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**DOMAIN WINTER WINNING CAMP-Day(4)**

1) MinStack

Code:

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

```
class MinStack {
```

```
    stack<int> s,
    minStack;
```

```
public:
```

```
    void push(int val) {
        s.push(val);
        if
        (minStack.empty()
        || val <=
        minStack.top()) {
```

```
        minStack.push(val);
        }
    }
```

```
    void pop() {
        if (s.top() ==
```

```
minStack.top()) {  
    minStack.pop();  
}  
s.pop();  
}
```

```
int top() {  
    return s.top();  
}
```

```
int getMin() {  
    return  
    minStack.top();  
}  
};
```

```
int main() {  
    MinStack minStack;  
    int n, operation, val;  
    cout << "Enter  
    number      of  
    operations: "; cin >>  
    n; for (int i = 0; i < n;  
  
    ++i) {  
        cout << "Choose  
        operation (1: push,  
        2: pop, 3: top, 4:
```

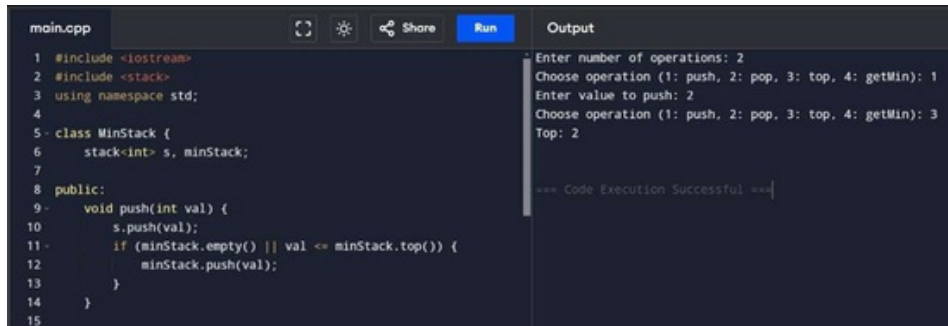
```

getMin): ";
    cin >> operation;
    if (operation == 1)
    {
        cout << "Enter
value to push: ";
        cin >> val;

        minStack.push(val);
    } else if (operation
== 2) {
        minStack.pop();
    } else if (operation
== 3) {
        cout << "Top: "
<< minStack.top()
<< endl;
    } else if (operation
== 4) {
        cout <<
"Minimum: " <<
minStack.getMin()
<< endl;
    }
}
return 0;
}

```

Output:



The screenshot shows a C++ IDE with a file named 'main.cpp'. The code defines a 'MinStack' class with a 'stack<int> s, minStack;' and a 'push' method that also updates 'minStack'. The output window shows the program's execution: it asks for the number of operations (2), then for a choice of operation (1: push, 2: pop, 3: top, 4: getMin), then for a value to push (2), and finally for another choice of operation (3: top), displaying 'Top: 2'. A success message '=== Code Execution Successful ===' is also visible.

```
main.cpp
1 #include <iostream>
2 #include <stack>
3 using namespace std;
4
5 class MinStack {
6     stack<int> s, minStack;
7
8 public:
9     void push(int val) {
10         s.push(val);
11         if (minStack.empty() || val <= minStack.top()) {
12             minStack.push(val);
13         }
14     }
15 }
```

Output

```
Enter number of operations: 2
Choose operation (1: push, 2: pop, 3: top, 4: getMin): 1
Enter value to push: 2
Choose operation (1: push, 2: pop, 3: top, 4: getMin): 3
Top: 2

=== Code Execution Successful ===
```

## 2) Balanced Brackets

```
#include <iostream>
```

```
#include <stack>
```

```
using namespace std;
```

```
bool isBalanced(string s) {
```

```
    stack<char> st;
```

```
    for (char c : s) {
```

```
        if (c == '(' || c == '{' || c == '[') {
```

```
            st.push(c);
```

```
        } else {
```

```
            if (st.empty()) return false;
```

```
            if ((c == ')' && st.top() != '(') ||
```

```
                (c == '}' && st.top() != '{') ||
```

```
                (c == ']' && st.top() != '[')) {
```

```
                return false;
```

```
            }
```

```
            st.pop();
```

```
        }
```

```
    }
```

```
    return st.empty();
```

```
}
```

```
int main() {
```

```
    int n;
```

```
    cout << "Enter number of bracket strings to check: ";
```

```
    cin >> n;
```

```
    for (int i = 0; i < n; ++i) {
```

```

    string s;
    cout << "Enter string: ";
    cin >> s;
    cout << (isBalanced(s) ? "YES" : "NO") << endl;
}
return 0;
}

```

Output:

The screenshot shows a C++ IDE with a file named `main.cpp`. The code implements a function `isBalanced` that uses a stack to check if a string of brackets is balanced. The output window shows the program's execution: it prompts for the number of strings to check (1), then for a string ("at"), and finally outputs "NO" because the string "at" is not composed of brackets. The execution is successful.

```

main.cpp
1 #include <iostream>
2 #include <stack>
3 using namespace std;
4
5 bool isBalanced(string s) {
6     stack<char> st;
7     for (char c : s) {
8         if (c == '(' || c == '{' || c == '[') {
9             st.push(c);
10        } else {
11            if (st.empty()) return false;
12            if ((c == ')' && st.top() != '(') ||
13                (c == '}' && st.top() != '{') ||
14                (c == ']' && st.top() != '[')) {
15                return false;
16            }
17        }
18    }
19    return true;
20 }

```

Output

```

Enter number of bracket strings to check: 1
Enter string: at
NO

=== Code Execution Successful ===

```

### 3) Evaluate Reverse Polish Notation

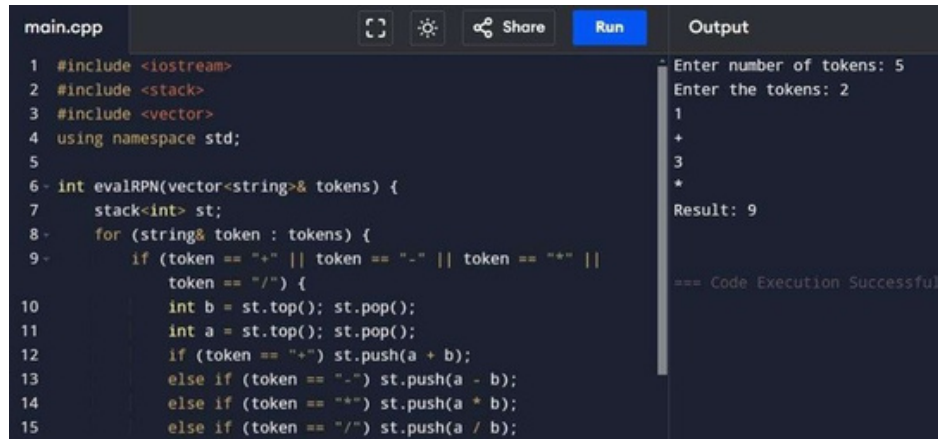
```
#include <iostream>
#include <stack>
#include <vector>
using namespace std;

int
evalRPN(vector<string>& tokens) {
    stack<int> st;
    for (string& token :
        tokens) {
        if (token == "+" ||
            token == "-" || token
            == "*" || token ==
            "/") {
            int b = st.top();
            st.pop();
            int a = st.top();
            st.pop();
            if (token == "+")
                st.push(a + b);
            else if (token == "-")
                st.push(a - b);
            else if (token ==
                "*") st.push(a * b);
            else if (token ==
                "/") st.push(a / b);
        } else {
```

```
        st.push(stoi(token));
    }
}
return st.top();
}
```

```
int main() {
    int n;
    cout << "Enter number
        of tokens: ";
    cin >> n;
    vector<string>
    tokens(n);
    cout << "Enter the
        tokens: ";
    for (int i = 0; i < n; ++i) {
        cin >> tokens[i];
    }
    cout << "Result: " <<
    evalRPN(tokens) <<
    endl;
    return 0;
}
```

Output:



The screenshot shows a C++ IDE with a file named 'main.cpp'. The code implements an RPN calculator using a stack. The output window shows the user entering 5 tokens, then the tokens '1', '+', '3', and '\*', resulting in a final result of 9. The code execution is successful.

```
main.cpp
1 #include <iostream>
2 #include <stack>
3 #include <vector>
4 using namespace std;
5
6 int evalRPN(vector<string>& tokens) {
7     stack<int> st;
8     for (string& token : tokens) {
9         if (token == "+" || token == "-" || token == "*" ||
10             token == "/") {
11             int b = st.top(); st.pop();
12             int a = st.top(); st.pop();
13             if (token == "+") st.push(a + b);
14             else if (token == "-") st.push(a - b);
15             else if (token == "*") st.push(a * b);
16             else if (token == "/") st.push(a / b);
17         } else {
18             st.push(stoi(token));
19         }
20     }
21     return st.top();
22 }
```

Output

Enter number of tokens: 5  
Enter the tokens: 2  
1  
+  
3  
\*  
Result: 9  
=== Code Execution Successful ===

#### 4) Longest Valid Parentheses

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

```
int longestValidParentheses(string s) {
    stack<int> st;
    st.push(-1);
    int maxLength = 0;

    for (int i = 0; i < s.size(); ++i) {
        if (s[i] == '(') {
            st.push(i);
        } else {
            st.pop();
            if (st.empty()) {
                st.push(i);
            } else {
                int length = i - st.top();
                maxLength = max(maxLength, length);
            }
        }
    }
    return maxLength;
}
```



```

    } else {
        maxLength = max(maxLength, i - st.top());
    }
}
}
return maxLength;
}

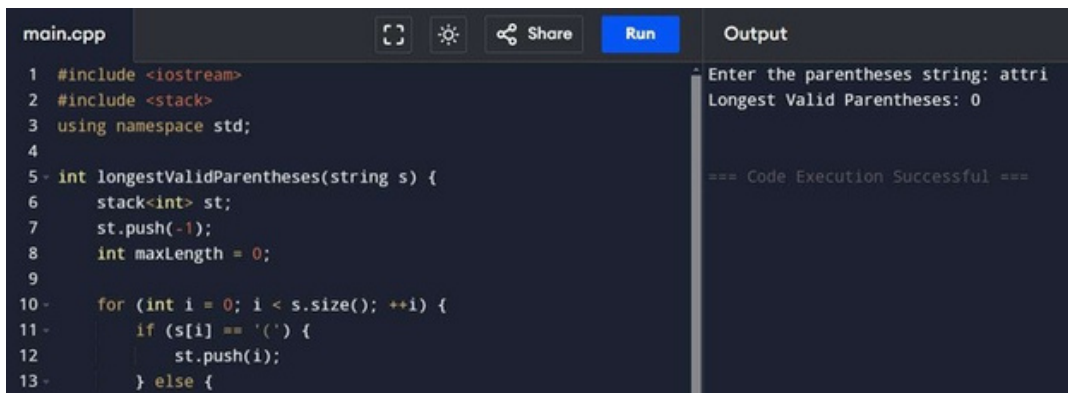
```

```

int main() {
    string s;
    cout << "Enter the parentheses string: ";
    cin >> s;
    cout << "Longest Valid Parentheses: " << longestValidParentheses(s) << endl;
    return 0;
}

```

Output:



The screenshot shows a C++ IDE with a file named 'main.cpp'. The code in the editor is as follows:

```

1 #include <iostream>
2 #include <stack>
3 using namespace std;
4
5 int longestValidParentheses(string s) {
6     stack<int> st;
7     st.push(-1);
8     int maxLength = 0;
9
10    for (int i = 0; i < s.size(); ++i) {
11        if (s[i] == '(') {
12            st.push(i);
13        } else {

```

The IDE interface includes a 'Run' button and a 'Share' icon. The 'Output' pane on the right displays the following text:

```

Enter the parentheses string: attri
Longest Valid Parentheses: 0

=== Code Execution Successful ===

```

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

int
poisonousPlants(vector
<int>& p) {
    vector<int>
days(p.size(), 0);
    vector<int> stack;
    int maxDays = 0;

    for (int i = 0; i <
p.size(); ++i) {
        int day = 0;
        while
(!stack.empty() &&
p[stack.back()] >= p[i]) {
            day = max(day,
days[stack.back()]);

stack.pop_back();
        } if (!stack.empty())
        { days[i] = day + 1;

        }
        stack.push_back(i);
        maxDays =
max(maxDays, days[i]);
```

```

    }
    return maxDays;
}

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

```

Output:

main.cpp	Output
<pre>1 #include &lt;iostream&gt; 2 #include &lt;vector&gt; 3 using namespace std; 4 5 int poisonousPlants(vector&lt;int&gt;&amp; p) { 6     vector&lt;int&gt; days(p.size(), 0); 7     vector&lt;int&gt; stack; 8     int maxDays = 0; 9 10    for (int i = 0; i &lt; p.size(); ++i) { 11        int day = 0; 12        while (!stack.empty() &amp;&amp; p[stack.back()] &gt;= p[i]) { 13            day = max(day, days[stack.back()]); 14            stack.pop_back(); 15        }</pre>	<pre>Enter number of plants: 7 Enter pesticide levels: 6 5 8 4 7 10 9 Days until no plants die: 2  === Code Execution Successful ===</pre>

## 6) Implement Queue Using Stacks

```
#include <iostream>
```

```
#include <stack>
```

```
using namespace std;
```

```
class MyQueue {
```

```
    stack<int> inStack, outStack;
```

```
    void transfer() {
```

```
        while (!inStack.empty()) {
            outStack.push(inStack.top());
            inStack.pop();
        }
```

```
    }
```

```
public:
```

```
    void push(int x) {
        inStack.push(x);
    }
```

```
    int pop() {
        if (outStack.empty()) transfer();
        int val = outStack.top();
        outStack.pop();
        return val;
    }
```

```
    int peek() {
```

```

        if (outStack.empty()) transfer();
        return outStack.top();
    }

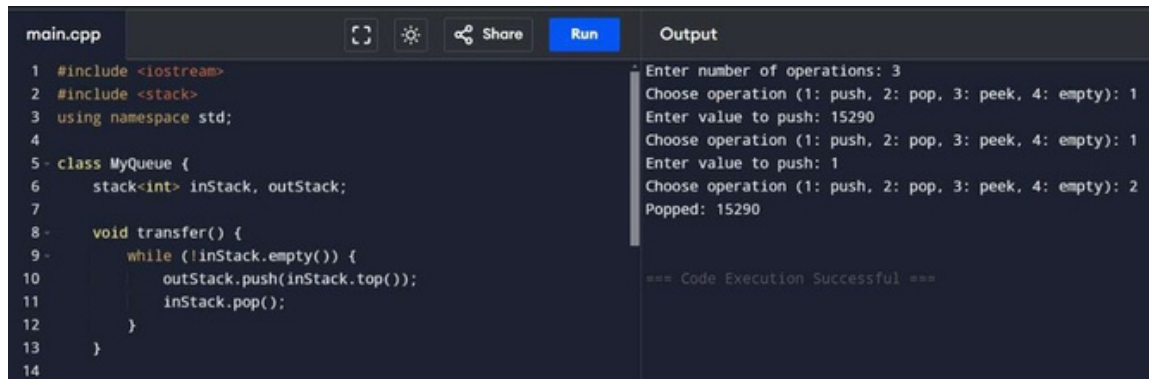
    bool empty() {
        return inStack.empty() && outStack.empty();
    }
};

int main() {

    MyQueue q;
    int n, op, x;
    cout << "Enter number of operations: ";
    cin >> n;
    for (int i = 0; i < n; ++i) {
        cout << "Choose operation (1: push, 2: pop, 3: peek, 4: empty): ";
        cin >> op;
        if (op == 1) {
            cout << "Enter value to push: ";
            cin >> x;
            q.push(x);
        } else if (op == 2) {
            cout << "Popped: " << q.pop() << endl;
        } else if (op == 3) {
            cout << "Front: " << q.peek() << endl;
        } else if (op == 4) {
            cout << "Empty: " << (q.empty() ? "Yes" : "No") << endl;
        }
    }
    return 0;
}

```

Output :



```
main.cpp  Run  Output
1 #include <iostream>
2 #include <stack>
3 using namespace std;
4
5 class MyQueue {
6     stack<int> inStack, outStack;
7
8     void transfer() {
9         while (!inStack.empty()) {
10             outStack.push(inStack.top());
11             inStack.pop();
12         }
13     }
14 }
```

Enter number of operations: 3  
Choose operation (1: push, 2: pop, 3: peek, 4: empty): 1  
Enter value to push: 15290  
Choose operation (1: push, 2: pop, 3: peek, 4: empty): 1  
Enter value to push: 1  
Choose operation (1: push, 2: pop, 3: peek, 4: empty): 2  
Popped: 15290  
  
=== Code Execution Successful ===

## 7) Reverse a Queue Using Recursion

```
#include <iostream>
```

```
#include <queue>
```

```
using namespace std;
```

```
void reverseQueue(queue<int>& q) {
```

```
    if (q.empty()) return;
```

```
    int front = q.front();
```

```
    q.pop();
```

```
    reverseQueue(q);
```

```
    q.push(front);
```

```
}
```

```
int main() {
```

```
    int n, val;
```

```
    queue<int> q;
```

```
    cout << "Enter number of elements in the queue: ";
```

```
    cin >> n;
```

```
    cout << "Enter elements: ";
```

```
    for (int i = 0; i < n; ++i) {
```

```
        cin >> val;
```

```
        q.push(val);
```

```
    }
```

```
    reverseQueue(q);
```

```
    cout << "Reversed queue: ";
```

```
    while (!q.empty()) {
```

```
        cout << q.front() << " ";
```

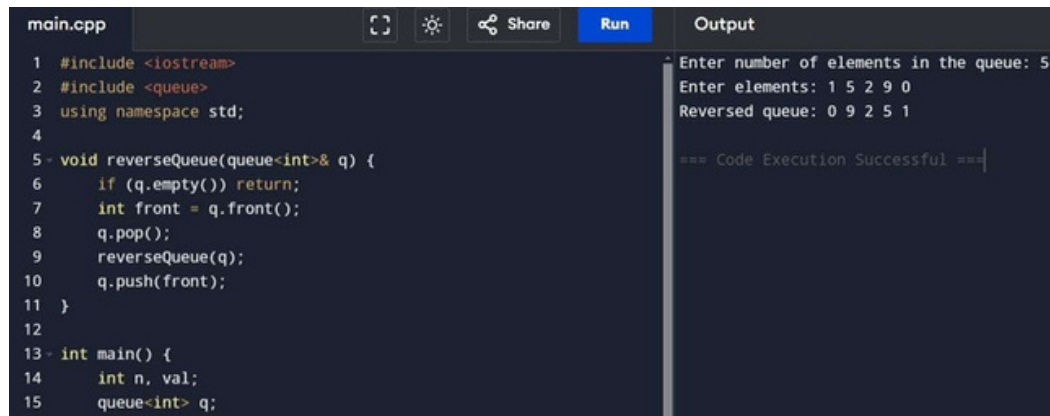
```
        q.pop();
```

```
    }
```

```
    return 0;
```

```
}
```

Output :



The screenshot shows a C++ IDE with a file named 'main.cpp'. The code implements a function 'reverseQueue' that takes a queue of integers and reverses it by repeatedly popping the front element and pushing it to the back. The 'main' function prompts the user to enter the number of elements (5) and the elements themselves (1 5 2 9 0). The output shows the reversed queue as 0 9 2 5 1. The IDE interface includes a 'Run' button and a 'Share' icon.

```
main.cpp
1 #include <iostream>
2 #include <queue>
3 using namespace std;
4
5 void reverseQueue(queue<int>& q) {
6     if (q.empty()) return;
7     int front = q.front();
8     q.pop();
9     reverseQueue(q);
10    q.push(front);
11 }
12
13 int main() {
14     int n, val;
15     queue<int> q;
```

Output

```
Enter number of elements in the queue: 5
Enter elements: 1 5 2 9 0
Reversed queue: 0 9 2 5 1

=== Code Execution Successful ===
```

## Sliding Window Maximum

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

vector<int> maxSlidingWindow(vector<int>& nums, int k) {
    deque<int> dq;
    vector<int> result;

    for (int i = 0; i < nums.size(); ++i) {
        if (!dq.empty() && dq.front() == i - k) 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() {
    int n, k;
    cout << "Enter number of elements: ";
    cin >> n;
    vector<int> nums(n);
    cout << "Enter elements: ";
    for (int i = 0; i < n; ++i) cin >> nums[i];
    cout << "Enter window size: ";
    cin >> k;
    vector<int> result = maxSlidingWindow(nums, k);
    cout << "Sliding window maximums: ";
```

```

for (int x : result) cout << x << " ";
return 0;
}

```

Output :

The screenshot shows a C++ IDE with a file named 'main.cpp'. The code implements a function 'maxSlidingWindow' that takes a vector of integers and a window size 'k'. It uses a deque to maintain the elements of the current window, ensuring it is sorted in descending order. The output window shows the following text:

```

Enter number of elements: 5
Enter elements: 1 5 2 9 0
Enter window size: 4
Sliding window maximums: 9 9
=== Code Execution Successful ===

```

## 9) Circular Queue Simulation

```

#include <iostream> <queue> <vector> using namespace std;
// Function to calculate the number of students unable to eat
int studentsUnableToEat(vector<int>& students, vector<int>& sandwiches) {

```

```

    queue<int> studentQueue;
    for (int s : students) {
        studentQueue.push(s);
    }

    int i = 0, count = 0;
    while (!studentQueue.empty() && count < studentQueue.size()) {
        if (studentQueue.front() == sandwiches[i]) {
            studentQueue.pop();
            ++i;
            count = 0;
        } else {
            studentQueue.push(studentQueue.front());
            studentQueue.pop();
            ++count;
        }
    }

    return studentQueue.size();
}

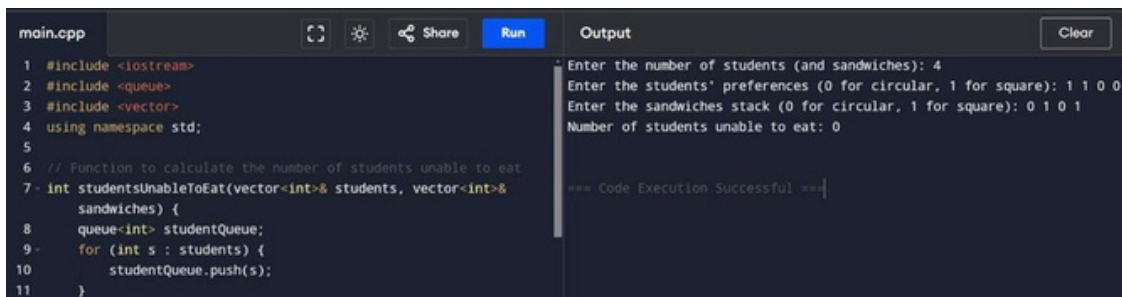
```



```
}
```

```
int main() {  
    int n;  
    cout << "Enter the number of students (and sandwiches): ";  
    cin >> n;  
    vector<int> students(n), sandwiches(n);  
    cout << "Enter the students' preferences (0 for circular, 1 for square): ";  
    for (int i = 0; i < n; ++i) {  
        cin >> students[i];  
    }  
  
    cout << "Enter the sandwiches stack (0 for circular, 1 for square): ";  
    for (int i = 0; i < n; ++i) {  
        cin >> sandwiches[i];  
    }  
  
    int result = studentsUnableToEat(students, sandwiches);  
    cout << "Number of students unable to eat: " << result << endl;  
    return 0;  
}
```

Output :



The screenshot shows a code editor with a file named 'main.cpp'. The code is a C++ program that takes input for the number of students and sandwiches, then for each student's preference (0 for circular, 1 for square) and each sandwich's type (0 for circular, 1 for square). It then calculates the number of students who cannot eat a sandwich of their preferred type. The output window shows the execution results for the input: 4 students, preferences [1, 1, 0, 0], and sandwiches [0, 1, 0, 1]. The result is 0 students unable to eat.

```
main.cpp  [Icons]  Share  Run  Clear  
1 #include <iostream>  
2 #include <queue>  
3 #include <vector>  
4 using namespace std;  
5  
6 // Function to calculate the number of students unable to eat  
7 int studentsUnableToEat(vector<int>& students, vector<int>&  
    sandwiches) {  
8     queue<int> studentQueue;  
9     for (int s : students) {  
10         studentQueue.push(s);  
11     }
```

```
Output  Clear  
Enter the number of students (and sandwiches): 4  
Enter the students' preferences (0 for circular, 1 for square): 1 1 0 0  
Enter the sandwiches stack (0 for circular, 1 for square): 0 1 0 1  
Number of students unable to eat: 0  
  
=== Code Execution Successful ===
```

## 10) Zuma Game

```
#include <iostream>
#include <unordered_map>
#include <string> #include
<vector> #include <climits>
using namespace std;

// Helper function to reduce the board by removing groups of 3 or more consecutive balls
string reduceBoard(string board) {
    int n = board.size();
    bool reduced = true;

    while (reduced) {
        reduced = false;
        int i = 0;

        while (i < n) {
            int j = i;
            while (j < n && board[i] == board[j]) {
                j++;
            }

            // If there are 3 or more consecutive balls, remove them
            if (j - i >= 3) {
                board = board.substr(0, i) + board.substr(j);
                n = board.size();
                reduced = true;
            } else {
                i = j;
            }
        }
    }
    return board;
}

// Helper function for DFS
int dfs(string board, unordered_map<char, int>& hand) {
    board = reduceBoard(board);
    if (board.empty()) return 0;
    int minSteps = INT_MAX, n = board.size();

    for (int i = 0; i < n; i++) {
        int j = i;
        while (j < n && board[i] == board[j]) {
            j++;
        }
    }
}
```

```

    }

    int need = 3 - (j - i);
    if (hand[board[i]] >= need) {
        hand[board[i]] -= need;
        int steps = dfs(board.substr(0, i) + board.substr(j), hand);
        if (steps != -1) {
            minSteps = min(minSteps, steps + need);
        }
        hand[board[i]] += need;
    }
}
return minSteps == INT_MAX ? -1 : minSteps;
}

// Main function to calculate the minimum steps to clear the board
int findMinStep(string board, string hand) {
    unordered_map<char, int> handCount;
    for (char c : hand) {
        handCount[c]++;
    }
    return dfs(board, handCount);
}

int main() {
    string board, hand;
    cout << "Enter the board string (e.g., WRRBBW): ";
    cin >> board;
    cout << "Enter the hand string (e.g., RB): ";
    cin >> hand;

    int result = findMinStep(board, hand);
    if (result == -1) {
        cout << "It is impossible to clear the board." << endl;
    } else {
        cout << "Minimum steps to clear the board: " << result << endl;
    }
    return 0;
}

```

Output :

main.cpp	Run	Output
<pre>1 #include &lt;iostream&gt; 2 #include &lt;unordered_map&gt; 3 #include &lt;string&gt; 4 #include &lt;vector&gt; 5 #include &lt;climits&gt; 6 using namespace std; 7 8 // Helper function to reduce the board by removing groups of 3   or more consecutive balls 9- string reduceBoard(string board) { 10     int n = board.size(); 11     bool reduced = true;</pre>		<pre>Enter the board string (e.g., WRRBBW): WRRBBW Enter the hand string (e.g., RB): RB It is impossible to clear the board.  === Code Execution Successful ===</pre>