Name: Vanshaj Rana **UID:22bcs15417**

Section: 22BCS_IOT_620-B **Date: 24-12-24**

DOMAIN WINTER WINNING CAMP-Day(4)

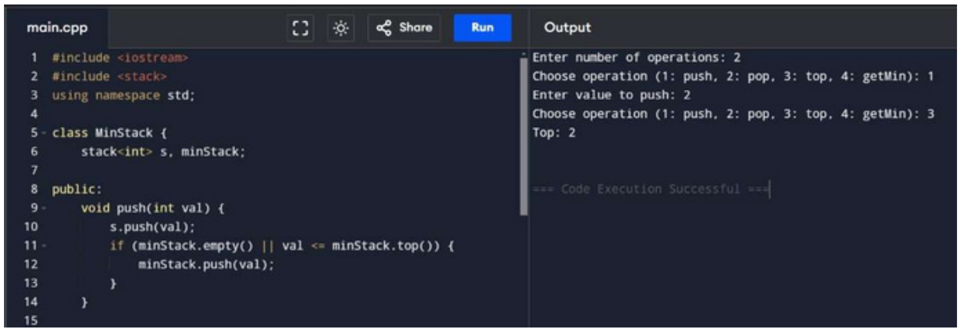
1) MinStack

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:



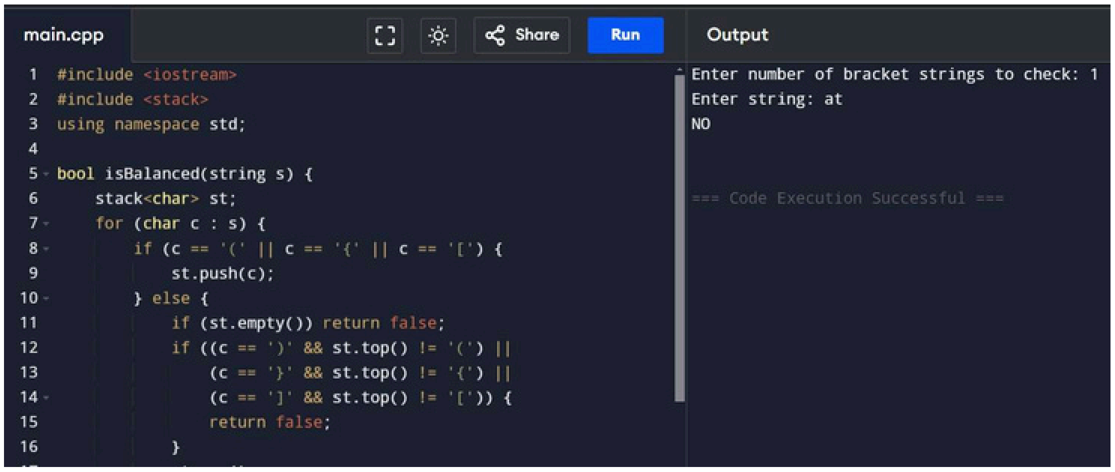
```cpp
#include <iostream>
#include <stack>
using namespace std;

class MinStack {
    stack<int> s, minStack;

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

```

```
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

```cpp
#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:



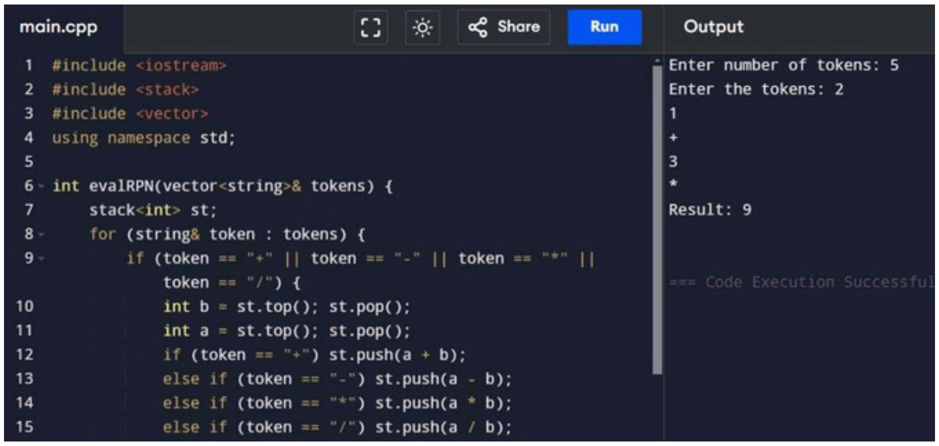
```
#include <iostream>
#include <stack>
using namespace std;

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;
            }
```

```
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<strin
    g>& 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:

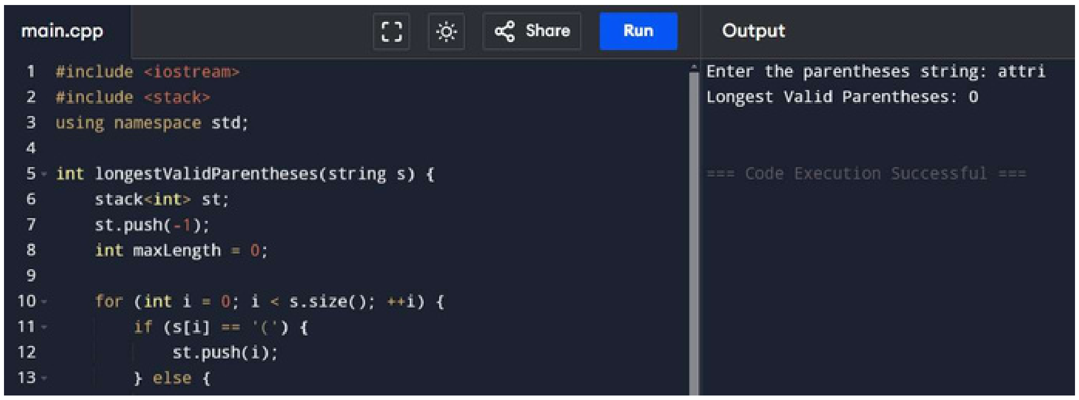


```
#include <iostream>
#include <stack>
#include <vector>
using namespace std;

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);
```

```
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 {
                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:


main.cpp

```
#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 {
```

Output

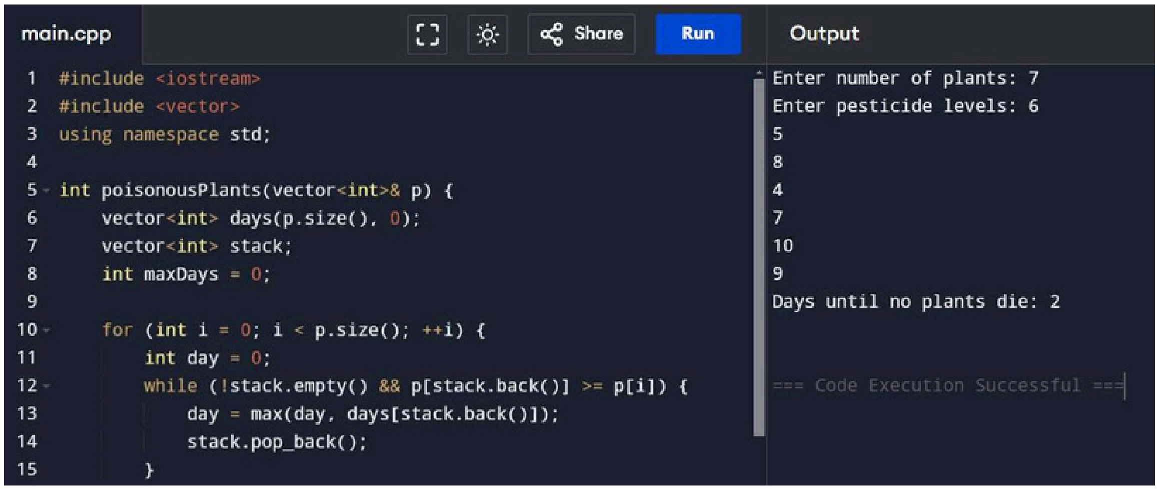
```
Enter the parentheses string: attri
Longest Valid Parentheses: 0

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

5) Poisonous Plants

```
#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:



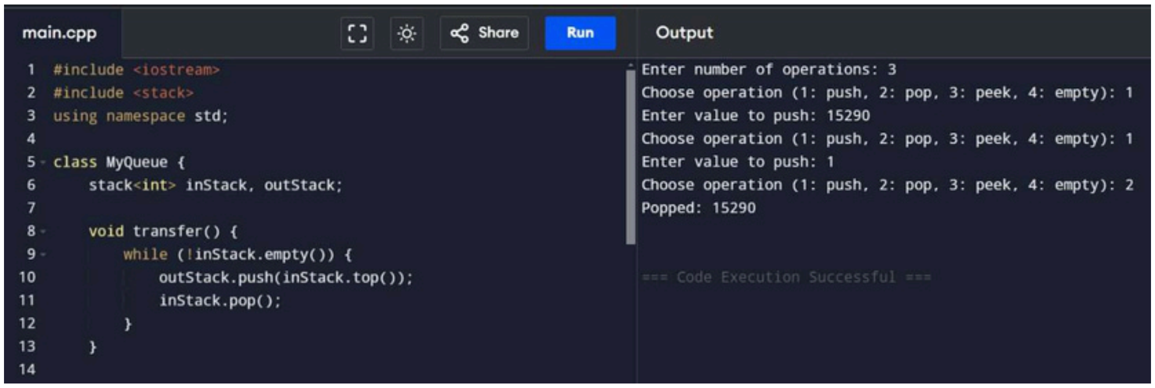
```
#include <iostream>
#include <vector>
using namespace std;

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();
        }
```

```
Enter number of plants: 7
Enter pesticide levels: 6
5
8
4
7
10
9
Days until no plants die: 2

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

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 :



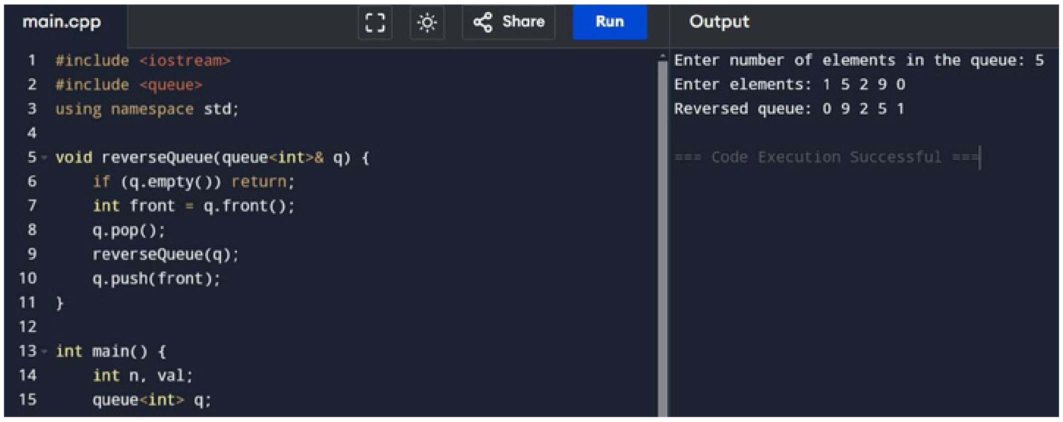
```
#include <iostream>
#include <stack>
using namespace std;

class MyQueue {
    stack<int> inStack, outStack;

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

```

```
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 :



```cpp
#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;
```

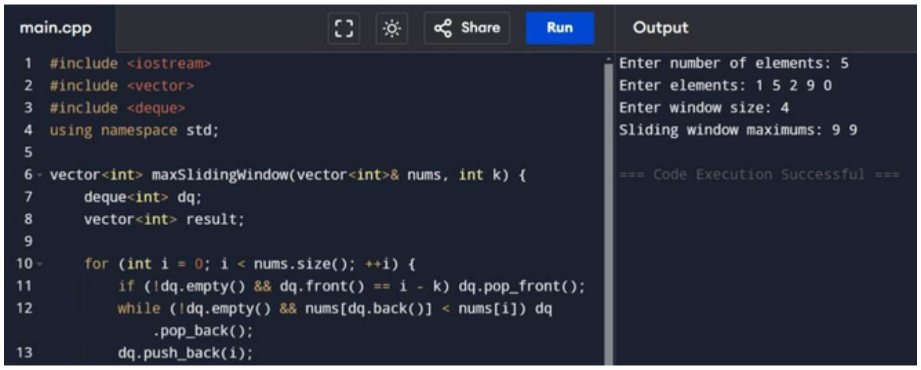
```
Enter number of elements in the queue: 5
Enter elements: 1 5 2 9 0
Reversed queue: 0 9 2 5 1

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

8) Sliding Window Maximum

```cpp
#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 :



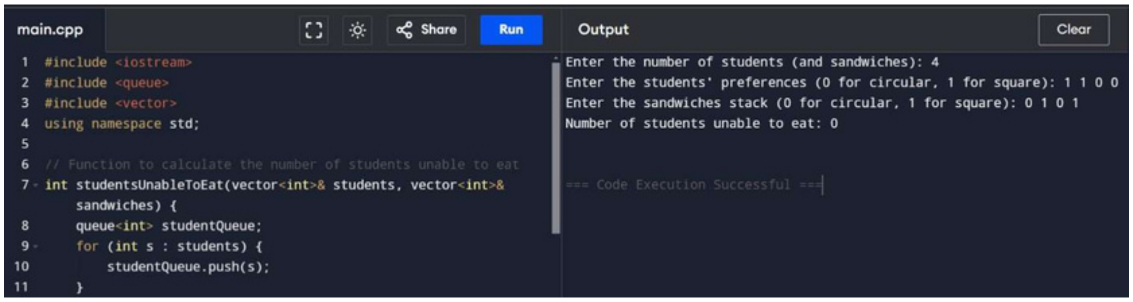
```
#include <iostream>
#include <vector>
#include <deque>
using namespace std;

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);
```

```
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>
#include      <queue>
#include      <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 :



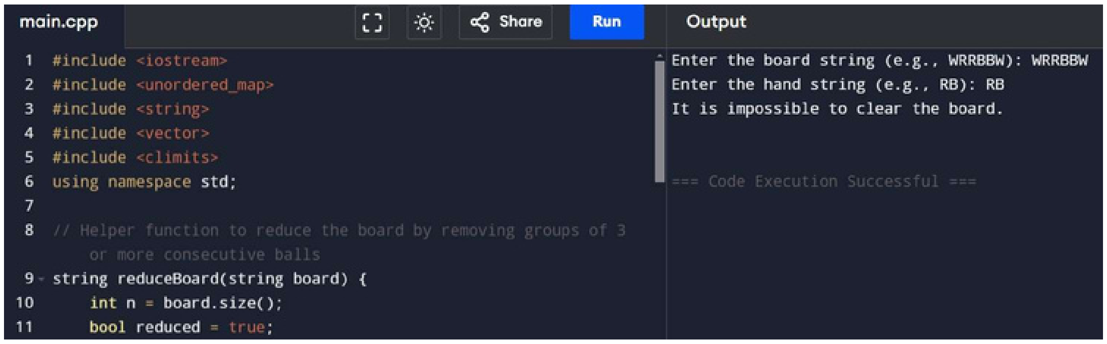
```
#include <iostream>
#include <queue>
#include <vector>
using namespace std;

// 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);
    }
```

```
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 :



```cpp
#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;
```

```
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 ===
```