DSA MOST LIKELY QUESTIONS

1-Set Matrix zeros:

***Problem Statement:****Given a matrix if an element in the matrix is 0 then you will have to set its entire column and row to 0 and then return the matrix.*

void setZeros(vector<vector<int>> &m)

{

    map<int, int> row, col;

    for (int i = 0; i < m.size(); i++)

    {

        for (int j = 0; j < m[0].size(); j++)

        {

            if (m[i][j] == 0)

            {

                row[i]++;

                col[j]++;

            }

        }

    }

    for (auto x : row)

    {

        for (int i = 0; i < m[0].size(); i++)

        {

            m[x.first][i] = 0;

        }

    }

    for (auto x : col)

    {

        for (int i = 0; i < m.size(); i++)

        {

            m[i][x.first] = 0;

        }

    }

}

2-Pascals Triangle:

***Problem Statement:****Given an integer****N****, return the first****N****rows of Pascal’s triangle.*

vector<vector<int>> generate(int numRows)

{

    vector<vector<int>> ans(numRows);

    for (int i = 0; i < numRows; i++)

    {

        ans[i].resize(i + 1);

        ans[i][0] = 1;

        ans[i][i] = 1;

        for (int j = 1; j < i; j++)

        {

            ans[i][j] = ans[i - 1][j - 1] + ans[i - 1][j];

        }

    }

    return ans;

}

3-Next Permutation

***Problem Statement:****Given an array Arr[] of integers, rearrange the numbers of the given array into the lexicographically next greater permutation of numbers.*

*If such an arrangement is not possible, it must rearrange it as the lowest possible order (i.e., sorted in ascending order).*

void nextPermutation(vector<int> &nums)

{

    int i = nums.size() - 2;

    while (i >= 0 && nums[i + 1] <= nums[i])

    {

        i--;

    }

    if (i >= 0)

    {

        int j = nums.size() - 1;

        while (nums[j] <= nums[i])

        {

            j--;

        }

        swap(nums[i], nums[j]);

    }

    reverse(nums.begin() + i + 1, nums.end());

}

4-Kadane’s Algorithm

***Problem Statement****: Given an integer array arr, find the contiguous sub-array (containing at least one number) which  
has the largest sum and return its sum and print the sub-array.*

int Kandane(vector<int> &nums)

{

    int ans = 0;

    int cur = 0;

    int mx = INT\_MIN;

    if (nums.size() == 1)

        return nums[0];

    for (auto x : nums)

    {

        cur += x;

        mx = max(mx, cur);

        if (cur > 0)

            ans = max(ans, cur);

        else

            cur = 0;

    }

    if (ans == 0)

        return mx;

    else

        return ans;

}

5-Sort an Array of 0’s 1’s & 2’s

***Problem Statement:****Given an array consisting of only 0s, 1s and 2s. Write a program to in-place sort the array without using inbuilt sort functions. ( Expected: Single pass-O(N) and constant space)*

void sortColors(vector<int> &nums)

{

    int i = 0;

    for (int v = 0; v <= 1; v++)

    {

        for (int j = 0; j < nums.size(); j++)

        {

            if (nums[j] == v)

            {

                swap(nums[j], nums[i]);

                i++;

            }

        }

    }

}

*6-Stock buy and sell problem*

**Problem Statement:** You are given an array of prices where prices[i] is the price of a given stock on an ith day. You want to maximize your profit by choosing a single day to buy one stock and choosing a different day in the future to sell that stock. Return the maximum profit you can achieve from this transaction. If you cannot achieve any profit, return 0.

int maxProfit(vector<int> &p)

{

    int curr = INT\_MAX;

    int ans = 0;

    for (int i = 0; i < p.size(); i++)

    {

        curr = min(curr, p[i]);

        int pro = p[i] - curr;

        ans = max(ans, pro);

    }

    return ans;

}

*7-Merge overlapping intervals*

***Problem Statement:****Given an array of intervals, merge all the overlapping intervals and return an array of non-overlapping intervals.*

vector<vector<int>> merge(vector<vector<int>> &inter)

{

    sort(inter.begin(), inter.end());

    vector<vector<int>> ans;

    ans.push\_back({inter[0][0], inter[0][1]});

    for (int i = 1; i < inter.size(); i++)

    {

        vector<int> bc = ans.back();

        if (inter[i][0] >= bc[0] && inter[i][0] <= bc[1])

        {

            ans.pop\_back();

            vector<int> temp = {min(bc[0], inter[i][0]), max(bc[1], inter[i][1])};

            ans.push\_back(temp);

        }

        else

        {

            ans.push\_back({inter[i][0], inter[i][1]});

        }

    }

    return ans;

}

*8-merge two sorted array without extra space*

***Problem statement:****Given two sorted arrays****arr1[]****and****arr2[]****of**sizes****n****and****m****in non-decreasing order. Merge them in sorted order. Modify arr1 so that it contains the first N elements and modify arr2 so that it contains the last M elements.*

void merge(vector<int> &nums1, int m, vector<int> &nums2, int n)

{

    vector<int> ans;

    int i = 0, j = 0;

    while (i < m and j < n)

    {

        if (nums1[i] < nums2[j])

        {

            ans.push\_back(nums1[i]);

            i++;

        }

        else

        {

            ans.push\_back(nums2[j]);

            j++;

        }

    }

    while (i < m)

    { ans.push\_back(nums1[i]);

        i++;

}

    while (j < n)

{

        ans.push\_back(nums2[j]);

        j++;

    }

    nums1 = ans;

}

*9-Find Duplicate*

***Problem Statement:****Given an array of N + 1 size, where each element is between 1 and N. Assuming there is only one duplicate number, your task is to find the duplicate number.*

int findDuplicate(vector<int> &nums)

{

    int fast = nums[0];

    int slow = nums[0];

    do

    {

        fast = nums[nums[fast]];

        slow = nums[slow];

    } while (slow != fast);

    fast = nums[0];

    while (slow != fast)

    {

        fast = nums[fast];

        slow = nums[slow];

    }

    return slow;

}

*10-Rotate Image by 90deg*

***Problem Statement:****Given a matrix, your task is to rotate the matrix 90 degrees clockwise*.

void rotate(vector<vector<int>> &mat)

{

    for (int i = 0; i < mat.size(); i++)

    {

        for (int j = i + 1; j < mat[0].size(); j++)

        {

            swap(mat[i][j], mat[j][i]);

        }

    }

    for (int i = 0; i < mat.size(); i++)

    {

        reverse(mat[i].begin(), mat[i].end());

    }

}

*11-Repeating and Missing Element*

***Problem Statement:****You are given a read-only array of N integers with values also in the range [1, N] both inclusive. Each integer appears exactly once except A which appears twice and B which is missing. The task is to find the repeating and missing numbers A and B where A repeats twice and B is missing*.

vector<int> Solution::repeatedNumber(const vector<int> &A)

{

    long long int len = A.size();

    long long int S = (len \* (len + 1)) / 2;

    long long int P = (len \* (len + 1) \* (2 \* len + 1)) / 6;

    long long int missingNumber = 0, repeating = 0;

    for (int i = 0; i < A.size(); i++)

    {

        S -= (long long int)A[i];

        P -= (long long int)A[i] \* (long long int)A[i];

    }

    missingNumber = (S + P / S) / 2;

    repeating = missingNumber - S;

    vector<int> ans;

    ans.push\_back(repeating);

    ans.push\_back(missingNumber);

    return ans;

}

*12-Count Inversions in an Array*

***Problem Statement:****Given an array of N integers, count the inversion of the array (using*[*merge-sort*](https://takeuforward.org/data-structure/merge-sort-algorithm/)*).What is an inversion of an array? Definition: for all i & j < size of array, if i < j then you have to find pair (A[i],A[j]) such that A[j] < A[i].*

long long merge(vector<long long> &arr, vector<long long> &temp, int l, int mid, int r)

{

    int inver = 0;

    int i = l;

    int j = mid;

    int k = l;

    while (i <= mid - 1 && j <= r)

    {

        if (arr[i] < arr[j])

        {

            temp[k++] = arr[i++];

        }

        else

        {

            temp[k++] = arr[j++];

            inver += mid - i;

        }

    }

    while (i <= mid - 1)

        temp[k++] = arr[i++];

while (j <= r)

        temp[k++] = arr[j++];

    for (int i = l; i <= r; i++)

        arr[i] = temp[i];

    return inver;

}

long long mergeSort(vector<long long> &arr, vector<long long> &temp, int l, int r)

{

    int inver = 0;

    if (l < r)

    {

        int mid = l + (r - l) / 2;

        inver += mergeSort(arr, temp, l, mid);

        inver += mergeSort(arr, temp, mid + 1, r);

        inver += merge(arr, temp, l, mid + 1, r);

    }

    return inver;

}

long long getInversions(vector<long long> &arr, int n)

{

    vector<long long> temp(n);

    return mergeSort(arr, temp, 0, n - 1);

}

*13-Search in a 2-D sorted Array*

***Problem Statement:****Given an m\*n 2D matrix and an integer, write a program to find if the given integer exists in the matrix*

*Given matrix has the following properties:*

*1-Integers in each row are sorted from left to right and the first integer of each row is greater than the last integer of the previous row*

bool searchMatrix(vector<vector<int>> &mat, int t)

{

    int m = mat.size();

    int n = mat[0].size();

    int r = 0, c = n - 1;

    bool found = false;

    while (r < m && c >= 0)

    {

        if (mat[r][c] > t)

            c--;

        else if (mat[r][c] < t)

            r++;

        else

        {

            found = true;

            break;

        }

    }

    return found;

}

*14-Power(x,n)*

***Problem Statement:****Given a double x and integer n, calculate x raised to power n. Basically Implement pow(x, n).*

double bin(double a, long b)

{

    double ans = 1;

    if (b < 0)

    {

        b = -b;

        a = 1 / a;

    }

    while (b)

    {

        if (b & 1)

        {

            ans \*= a;

        }

        a = (a \* a);

        b >>= 1;

    }

    return ans;

}

double myPow(double x, int n)

{

    double ans = bin(x, n);

    return ans;

}

*15-Find the majority element that occurs more than n/2 times*

***Problem Statement:****Given an array of****N integers****, write a program to return an element that occurs more than****N/2****times in the given array. You may consider that such an element always exists in the array.*

int majorityElement(vector<int> &nums)

{

    // Moore’s Voting Algorithm

    int cnt = 0;

    int ele = 0;

    for (auto x : nums)

    {

        if (cnt == 0)

        {

            ele = x;

        }

        if (x == ele)

            cnt++;

        else

            cnt--;

    }

    return ele;

}

*16- Find the majority element that occurs more than n/3 times*

***Problem Statement:****Given an array of N integers. Find the elements that appear more than****N/3****times in the array. If no such element exists, return an empty vector.*

vector<int> majorityElement(vector<int> &nums)

{

    int c1 = 0;

    int c2 = 0;

    int n1 = -1;

    int n2 = -1;

    int n = nums.size();

    for (auto x : nums)

    {

        if (x == n1)

            c1++;

        else if (x == n2)

            c2++;

        else if (c1 == 0)

        {

            c1 = 1;

            n1 = x;

        }

        else if (c2 == 0)

        {

            c2 = 1;

            n2 = x;

        }

        else

        {

            c1--;

            c2--;

        }

    }

    c1 = 0;

    c2 = 0;

    for (auto x : nums)

    {

        if (x == n1)

            c1++;

        else if (x == n2)

            c2++;

    }

    vector<int> ans;

    if (c1 > n / 3)

        ans.push\_back(n1);

    if (c2 > n / 3)

        ans.push\_back(n2);

    return ans;

}

*17-Count Unique Paths*

***Problem Statement:****Given a matrix****m X n****, count paths from left-top to the right bottom of a matrix with the constraints that from each cell you can either only move to the rightward direction or the downward direction. The test cases are generated so that the answer will be less than or equal to 2 \* 109.*

int Paths(int i, int j, int n, int m, vector<vector<int>> &dp)

{

    if (i > n - 1 || j > m - 1)

        return 0;

    if (dp[i][j] != -1)

        return dp[i][j];

    if (i == n - 1 && j == m - 1)

        return 1;

    int ans = Paths(i + 1, j, n, m, dp) + Paths(i, j + 1, n, m, dp);

    return dp[i][j] = ans;

}

int uniquePaths(int n, int m)

{

    vector<vector<int>> dp(n + 1, vector<int>(m, -1));

    return Paths(0, 0, n, m, dp);

}

*18-Count Reverse Pairs*

***Problem Statement:****Given an array of numbers, you need to return the count of reverse pairs.****Reverse Pairs****are those pairs where i<j and arr[i]>2\*arr[j].*

int Merge(int l, int mid, int r, vector<int> &v, vector<int> &temp)

{

    int total = 0;

    int j = mid + 1;

    for (int i = l; i <= mid; i++)

    {

        while (j <= r && v[i] > 2LL \* v[j])

        {

            j++;

        }

        total += (j - (mid + 1));

    }

    int i = l;

    j = mid + 1;

    int k = l;

    while (i <= mid && j <= r)

    {

        if (v[i] <= v[j])

        {

            temp[k++] = v[i++];

        }

        else

        {

            temp[k++] = v[j++];

        }

    }

    while (i <= mid)

        temp[k++] = v[i++];

    while (j <= r)

        temp[k++] = v[j++];

    for (int i = l; i <= r; i++)

        v[i] = temp[i];

    return total;

}

int mergeSort(int l, int r, vector<int> &v, vector<int> &temp)

{

    int pairs = 0;

    if (l < r)

    {

        int mid = l + (r - l) / 2;

        pairs += mergeSort(l, mid, v, temp);

        pairs += mergeSort(mid + 1, r, v, temp);

        pairs += Merge(l, mid, r, v, temp);

    }

    return pairs;

}

int ReversePairs(vector<int> &v, int n)

{

    vector<int> temp(n);

    return mergeSort(0, n - 1, v, temp);

}