Олимпиада СПбГУ по информатике 2020/21 учебного года

A	B	C	D	E	F	Sum
100	100	100	100	55	25	480

Task A ()

```
#include <bits/stdc++.h>
using namespace std;

#define int long long
#define all(x) (x).begin(), (x).end()
#define rall(x) (x).rbegin(), (x).rend()
#define fs first
#define sc second
#define MP make_pair
#define pb push_back
#define sz(x) (int)x.size()
#define sqr(x) ((x) * (x))
mt19937 rng(chrono::steady_clock::now().time_since_epoch().count());

signed main() {
    ios_base::sync_with_stdio(0), cin.tie(0), cout.tie(0);
#ifdef FLameDragon
    freopen("in.txt", "r", stdin);
//    freopen("out.txt", "w", stdout);
#endif
    int n;
    cin >> n;
    if (n <= 10) {
        cout << n % 10 << '\n';
    } else {
        n--;
        n %= 9;
        if (n == 0) {
            cout << "0\n";
        } else {
            cout << n + 1 << '\n';
        }
    }
}
```

Task B ()

```cpp
#include <bits/stdc++.h>
using namespace std;

#define int long long
#define all(x) (x).begin(), (x).end()
#define rall(x) (x).rbegin(), (x).rend()
#define fs first
#define sc second
#define MP make_pair
#define pb push_back
#define sz(x) (int)x.size()
#define sqr(x) ((x) * (x))
mt19937 rng(chrono::steady_clock::now().time_since_epoch().count());

signed main() {
    ios_base::sync_with_stdio(0), cin.tie(0), cout.tie(0);
#ifdef FLameDragon
    freopen("in.txt", "r", stdin);
//    freopen("out.txt", "w", stdout);
#endif
    int n, k;
    cin >> n >> k;
    string s;
    cin >> s;
    int ans = 0;
    for (int i = 0; i < n; i += 1) {
        int j = i;
        set<int> cur;
        while (j < n) {
            cur.insert(s[j]);
            if (sz(cur) > 3 || j - i >= k) break;
            j += 1;
        }
        i = j - 1;
        cerr << i << endl;
        ans += 1;
    }
    cout << ans << '\n';
}
```

Task C ()

```
#include <bits/stdc++.h>
using namespace std;

//#define int long long
#define all(x) (x).begin(), (x).end()
#define rall(x) (x).rbegin(), (x).rend()
#define fs first
#define sc second
#define MP make_pair
#define pb push_back
#define sz(x) (int)x.size()
#define sqr(x) ((x) ∗ (x))
mt19937 rng(chrono::steady_clock::now().time_since_epoch().count());

const int N = 500 + 10;
const int W = 250000 + 10;
const int INF = 1e9;
int n, X, Y;
int x[N], y[N];
int dp[N][W];

inline bool updMax(int &x, int y) {
    if (y > x) {
        x = y;
        return true;
    }
    return false;
}

void init() {
    for (int i = 0; i < N; i++) {
        for (int j = 0; j < W; j++) {
            dp[i][j] = −INF;
        }
    }
}

signed main() {
    ios_base::sync_with_stdio(0), cin.tie(0), cout.tie(0);
#ifdef FLameDragon
    freopen("in.txt", "r", stdin);
//    freopen("out.txt", "w", stdout);
#endif
    init();
    cin >> n >> X >> Y;
    for (int i = 1; i <= n; i++) {
        cin >> x[i];
    }
    int sum = 0;
    for (int i = 1; i <= n; i++) {
        cin >> y[i];
        sum += y[i];
    }
    Y = sum − Y;
    Y = max(Y, 0);
    dp[0][0] = 0;
    for (int i = 1; i <= n; i++) {
        int cur = x[i];
        for (int w = 0; w < W; w++) {
            dp[i][w] = dp[i − 1][w];
        }
        for (int w = cur; w <= X; w++) {
            updMax(dp[i][w], dp[i − 1][w − cur] + y[i]);
        }
    }
    int i = 0, j = 0;
    for (int a = 0; a <= n; a++) {
        for (int b = 0; b <= X; b++) {
            if (dp[a][b] > dp[i][j]) {
                i = a;
                j = b;
            }
        }
    }
    if (dp[i][j] < Y) {
        cout << "-1\n";
        return 0;
    }
    cerr << i << ' ' << j << endl;
    string ans(n, 'y');
    while (i) {
        if (j >= x[i] && dp[i][j] == dp[i - 1][j - x[i]] + y[i]) {
            j -= x[i];
            ans[i - 1] = 'x';
        }
        i -= 1;
    }
    cout << ans << '\n';
}
```

Task D ()

```
#include <bits/stdc++.h>
using namespace std;

#define int long long
#define all(x) (x).begin(), (x).end()
#define rall(x) (x).rbegin(), (x).rend()
#define fs first
#define sc second
#define MP make_pair
#define pb push_back
#define sz(x) (int)x.size()
#define sqr(x) ((x) * (x))
mt19937 rng(chrono::steady_clock::now().time_since_epoch().count());

signed main() {
    ios_base::sync_with_stdio(0), cin.tie(0), cout.tie(0);
#ifdef FLameDragon
    freopen("in.txt", "r", stdin);
//    freopen("out.txt", "w", stdout);
#endif
    int n;
    cin >> n;
    string s;
    cin >> s;
    int ans = 0;
    auto getType = [&](char c) {
        if (c == '(' || c == ')') {
            return 0;
        } else {
            return 1;
        }
    };
    string tmp;
    for (int i = 0; i < 2 * n; i++) {
        int j = i;
        while (j < 2 * n && getType(s[i]) == getType(s[j])) {
            j += 1;
        }
        int len = j - i;
        if (len % 2 == 1) {
            tmp += s[i];
            if (sz(tmp) > 1 && getType(tmp[sz(tmp) - 2]) == getType(s[i])) {
                tmp.pop_back();
                tmp.pop_back();
            }
        }
        i = j - 1;
    }
    ans = sz(tmp);
    assert(ans % 2 == 0);
    cout << ans / 2 << '\n';
}
```

Task E ()

```
#include <bits/stdc++.h>
using namespace std;

#define int long long
#define all(x) (x).begin(), (x).end()
#define rall(x) (x).rbegin(), (x).rend()
#define fs first
#define sc second
#define MP make_pair
#define pb push_back
#define sz(x) (int)x.size()
#define sqr(x) ((x) * (x))
mt19937 rng(chrono::steady_clock::now().time_since_epoch().count());

const int P = 2523;
const int N = 100000;
const int K = 12;
vector<int> kek = { 84458, 4518, 1563, 46730, 84673, 4096, 37951, 99831, 48627, 12739, 3223,
    80926, 16950, 49532, 10422, 29248, 92398, 51676, 9628, 5987, 41762, 9734, 18197, 86891, 19300,
     29150, 29860, 89831, 11201, 40772, 9353, 26442, 6390, 76866, 3847, 34577, 21625, 29309,
    34551, 41010, 29941, 64958, 98008, 63469, 98515, 8628, 94739, 70051, 19646, 56416, 93687,
    60223, 41999, 84844, 65942, 17961, 13159, 72918, 48786, 54116, 92921, 25271, 35735, 19146,
    22576, 20133, 89134, 3814, 30415, 8380, 7227, 39202, 76246, 4255, 50715, 29220, 37127, 5183,
    27655, 43034, 65242, 22449, 39724, 5040, 99725, 53088, 88382, 93200, 31275, 30493, 49031,
    26219, 95346, 91167, 2190, 44257, 65487, 94600, 34557, 19340};
vector<int> idk = {32, 2049, 3, 515, 36, 69, 70, 1031, 264, 73, 74, 2059, 1036,
1037, 526, 47, 528, 81, 2066, 1043, 2068, 533, 150, 279, 2072, 57, 282, 155, 540,
1053, 94, 95, 1056, 1057, 98, 1059, 292, 165, 2086, 2087, 104, 297, 170, 171, 172,
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, 125, 318, 1087, 96, 193, 578, 2115, 100, 581, 86, 199, 584, 585, 2122, 587, 204,
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, 378, 251, 252, 253, 1150, 639, 192, 2177, 162, 2179, 196, 2181, 1158, 1159, 392,
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signed main() {
    ios_base::sync_with_stdio(0), cin.tie(0), cout.tie(0);
#ifdef FLameDragon
    freopen("in.txt", "r", stdin);
//    freopen("out.txt", "w", stdout);
#endif
    string type;
    cin >> type;
    int q;
    cin >> q;
    while (q--) {
        int n, k;
        cin >> n >> k;
        vector<int> a;
        for (int i = 0; i < k + (type == "clear"); i++) {
            int x;
            cin >> x;
            a.push_back(x);
        }
        sort(all(a));
        if (n < 11) {
            assert(k == 3);
            int mask = 0;
            int deg = 1;
            for (auto x : a) {
                mask += (x - 1) * deg;
                deg *= 10;
            }
//            cerr << mask << endl;
//            cerr << tmp[mask] << endl;
            if (type == "clear") {
                int ban = -1;
                for (int i = 0; i < sz(tmp); i++) {
                    if (tmp[i] == -1) continue;
                    vector<int> perm(4);
                    iota(all(perm), 0);
                    do {
                        int cur = 0;
                        deg = 1;
                        for (int i = 0; i < 4; i++) {
                            cur += deg * (a[perm[i]] - 1);
                            deg *= 10;
                        }
                        if (cur == tmp[i]) {
                            set<int> mda;
                            for (auto x : a) {
                                mda.insert(x - 1);
                            }
                            int x = i;
                            for (int j = 0; j < 3; j++) {
                                mda.erase(x % 10);
                                x /= 10;
                            }
                            cerr << i << '␣' << cur << endl;
                            assert(sz(mda) == 1);
                            ban = *mda.begin() + 1;
                            cerr << ban << endl;
                            break;
                        }
                    } while (next_permutation(all(perm)));
                }
                assert(ban != -1);
                for (auto x : a) {
                    if (x != ban) {
                        cout << x << '␣';
                    }
                }
                cout << endl;
            } else {
                assert(tmp[mask] != -1);
                int res = -1;
                int x = tmp[mask];
                for (int j = 0; j < 4; j++) {
                    if (!binary_search(all(a), x % 10 + 1)) {
                        res = x % 10 + 1;
                    }
                    x /= 10;
                }
                cout << res <<  endl;
            }
            continue;
        }

        if (k <= 10) {
            if (type == "clear") {
                for (auto x : a) {
                    if (x != P) {
                        cout << x << '␣';
                    }
                }
                cout << endl;
            } else {
                for (auto x : a) {
                    assert(x != P);
                }
                cout << P << endl;
            }
        } else {
            if (type == "add") {
                int mask = 0;
                for (int bit = 0; bit < K; bit++) {
                    if (binary_search(all(a), kek[bit])) {
                        mask += 1 << bit;
                    }
                }
                int bit = mask ^ idk[mask];
                assert(__builtin_popcount(bit) == 1);
                int deg = 0;
                while ((1 << deg) < bit) {
                    deg += 1;
                }
                cout << kek[deg] << endl;
            } else {
                int mask = 0;
                for (int bit = 0; bit < K; bit++) {
                    if (binary_search(all(a), kek[bit])) {
                        mask += 1 << bit;
                    }
                }
                int from = -1;
                for (int x = 0; x < (1 << K); x++) {
                    if (idk[x] == mask) {
                        from = x;
                        break;
                    }


                }
                assert(from != -1);
                int bit = mask ^ from;
                assert(__builtin_popcount(bit) == 1);
                int deg = 0;
                while ((1 << deg) < bit) {
                    deg += 1;
                }

                int ban = idk[deg];
                for (auto x : a) {
                    if (x != ban) {
                        cout << x << '␣';
                    }
                }
                cout << endl;
            }
        }
    }
}
```

Task F ()

```
#include <bits/stdc++.h>
using namespace std;

#define int long long
#define all(x) (x).begin(), (x).end()
#define rall(x) (x).rbegin(), (x).rend()
#define fs first
#define sc second
#define MP make_pair
#define pb push_back
#define sz(x) (int)x.size()
#define sqr(x) ((x) * (x))
mt19937 rng(chrono::steady_clock::now().time_since_epoch().count());

signed main() {
    ios_base::sync_with_stdio(0), cin.tie(0), cout.tie(0);
#ifdef FLameDragon
    freopen("in.txt", "r", stdin);
//    freopen("out.txt", "w", stdout);
#endif
    int n;
    cin >> n;
    cout << "4\n";
    cout << "0␣0\n";
    cout << "0␣2\n";
    cout << "2␣2\n";
    cout << "2␣0\n";
    vector<int> x = {-2, -2, -2, 0, 0, 2, 2, 2};
    vector<int> y = {-2, 0, 2, -2, 2, -2, 0, 2};
    for (int i = 0; i < n; i++) {
        cout << x[i] << '␣' << y[i] << '\n';
    }
}
```