Day 2

Array & Linked list

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Section : 620 -B

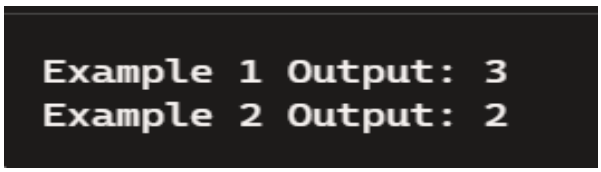
Very Easy

Q 1 : Majority Elements

Given an array nums of size n, return the majority element.
The majority element is the element that appears more than ⌊n / 2⌋ times. You may assume that the majority element always exists in the array.

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

int findMajorityElement(int arr[], int n) {
    int count = 0, candidate = -1;
    for (int i = 0; i < n; i++) {
        if (count == 0) {
            candidate = arr[i];
            count = 1;
        } else if (arr[i] == candidate) {
            count++;
        } else {
            count--;
        }
    }

    count = 0;
    for (int i = 0; i < n; i++) {
        if (arr[i] == candidate) {
            count++;
        }
    }

    if (count > n / 2) {
        return candidate;
```

```
    } else {
        return -1; // No majority element found
    }
}

int main() {
    int nums1[] = {3, 2, 3};
    int n1 = sizeof(nums1) / sizeof(nums1[0]);
    int majorityElement1 = findMajorityElement(nums1, n1);
    cout << "Example 1 Output: " << majorityElement1 << endl;

    int nums2[] = {2, 2, 1, 1, 1, 2, 2};
    int n2 = sizeof(nums2) / sizeof(nums2[0]);
    int majorityElement2 = findMajorityElement(nums2, n2);
    cout << "Example 2 Output: " << majorityElement2 << endl;

    return 0;
}
```

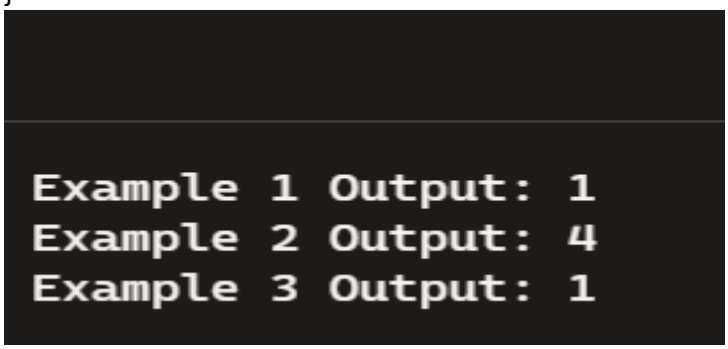


Question 2. Single Number

Given a non-empty array of integers nums, every element appears twice except for one. Find that single one.
You must implement a solution with a linear runtime complexity and use only constant extra space.

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

int singleNumber(int nums[], int n) {
    int result = 0;
    for (int i = 0; i < n; i++) {
        result ^= nums[i];
    }
    return result;
}
```

```
int main() {
    int nums1[] = {2, 2, 1};
    int n1 = sizeof(nums1) / sizeof(nums1[0]);
    int single1 = singleNumber(nums1, n1);
    cout << "Example 1 Output: " << single1 << endl;

    int nums2[] = {4, 1, 2, 1, 2};
    int n2 = sizeof(nums2) / sizeof(nums2[0]);
    int single2 = singleNumber(nums2, n2);
    cout << "Example 2 Output: " << single2 << endl;

    int nums3[] = {1};
    int n3 = sizeof(nums3) / sizeof(nums3[0]);
    int single3 = singleNumber(nums3, n3);
    cout << "Example 3 Output: " << single3 << endl;

    return 0;
}
```



Easy

Question 1. Pascal's Triangle

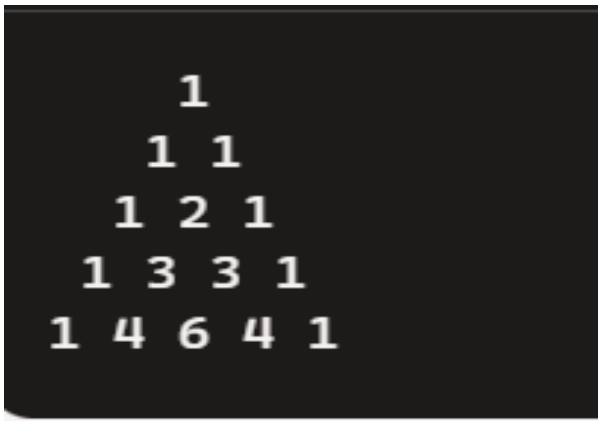
Given an integer numRows, return the first numRows of Pascal's triangle.

In Pascal's triangle, each number is the sum of the two numbers directly above it as shown:

Code:

```
#include <iostream>

using namespace std;

void printPascal(int n) {
    for (int line = 0; line < n; line++) {
```

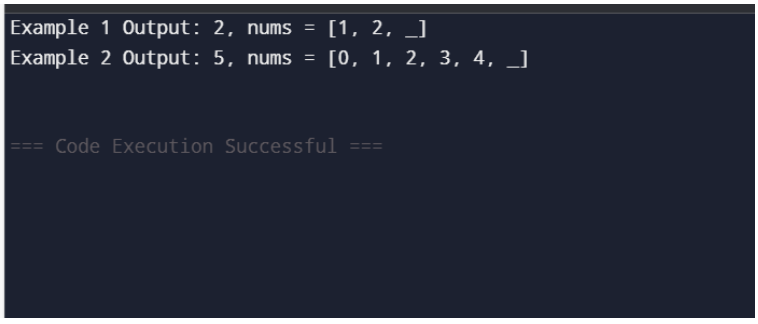
```
        for (int space = 0; space < n - line - 1; space++) {
            cout << " ";
        }
        int value = 1;
        for (int i = 0; i <= line; i++) {
            cout << value << " ";
            value = value * (line - i) / (i + 1);
        }
        cout << endl;
    }
}

int main() {
    int numRows;
    cout << "Enter the number of rows: ";
    cin >> numRows;
    printPascal(numRows);
    return 0;
}
```



Question 2. Remove Element

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

int removeDuplicates(int nums[], int n) {
    if (n == 0) return 0;
    int k = 1;
    for (int i = 1; i < n; i++) {
        if (nums[i] != nums[i - 1]) {
            nums[k] = nums[i];
            k++;
        }
```

```
    }
    return k;
}

int main() {
    int nums1[] = {1, 1, 2};
    int n1 = sizeof(nums1) / sizeof(nums1[0]);
    int k1 = removeDuplicates(nums1, n1);
    cout << "Example 1 Output: " << k1 << ", nums = [";
    for (int i = 0; i < k1; i++) {
        cout << nums1[i];
        if (i < k1 - 1) cout << ", ";
    }
    cout << ", _]" << endl;

    int nums2[] = {0, 0, 1, 1, 1, 2, 2, 3, 3, 4};
    int n2 = sizeof(nums2) / sizeof(nums2[0]);
    int k2 = removeDuplicates(nums2, n2);
    cout << "Example 2 Output: " << k2 << ", nums = [";
    for (int i = 0; i < k2; i++) {
        cout << nums2[i];
        if (i < k2 - 1) cout << ", ";
    }
    cout << ", _]" << endl;

    return 0;
}
```



Q3 .Remove Linked List Elements

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

struct ListNode {
    int val;
    ListNode* next;
    ListNode(int x) : val(x), next(NULL) {}
};
```

```
ListNode* removeElements(ListNode* head, int val) {
    while (head != NULL && head->val == val) {
        ListNode* temp = head;
head = head->next;
        delete temp;
    }

    ListNode* current = head;
    while (current != NULL && current->next != NULL) {
        if (current->next->val == val) {
            ListNode* temp = current->next;
            current->next = current->next->next;
            delete temp;
        } else {
            current = current->next;
        }
    }

    return head;
}

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

int main() {
    ListNode* head = new ListNode(1);
    head->next = new ListNode(2);
    head->next->next = new ListNode(6);
    head->next->next->next = new ListNode(3);
    head->next->next->next->next = new ListNode(4);
    head->next->next->next->next->next = new ListNode(5);
    head->next->next->next->next->next->next = new ListNode(6);

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

    int val = 6;
    head = removeElements(head, val);

    cout << "List after removing " << val << ": ";
    printList(head);
```

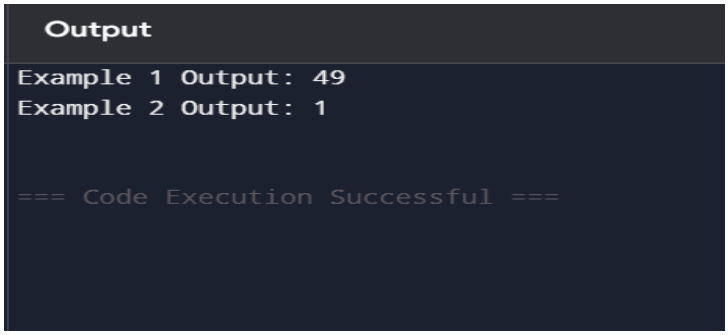
```
    return 0;
}
```

```
Original List: 1 2 6 3 4 5 6
List after removing 6: 1 2 3 4 5
```

Medium

Question 1. Container With Most Water

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

int maxArea(vector<int>& height) {
    int left = 0, right = height.size() - 1;
    int max_area = 0;

    while (left < right) {
        int width = right - left;
        int current_area = min(height[left], height[right]) * width;
        max_area = max(max_area, current_area);

        if (height[left] < height[right]) {
            left++;
        } else {
            right--;
        }
    }

    return max_area;
}

int main() {
    vector<int> height1 = {1, 8, 6, 2, 5, 4, 8, 3, 7};
    cout << "Example 1 Output: " << maxArea(height1) << endl;

    vector<int> height2 = {1, 1};
    cout << "Example 2 Output: " << maxArea(height2) << endl;

    return 0;
}
```



Question 2. Valid Sudoku

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

bool isValidSudoku(vector<vector<char>>& board) {
    vector<unordered_set<char>> rows(9), cols(9), boxes(9);

    for (int i = 0; i < 9; i++) {
        for (int j = 0; j < 9; j++) {
            char num = board[i][j];
            if (num == '.') continue;

            int boxIndex = (i / 3) * 3 + j / 3;
            if (rows[i].count(num) || cols[j].count(num) || boxes[boxIndex].count(num)) {
                return false;
            }

            rows[i].insert(num);
            cols[j].insert(num);
            boxes[boxIndex].insert(num);
        }
    }

    return true;
}

int main() {
    vector<vector<char>> board1 = {
        {'5', '3', '.', '.', '7', '.', '.', '.', '.'},
        {'6', '.', '.', '1', '9', '5', '.', '.', '.'},
        {'.', '9', '8', '.', '.', '.', '.', '6', '.'},
        {'8', '.', '.', '.', '6', '.', '.', '.', '3'},
        {'4', '.', '.', '8', '.', '3', '.', '.', '1'},
```

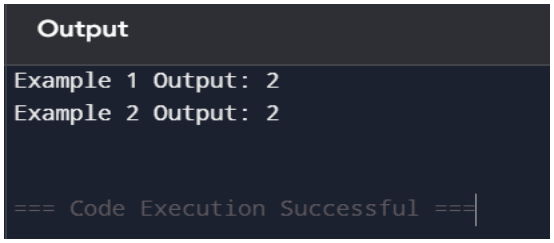
```
        {'7', '.', '.', '.', '2', '.', '.', '.', '6'},
        {'.', '6', '.', '.', '.', '.', '2', '8', '.'},
        {'.', '.', '.', '4', '1', '9', '.', '.', '5'},
        {'.', '.', '.', '.', '8', '.', '.', '7', '9'}
    };
    cout << "Example 1 Output: " << (isValidSudoku(board1) ? "true" : "false") << endl;



    return 0;
```

```
Output
Example 1 Output: true


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

Question 3 : Jump Game II

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

int jump(vector<int>& nums) {
    int n = nums.size();
    if (n == 1) return 0;

    int jumps = 0, currentEnd = 0, farthest = 0;
    for (int i = 0; i < n - 1; i++) {
        farthest = max(farthest, i + nums[i]);
        if (i == currentEnd) {
            jumps++;
            currentEnd = farthest;
        }
    }

    return jumps;
}

int main() {
    vector<int> nums1 = {2, 3, 1, 1, 4};
    cout << "Example 1 Output: " << jump(nums1) << endl;

    vector<int> nums2 = {2, 3, 0, 1, 4};
```

```
    cout << "Example 2 Output: " << jump(nums2) << endl;

    return 0;
}
```



Hard

Question 1. Maximum Number of Groups Getting Fresh Donuts

There is a donuts shop that bakes donuts in batches of batchSize. They have a rule where they must serve all of the donuts of a batch before serving any donuts of the next batch. You are given an integer batchSize and an integer array groups, where groups[i] denotes that there is a group of groups[i] customers that will visit the shop. Each customer will get exactly one donut.

Code:

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

int maxHappyGroups(int batchSize, vector<int>& groups) {
    unordered_map<int, int> remainderCount;
    for (int group : groups) {
        remainderCount[group % batchSize]++;
    }

    int happyGroups = remainderCount[0];
    for (int i = 1; i <= batchSize / 2; i++) {
        if (i == batchSize - i) {
            happyGroups += remainderCount[i] / 2;
        } else {
            happyGroups += min(remainderCount[i], remainderCount[batchSize - i]);
```

```
        }
    }

    return happyGroups;
}

int main() {
    int batchSize = 3;

    vector<int> groups = {1, 2, 3, 4, 5, 6};
    cout << "Maximum number of happy groups: " << maxHappyGroups(batchSize,
groups) << endl;

    return 0;
}
```

```
Maximum number of happy groups: 3
```

Ques 2 :Maximum Twin Sum of a Linked List

In a linked list of size n, where n is **even**, the ith node (**0-indexed**) of the linked list is known as the **twin** of the (n-1-i)th node, if 0 <= i <= (n / 2) - 1.

- For example, if n = 4, then node 0 is the twin of node 3, and node 1 is the twin of node 2. These are the only nodes with twins for n = 4.

The **twin sum** is defined as the sum of a node and its twin.
Given the head of a linked list with even length, return *the **maximum twin sum** of the linked list*.

Code :

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

```
struct ListNode {
    int val;
    ListNode* next;
    ListNode(int x) : val(x), next(NULL) {}
};

int pairSum(ListNode* head) {
    vector<int> values;
    ListNode* current = head;
    while (current != NULL) {
        values.push_back(current->val);
        current = current->next;
    }

    int maxSum = 0;
    int n = values.size();
    for (int i = 0; i < n / 2; i++) {
        int twinSum = values[i] + values[n - 1 - i];
        maxSum = max(maxSum, twinSum);
    }

    return maxSum;
}

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

int main() {
    ListNode* head1 = new ListNode(5);
    head1->next = new ListNode(4);
    head1->next->next = new ListNode(2);
    head1->next->next->next = new ListNode(1);
```

```
    cout << "Example 1 Output: " << pairSum(head1) << endl;

    ListNode* head2 = new ListNode(4);
    head2->next = new ListNode(2);
    head2->next->next = new ListNode(2);
    head2->next->next->next = new ListNode(3);

    cout << "Example 2 Output: " << pairSum(head2) << endl;

    return 0;
}
```