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DEPARTMENT OF
COMPUTER SCIENCE & ENGINEERING

DAY 4

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Branch: BE-CSE Section/Group: 620 - A

Date of Performance:24/12/24

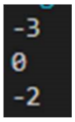
Problem 1

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

```
#include <stack>
#include <limits> class
MinStack { private:
   std::stack<int> mainStack; // Stack to store the actual elements
std::stack<int> minStack;   // Stack to store the minimum elements public:
   MinStack() {
   }     void push(int val) {
mainStack.push(val);
      // If minStack is empty or the current value is less than or equal to the
top of minStack        if (minStack.empty() || val <= minStack.top()) {
minStack.push(val); // Push the new minimum onto minStack
      }
   }     void
pop() {
      if (mainStack.empty()) return; // Check if the stack is empty
int topValue = mainStack.top();        mainStack.pop();
      if (topValue == minStack.top()) {
minStack.pop();
```

```
        }     }     int top() {         return mainStack.top(); // Return the top
element of the main stack
    }     int getMin() {         return minStack.top(); // Return the top
element of the min stack
    } }; int
main() {
    MinStack minStack;     minStack.push(-2);
minStack.push(0);     minStack.push(-3);     std::cout <<
minStack.getMin() << std::endl; // return -3
minStack.pop();     std::cout << minStack.top() <<
std::endl;    // return 0     std::cout << minStack.getMin()
<< std::endl; // return -2     return 0;
}
```

3. Output:



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

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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:

```
string reverseString(const string& str) {
stack<char> charStack;     for (char ch :
str) {         charStack.push(ch);
   }
   string reversedStr;     while
(!charStack.empty()) {
reversedStr += charStack.top();
charStack.pop();
   }     return
reversedStr;
} int main()
{     string
input;
cout <<
"Enter a
string to
reverse: ";
getline(cin,
input);
string
reversed =
reverseStrin
```

```
g(input);
cout <<
"Reversed
string:
"<<reversed
<<endl;
return 0;
}
```

3. Output:

```
Enter a string to reverse: ABHISHEK
Reversed string: KEHSIHBA
```

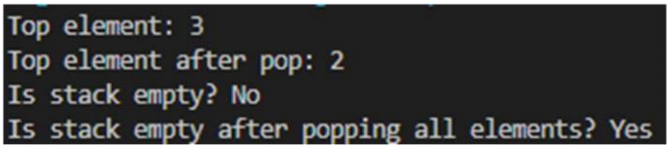
Problem 7

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

```
class StackUsingQueues { private:
   queue<int> q1;
queue<int> q2; public:
   void push(int x) {
q2.push(x);        while
(!q1.empty()) {
q2.push(q1.front());
q1.pop();
      }
      swap(q1, q2);
```

```
    }     void pop() {
if (!q1.empty()) {
q1.pop();
        }
    }     int top() {        if
(!q1.empty()) {
return q1.front();
        }
        throw out_of_range("Stack is empty");
    }
    bool isEmpty() {
return q1.empty();
    }         int  size()  {
return q1.size();
    } }; int
main() {
    StackUsingQueues stack;     stack.push(1);     stack.push(2);
stack.push(3);     cout <<"Top element: "<<stack.top()<<endl;
stack.pop();     cout <<"Top element after pop: "<<stack.top()<<endl;
cout<<"Is stack empty? "<<(stack.isEmpty() ? "Yes" : "No")<<endl;
stack.pop();     stack.pop();
    cout<<"Is stack empty after popping all elements? "<<(stack.isEmpty()
? "Yes" : "No")<<endl;
return 0;
}
```

3. Output:



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:

```
int firstNonRepeatingCharacter(const string& str) {
unordered_map<char, int> charCount;     for (char
ch : str) {         charCount[ch]++;
    }     for (int i = 0; i < str.length();
i++) {         if (charCount[str[i]] == 1)
{             return i;
       }
}
   return -1;
} int main() {     string input;
cout << "Enter a string: ";
getline(cin, input);
   int index = firstNonRepeatingCharacter(input);     if (index != -1) {
cout        <<     "The    first    non-repeating        character     is     at
     index:
"<<index<<endl;
   } else {         cout << "No non-repeating character found."
<< std::endl;
   }
return 0;
}
```

3. Output:

```
Enter a string: ABHISHEK
The first non-repeating character is at index: 0
```

Problem 9

1. Aim: CHECK THE MINIMUM VALUE OF STACK AFTER PUSH AND POP OPERATIONS

2. Code:

```
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 is : "<<arr[0]<<endl;
return 0;


   }
```

3. Output:

```
the minimum stack is : 18
```

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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: