Day 2 Questions

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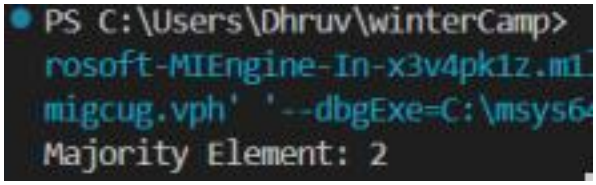
22BCS10381
KPIT-901/A

Q1. 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.

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

int majorityNum(const vector<int>& nums) {
   int max = 0;
   int count = 0;

   for (int num : nums) {
      if (count == 0) {
         max = num;
         count = 1;
      } else if (num == max) {
         count++;
      } else {
         count--;
      }
   }
   return max;
}

int main() {
   vector<int> nums = {2,2,1,1,1,2,2};
   cout << "Majority Element: " << majorityNum(nums) << endl;
   return 0;
}
```

Output:



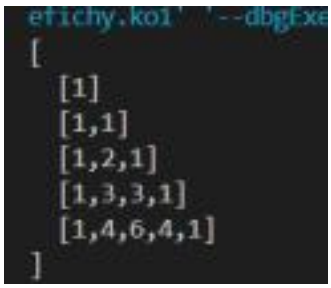
Q2. **Pascal's Triangle:**

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

Code:

```
#include <iostream>
#include <vector>
using namespace std;
vector<vector<int>> generate(int numRows) {
   vector<vector<int>> result;
   result.reserve(numRows);

   for (int i = 0; i < numRows; ++i) {
      vector<int> row(i + 1, 1); // Initialize all to 1
      for (int j = 1; j < i; ++j) {
         row[j] = result[i-1][j-1] + result[i-1][j];
      }
      result.push_back(row);
   }

   return result;
}

int main() {
   int numRows = 5;
   vector<vector<int>> pascal = generate(numRows);

   cout << "[\n";
   for (const auto& row : pascal) {
      cout << " [";
      for (int i = 0; i < (int)row.size(); ++i) {
         cout << row[i];
         if (i < (int)row.size() - 1) cout << ",";
      }
      cout << "]\n";
   }
   cout << "]" << endl;

   return 0;
}
```

Output:



Q3. **Container With Most Water**

You are given an integer array height of length n. There are n vertical lines drawn such that the two endpoints of the ith line are (i, 0) and (i, height[i]).

Find two lines that together with the x-axis form a container, such that the container contains the most water.

Return the maximum amount of water a container can store.

Code:

```
#include <iostream>
#include <vector>
#include <algorithm>

using namespace std;

class Solution {
public:
   int maxArea(vector<int>& height) {
      int left = 0;
      int right = (int)height.size() - 1;
      int max_water = 0;

      while (left < right) {
         int current_height = min(height[left], height[right]);
         int current_width = right - left;
         int current_area = current_height * current_width;

         max_water = max(max_water, current_area);

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

      return max_water;
   }
};

int main() {
   vector<int> height = {1,8,6,2,5,4,8,3,7};
   Solution sol;
   cout << "Maximum Area: " << sol.maxArea(height) <<
   endl; return 0;
}
```

Output:

Q4. Maximum Number of Groups Getting Fresh

Donuts. Q5. Find Minimum Time to Finish All Jobs.

Code:

```
#include <iostream>
#include <vector>
#include <algorithm>
#include <unordered_set>
#include <functional>
```

```
using namespace std;

class Solution {
public:
    int maxHappyGroups(int batchSize, vector<int>& groups) {
        int ans = 0;
        vector<int> cnt(batchSize, 0);
        for (int g : groups) {
            int r = g % batchSize;
            if (r == 0) ans++;
            else cnt[r]++;
        }
        vector<int> freq;
        for (int i = 1; i < batchSize; i++) {
            for (int j = 0; j < cnt[i]; j++)
                freq.push_back(i);
        }
        if (freq.empty()) return ans;
        int n = (int)freq.size();
        vector<vector<int>> memo(1 << n, vector<int>(batchSize, -1));
        function<int(int,int)> dfs = [&](int mask, int r) -> int {
            if (mask == (1 << n) - 1) return 0;
            if (memo[mask][r] != -1) return memo[mask][r];
            int res = 0;
            for (int i = 0; i < n; i++) {
                if ((mask & (1 << i)) == 0) {
                    int nr = (r + freq[i]) % batchSize;
                    res = max(res, (nr == 0 ? 1 : 0) + dfs(mask | (1 << i), nr));
                }
            }
            memo[mask][r] = res;
            return res;
        };
        ans += dfs(0, 0);
        return ans;
    }
};

class Solution2 {
public:
    int res;
    void backtrack(vector<int>& jobs, vector<int>& workerTime, int idx, int k, int
        curMax) { if (idx == (int)jobs.size()) {
            res = min(res, curMax);
            return;
        }
        if (curMax >= res) return;
        unordered_set<int> seen;
        for (int i = 0; i < k; i++) {
            if (seen.count(workerTime[i])) continue;
            seen.insert(workerTime[i]);
            workerTime[i] += jobs[idx];
            backtrack(jobs, workerTime, idx + 1, k, max(curMax,
            workerTime[i])); workerTime[i] -= jobs[idx];
            if (workerTime[i] == 0) break;
        }
    }
    int minimumTimeRequired(vector<int>& jobs, int k)
```

```
        { sort(jobs.begin(), jobs.end(), greater<int>());
        int sum = 0;
        for (auto j : jobs) sum += j;
        res = sum;
        vector<int> workerTime(k, 0);
        backtrack(jobs, workerTime, 0, k, 0);
        return res;
    }
};

int main() {
    {
        Solution sol;
        int batchSize = 3;
        vector<int> groups = {1,2,3,4,5,6};
        cout << sol.maxHappyGroups(batchSize, groups) <<
    endl; }
    {
        Solution sol;
        int batchSize = 4;
        vector<int> groups = {1,3,2,5,2,2,1,6};
        cout << sol.maxHappyGroups(batchSize, groups) <<
    endl; }
    {
        Solution2 sol2;
        vector<int> jobs = {3,2,3};
        int k = 3;
        cout << sol2.minimumTimeRequired(jobs, k) <<
    endl; }
    {
        Solution2 sol2;
        vector<int> jobs = {1,2,4,7,8};
        int k = 2;
        cout << sol2.minimumTimeRequired(jobs, k) <<
    endl; }
    return 0;
}
```

Output: