    }
    return -1;
}
int main() {
    string s = "leetcode";
    int index = firstUniqChar(s);
    if (index != -1) {
        cout << "First non-repeating character: " << s[index] << " at index " <<
index << endl;
    } else {
        cout << "No unique character found." << endl;
    }
    return 0;
}
```

3. Output:



```
First non-repeating character: l at index 0


...Program finished with exit code 0
```

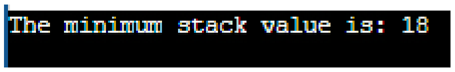
Problem 9

1. Aim: Check the minimum value of stack after PUSH and POP operations.

2. Code:

```
#include<iostream>
#include<stack>
using namespace std;
int main() {
    stack <int> s;
    int arr[] = {18,19,29,16,15};
    int n = sizeof(arr)/sizeof(arr[0]);
    for(int i=0;i<n;++i){
        s.push(arr[i]);
    }
    cout<<"The minimum stack value is: "<<arr[0]<<endl;
    return 0;
   }
```

3. Output:



```
The minimum stack value is: 18
```

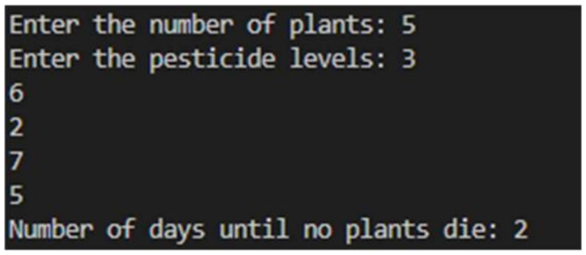
Problem 10

1. Aim: There are a number of plants in a garden. Each of the plants has been treated with some amount of pesticide. After each day, if any plant has more pesticide than the plant on its left, being weaker than the left one, it dies.
2. Code:

```
#include <iostream>
#include <vector>
#include <stack> #include
<algorithm> using namespace std; int
poisonousPlants(vector<int>& p) {
```

```
int n = p.size();     vector<int> days(n,
0);      stack<int> s;

    for (int i = 0; i < n; ++i) {          while
(!s.empty() && p[i] > p[s.top()]) {
days[i] = max(days[i], days[s.top()] + 1);
s.pop();
        }
        s.push(i);
}
    return *max_element(days.begin(), days.end());
}

int main() {
int n;
    cout << "Enter the number of plants: ";
cin >> n;      vector<int> p(n);     cout <<
"Enter the pesticide levels: ";     for (int i
= 0; i < n; ++i) {          cin >> p[i];
    }
    int result = poisonousPlants(p);
    cout << "Number of days until no plants die: " << result << endl;
return 0;
}
```

3. Output:



```
Enter the number of plants: 5
Enter the pesticide levels: 3
6
2
7
5
Number of days until no plants die: 2
```