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Section: 22BCS_IOT_620-A **Date:** 20-12-24

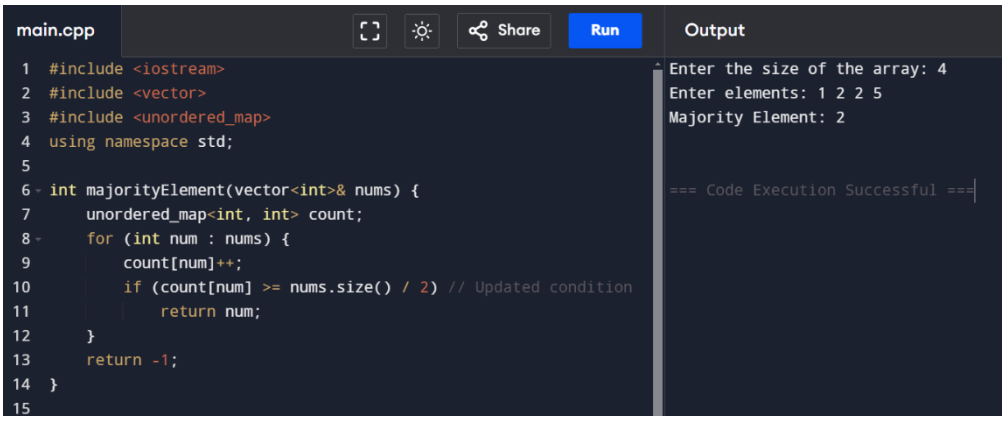
DOMAIN WINTER WINNING CAMP-Day(2)

1) Majority Element

Code:

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

int majorityElement(vector<int>& nums) {
   unordered_map<int, int> count;
   for (int num : nums) {
      count[num]++;
      if (count[num] >= nums.size() / 2) // Updated condition
         return num;
   }
   return -1;
}

int main() {
   int n;
   cout << "Enter the size of the array: ";
   cin >> n;
   vector<int> nums(n);
   cout << "Enter elements: ";
   for (int& num : nums) cin >> num;
   cout << "Majority Element: " << majorityElement(nums) << endl;
   return 0;
}
```

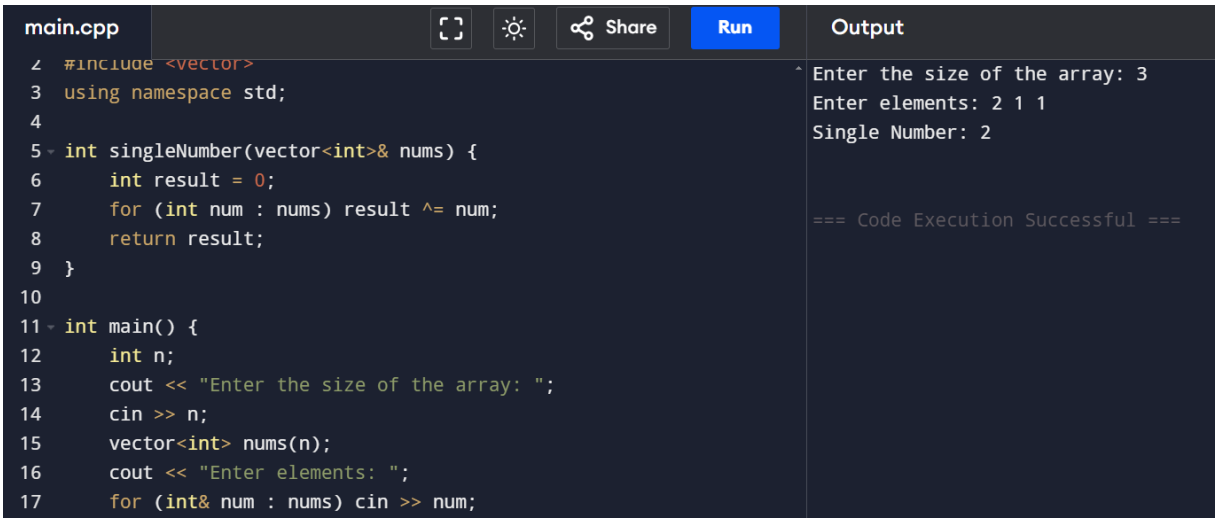
Output:



2) Single Number

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

int singleNumber(vector<int>& nums) {
    int result = 0;
    for (int num : nums) result ^= num;
    return result;
}

int main() {
    int n;
    cout << "Enter the size of the array: ";
    cin >> n;
    vector<int> nums(n);
    cout << "Enter elements: ";
    for (int& num : nums) cin >> num;
    cout << "Single Number: " << singleNumber(nums) << endl;
    return 0;
}
```

Output:



3) Convert Sorted Array to Binary Search Tree

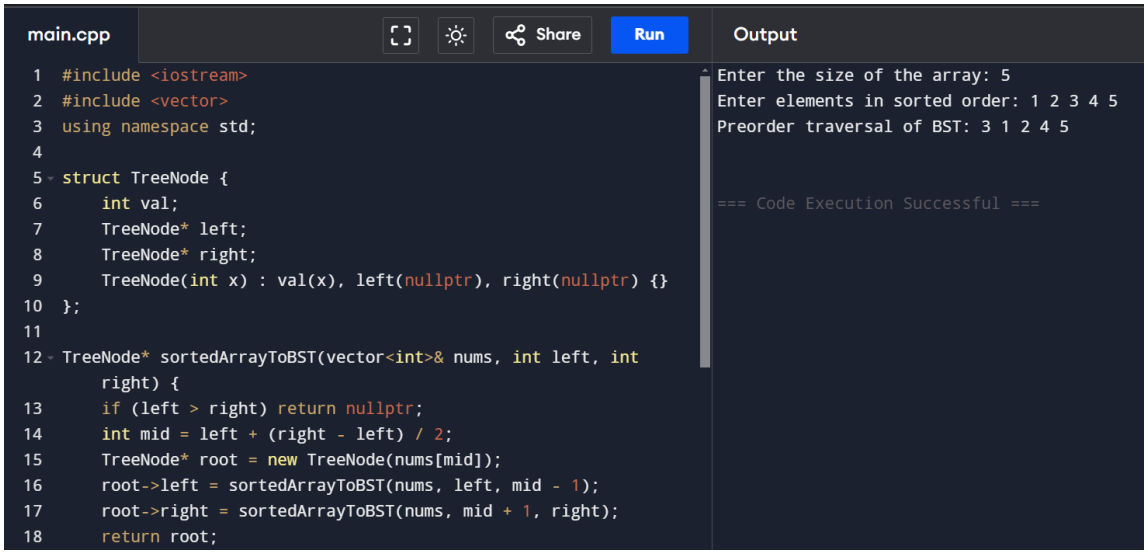
```
#include <iostream>

#include <vector>

using namespace std;


struct TreeNode {

    int val;

    TreeNode* left;

    TreeNode* right;

    TreeNode(int x)
val(x), left(nullptr),
right(nullptr) {}

};
```

```
TreeNode*
sortedArrayToBST(vect
or<int>& nums, int left,
int right) {
   if (left > right) return
nullptr;
   int mid = left + (right
- left) / 2;
   TreeNode* root =
new
TreeNode(nums[mid]);
   root->left =
sortedArrayToBST(num
s, left, mid - 1);
   root->right =
sortedArrayToBST(num
s, mid + 1, right);
   return root;
}

void
preorder(TreeNode*
root) {
   if (!root) return;
   cout << root->val <<
```

```
";
    preorder(root->left);
    preorder(root-
>right);
}

int main() {
    int n;
    cout << "Enter the
size of the array: ";
    cin >> n;
    vector<int> nums(n);
cout << "Enter
elements in sorted
order: ";
    for (int& num : nums)
cin >> num;
    TreeNode* root =
sortedArrayToBST(num
s, 0, n - 1);
    cout << "Preorder
traversal of BST: ";
    preorder(root);
```

```
    cout << endl;

    return 0;

}
```

Output:



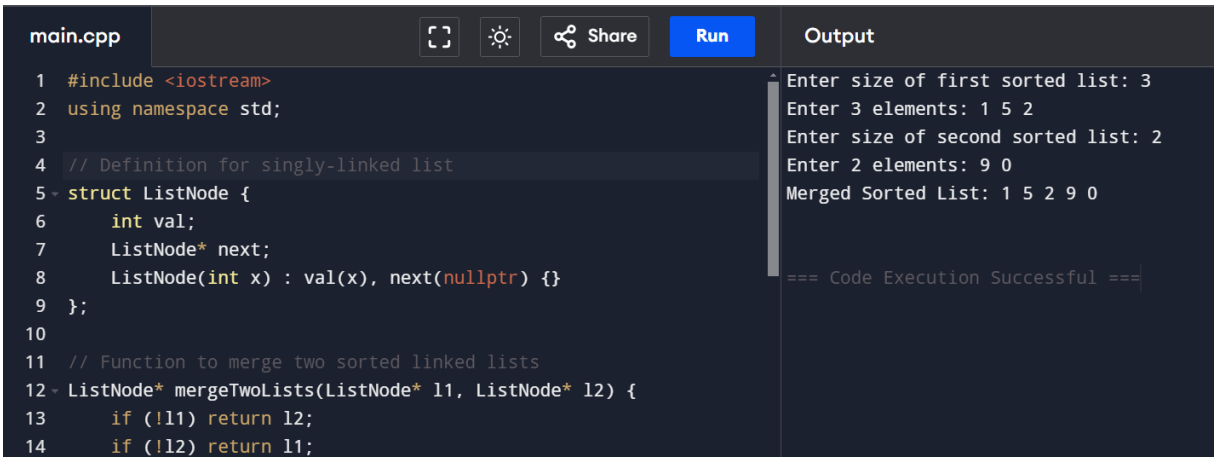
4) Merge Two Sorted Lists

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

// Definition for singly-linked list
struct ListNode {
    int val;
    ListNode* next;
    ListNode(int x) : val(x), next(nullptr) {}
};

// Function to merge two sorted linked lists
ListNode* mergeTwoLists(ListNode* l1, ListNode* l2) {
    if (!l1) return l2;
    if (!l2) return l1;
    if (l1->val < l2->val) {
        l1->next = mergeTwoLists(l1->next, l2);
        return l1;
    } else {
        l2->next = mergeTwoLists(l1, l2->next);
```

```
        return l2;
    }
}

// Function to create a linked list from user input
ListNode* createList(int n) {
    ListNode* head = nullptr;
    ListNode* tail = nullptr;
    cout << "Enter " << n << " elements: ";
    for (int i = 0; i < n; i++) {
        int val;
        cin >> val;
        ListNode* newNode = new ListNode(val);
        if (!head) {
            head = tail = newNode;
        } else {
            tail->next = newNode;
            tail = newNode;
        }
    }
    return head;
}

// Function to print a linked list
void printList(ListNode* head) {
    while (head) {
        cout << head->val << " ";
        head = head->next;
    }
    cout << endl;
}

int main() {
    int n1, n2;
    cout << "Enter size of first sorted list: ";
    cin >> n1;
    ListNode* l1 = createList(n1);

    cout << "Enter size of second sorted list: ";
    cin >> n2;
    ListNode* l2 = createList(n2);

    ListNode* mergedList = mergeTwoLists(l1, l2);
```

```
    cout << "Merged Sorted List: ";
    printList(mergedList);

    return 0;
}
```

Output:



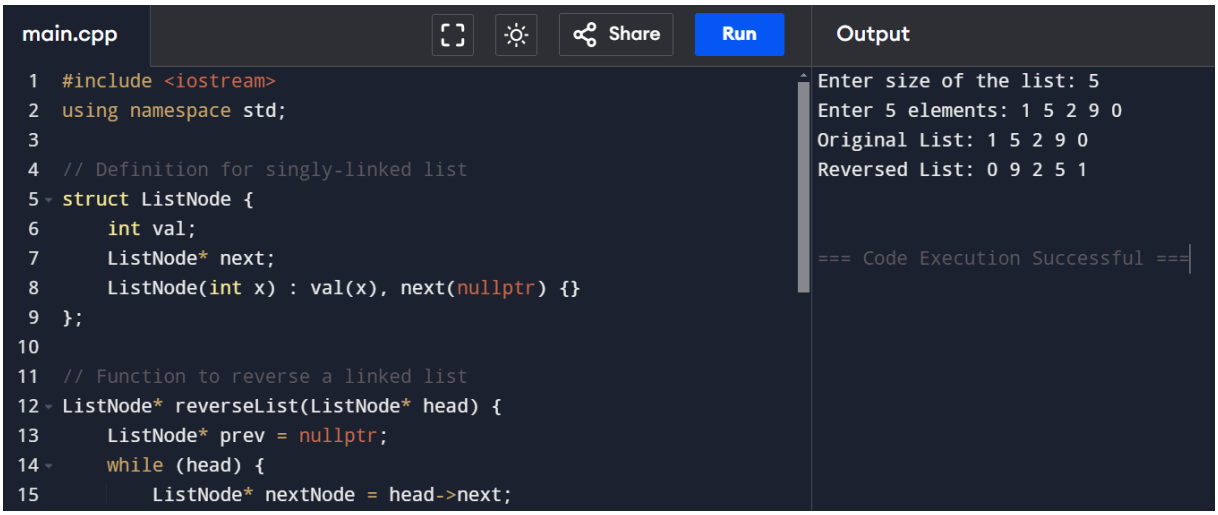
5) Reverse Linked List

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

// Definition for singly-linked list
struct ListNode {
    int val;
    ListNode* next;
    ListNode(int x) : val(x), next(nullptr) {}
};

// Function to reverse a linked list
ListNode* reverseList(ListNode* head) {
    ListNode* prev = nullptr;
```

```
    while (head) {
        ListNode* nextNode = head->next;
        head->next = prev;
        prev = head;
        head = nextNode;
    }
    return prev;
}

// Function to create a linked list from user input
ListNode* createList(int n) {
    ListNode* head = nullptr;
    ListNode* tail = nullptr;
    cout << "Enter " << n << " elements: ";
    for (int i = 0; i < n; i++) {
        int val;
        cin >> val;
        ListNode* newNode = new ListNode(val);
        if (!head) {
            head = tail = newNode;
        } else {
            tail->next = newNode;
            tail = newNode;
        }
    }
    return head;
}

// Function to print a linked list
```

```
void printList(ListNode* head) {
    while (head) {
        cout << head->val << " ";
        head = head->next;
    }
    cout << endl;
}

int main() {
    int n;
    cout << "Enter size of the list: ";
    cin >> n;
    ListNode* head = createList(n);

    cout << "Original List: ";
    printList(head);

    head = reverseList(head);

    cout << "Reversed List: ";
    printList(head);

    return 0;
}
```

Output:

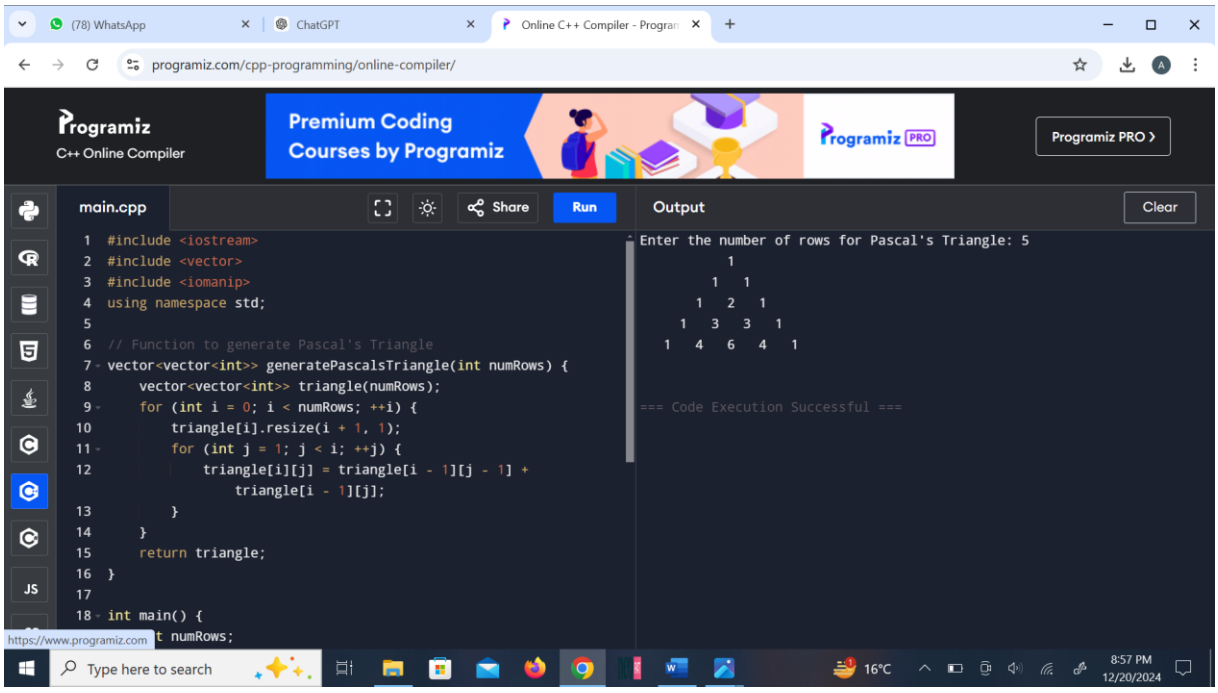


6) Pascals triangle

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

// Function to generate Pascal's Triangle
vector<vector<int>> generatePascalsTriangle(int numRows) {
    vector<vector<int>> triangle(numRows);
    for (int i = 0; i < numRows; ++i) {
        triangle[i].resize(i + 1, 1);
        for (int j = 1; j < i; ++j) {
            triangle[i][j] = triangle[i - 1][j - 1] + triangle[i - 1][j];
        }
    }
    return triangle;
}

int main() {
    int numRows;
    cout << "Enter the number of rows for Pascal's Triangle: ";
    cin >> numRows;

    vector<vector<int>> triangle = generatePascalsTriangle(numRows);

    // Calculate the maximum width for spacing
    int maxWidth = triangle[numRows - 1].size() * 4;
```

```
    for (int i = 0; i < numRows; ++i) {
        // Print leading spaces for alignment
        int leadingSpaces = (maxWidth - (triangle[i].size() * 4)) / 2;
        cout << string(leadingSpaces, ' ');

        // Print the current row of Pascal's Triangle
        for (int num : triangle[i]) {
            cout << setw(4) << num;
        }
        cout << endl;
    }

    return 0;
}
```

Output :



7) Container With Most Water

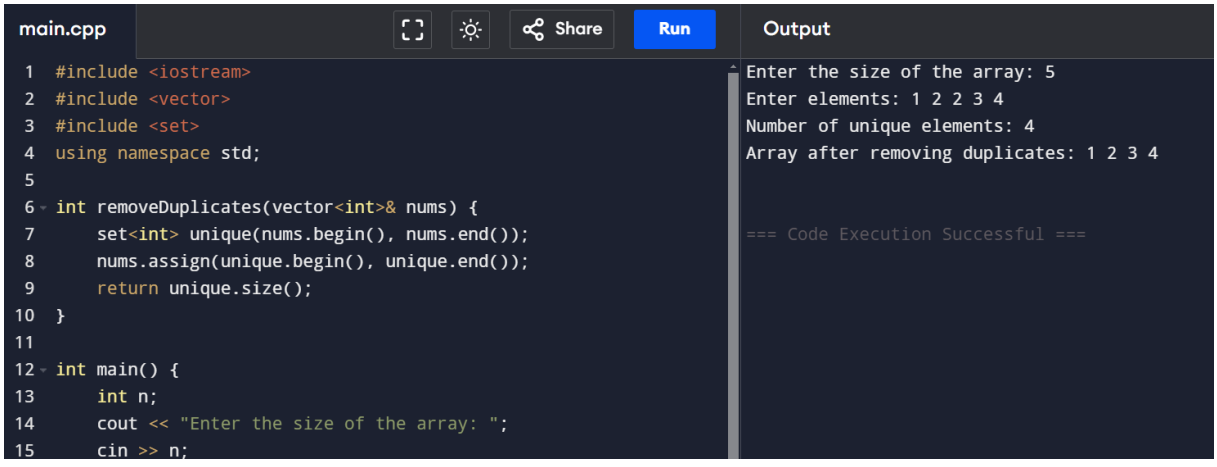
```
#include <iostream>
#include <vector>
using namespace std;

int maxArea(vector<int>& height) {
    int left = 0, right = height.size() - 1;
    int maxArea = 0;
    while (left < right) {
        maxArea = max(maxArea, min(height[left], height[right]) * (right - left));
        if (height[left] < height[right]) ++left;
        else --right;
    }
    return maxArea;
}

int main() {
    int n;
    cout << "Enter the size of the array: ";
    cin >> n;
    vector<int> height(n);
    cout << "Enter elements (heights): ";
    for (int& h : height) cin >> h;
    cout << "Maximum water area: " << maxArea(height) << endl;
    return 0;
}
```

Output :

8) Remove Duplicates from Array

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

int removeDuplicates(vector<int>& nums) {
    set<int> unique(nums.begin(), nums.end());
    nums.assign(unique.begin(), unique.end());
    return unique.size();
}

int main() {
    int n;
    cout << "Enter the size of the array: ";
    cin >> n;
    vector<int> nums(n);
    cout << "Enter elements: ";
    for (int& num : nums) cin >> num;
    int uniqueCount = removeDuplicates(nums);
    cout << "Number of unique elements: " << uniqueCount << endl;
    cout << "Array after removing duplicates: ";
    for (int num : nums) cout << num << " ";
    cout << endl;
    return 0;
}
```

Output :

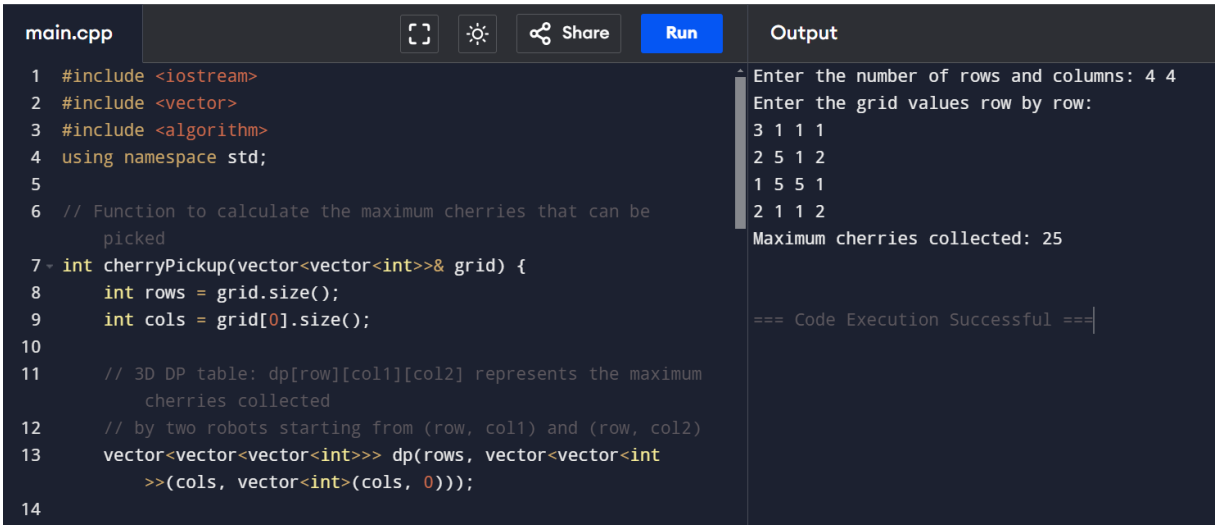


9) Cherry Pickup II (Dynamic Programming Solution)

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

// Function to calculate the maximum cherries that can be picked
int cherryPickup(vector<vector<int>>& grid) {
    int rows = grid.size();
    int cols = grid[0].size();

    // 3D DP table: dp[row][col1][col2] represents the maximum cherries
collected
    // by two robots starting from (row, col1) and (row, col2)
    vector<vector<vector<int>>> dp(rows, vector<vector<int>>(cols,
vector<int>(cols, 0)));

    // Base case: Last row, both robots can collect cherries at their positions
    for (int col1 = 0; col1 < cols; ++col1) {
        for (int col2 = 0; col2 < cols; ++col2) {
            if (col1 == col2) {
                dp[rows - 1][col1][col2] = grid[rows - 1][col1];
            } else {
                dp[rows - 1][col1][col2] = grid[rows - 1][col1] + grid[rows - 1][col2];
            }
        }
    }

    // Fill the DP table from bottom to top
    for (int row = rows - 2; row >= 0; --row) {
        for (int col1 = 0; col1 < cols; ++col1) {
            for (int col2 = 0; col2 < cols; ++col2) {
                int maxCherries = 0;

                // Try all possible moves for both robots
                for (int move1 = -1; move1 <= 1; ++move1) {
                    for (int move2 = -1; move2 <= 1; ++move2) {
                        int newCol1 = col1 + move1;
                        int newCol2 = col2 + move2;

                        if (newCol1 >= 0 && newCol1 < cols && newCol2 >= 0 &&
newCol2 < cols) {
```

```
                    maxCherries = max(maxCherries, dp[row +
1][newCol1][newCol2]);
                }
            }
        }

        if (col1 == col2) {
            dp[row][col1][col2] = grid[row][col1] + maxCherries;
        } else {
            dp[row][col1][col2] = grid[row][col1] + grid[row][col2] +
maxCherries;
        }
      }
    }
  }

  // Maximum cherries collected starting from the top row
  return dp[0][0][cols - 1];
}

int main() {
  int rows, cols;
  cout << "Enter the number of rows and columns: ";
  cin >> rows >> cols;

  vector<vector<int>> grid(rows, vector<int>(cols));
  cout << "Enter the grid values row by row:\n";
  for (int i = 0; i < rows; ++i) {
    for (int j = 0; j < cols; ++j) {
      cin >> grid[i][j];
    }
  }

  int result = cherryPickup(grid);
  cout << "Maximum cherries collected: " << result << endl;

  return 0;
}
```

Output :



10) Valid Sudoku

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

bool isValidSudoku(vector<vector<char>>& board) {
  for (int i = 0; i < 9; ++i) {
    unordered_set<char> rows, cols, box;
    for (int j = 0; j < 9; ++j) {
      if (board[i][j] != '.' && !rows.insert(board[i][j]).second) return false;
      if (board[j][i] != '.' && !cols.insert(board[j][i]).second) return false;
      int boxRow = 3 * (i / 3) + j / 3;
      int boxCol = 3 * (i % 3) + j % 3;
      if (board[boxRow][boxCol] != '.' &&
!box.insert(board[boxRow][boxCol]).second) return false;
    }
  }
  return true;
}

int main() {
  vector<vector<char>> board(9, vector<char>(9));
  cout << "Enter Sudoku board row by row (use '.' for empty cells):\n";
  for (int i = 0; i < 9; ++i) {
    for (int j = 0; j < 9; ++j) cin >> board[i][j];
  }
  cout << (isValidSudoku(board) ? "Valid Sudoku" : "Invalid Sudoku") << endl;
```

```
    return 0;
}
```

Output :