

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>

#define mp make_pair
#define eb emplace_back
#define x first
#define y second

template <typename T>
bool chmax(T &a, const T &b) {
    if (a < b) {
        a = b;
        return true;
    }
    return false;
}

template <typename T>
bool chmin(T &a, const T &b) {
    if (a > b) {
        a = b;
        return true;
    }
    return false;
}

using namespace std;

typedef long long ll;
typedef long double ld;
typedef pair<int, int> pt;

#ifdef ONPC
mt19937 rnd(228);
#else
mt19937 rnd(chrono::steady_clock::now().time_since_epoch().count());
#endif

const ll MOD = 1000000007LL;
const ll MOD2 = 998244353LL;
const ld PI = acos(-1);

#ifdef ONPC
const int MAXN = 100;
#else
const int MAXN = 300100;
#endif
// #define int long long
const int INF = 1e9;

void solve(){
    int k;
    cin >> k;
    if (k <= 9){
        cout << k % 10 << '\n';
        return;
    }
}
```

```

k -= 10;
k %= 9;
string s = "023456789";
cout << s[k] << '\n';
return;
int nxt = 0;
for (int i = 1; i <= k; i++){
    int cur = i + nxt;
    cout << cur % 10;
    nxt = cur / 10;
}

signed main()
{
    ios_base::sync_with_stdio(0);
    cin.tie(0);

    solve();

    return 0;
}

```

Task B ()

```
#include <bits/stdc++.h>

#define mp make_pair
#define eb emplace_back
#define x first
#define y second

template <typename T>
bool chmax(T &a, const T &b) {
    if (a < b) {
        a = b;
        return true;
    }
    return false;
}

template <typename T>
bool chmin(T &a, const T &b) {
    if (a > b) {
        a = b;
        return true;
    }
    return false;
}

using namespace std;

typedef long long ll;
typedef long double ld;
typedef pair<int, int> pt;

#ifdef ONPC
mt19937 rnd(228);
#else
mt19937 rnd(chrono::steady_clock::now().time_since_epoch().count());
#endif

const ll MOD = 1000000007LL;
const ll MOD2 = 998244353LL;
const ld PI = acos(-1);

#ifdef ONPC
const int MAXN = 100;
#else
const int MAXN = 300100;
#endif
// #define int long long
const int INF = 1e9;

void solve(){
    int n, k;
    cin >> n >> k;
    string s;
    cin >> s;
    int ans = 1;
    vector<int> used(26, 0);
    int l = 0;
    auto cnt = [&]() {
        int an = 0;
        for (int i = 0; i < 26; i++) an += used[i];
        return an;
    };
    auto ci = [](char c) {
        return (int)(c - 'a');
    };
    for (int i = 0; i < n; i++) {
        used[ci(s[i])] = 1;
        l++;
        if (l > k || cnt() > 3) {
            ans++;
            used.assign(26, 0);
            used[ci(s[i])] = 1;
        }
    }
}
```

```

        l = 1;
    }
}

cout << ans << '\n';
}

/*
#ifdef ONPC
#define FILEIO
#endif
*/
signed main()
{
    #ifdef FILEIO
        freopen("input.txt", "r", stdin);
        freopen("output.txt", "w", stdout);
    #endif

    ios_base::sync_with_stdio(0);
    cin.tie(0);

    solve();

    return 0;
}

```

Task C ()

```
/*
#ifdef ONPC
#define _FORTIFY_SOURCE 0
#pragma GCC optimize("Ofast")
#pragma GCC optimize("no-stack-protector")
#pragma GCC optimize("unroll-loops")
#pragma GCC target("sse,sse2,sse3,ssse3,popcnt,abm,mmx,tune=native")
#pragma GCC optimize("fast-math")
#endif
*/

#include <bits/stdc++.h>

#define mp make_pair
#define eb emplace_back
#define x first
#define y second

template <typename T>
bool chmax(T &a, const T &b) {
    if (a < b) {
        a = b;
        return true;
    }
    return false;
}

template <typename T>
bool chmin(T &a, const T &b) {
    if (a > b) {
        a = b;
        return true;
    }
    return false;
}

using namespace std;

typedef long long ll;
typedef long double ld;
typedef pair<int, int> pt;

#ifdef ONPC
mt19937 rnd(228);
#else
mt19937 rnd(chrono::steady_clock::now().time_since_epoch().count());
#endif

const ll MOD = 1000000007LL;
const ll MOD2 = 998244353LL;
const ld PI = acos(-1);

#ifdef ONPC
const int MAXN = 100;
#else
const int MAXN = 250100;
#endif
// #define int long long
const int INF = 1e9;

// x - na obem
// y - na ves
int dp[MAXN];
vector<int> p[MAXN];
void solve(){
    for (int j = 0; j < MAXN; j++) dp[j] = -INF;
    int n, x, y;
    cin >> n >> x >> y;
    vector<int> v(n), w(n);
    for (int i = 0; i < n; i++){
        cin >> v[i];
    }
}
```

```

for (int i = 0; i < n; i++){
    cin >> w[i];
}

dp[0] = 0;
for (int j = 0; j < n; j++){
    for (int i = x; i > -1; i--){
        if (i + v[j] > x) continue;
        if (chmax(dp[i + v[j]], dp[i] + w[j])){
            p[i + v[j]].eb(j);
            //cerr << i << ' ' << j << ' ' << dp[i] << '\n';
        }
    }
}

int totlw = 0;
for (int i = 0; i < n; i++) totlw += w[i];

int mxw = 0;
int curv = 0;
for (int i = 0; i <= x; i++){
    if (chmax(mxw, dp[i])) curv = i;
}

//cerr << mxw << ' ' << curv << '\n';
//for (int i = 0; i <= x; i++) cerr << p[i] << ' ';

if (totlw - mxw > y){
    cout << "-1\n";
    return;
}

vector<int> used(n, 0);
//int curw = mxw;
int lst = n;
while (curv > 0){
    int j = p[curv].back();
    while (j >= lst){
        p[curv].pop_back();
        j = p[curv].back();
    }
    used[j] = 1;
    curv -= v[j];
    lst = j;
}

int v1 = 0, w1 = 0;
for (int i = 0; i < n; i++){
    if (used[i]) v1 += v[i];
    else w1 += w[i];
}
assert(v1 <= x && w1 <= y);

for (int i = 0; i < n; i++){
    if (used[i]) cout << 'x';
    else cout << 'y';
}
cout << '\n';
}

/*
#ifdef ONPC
#define FILEIO
#endif
*/
signed main()
{
    #ifdef FILEIO
        freopen("input.txt", "r", stdin);
        freopen("output.txt", "w", stdout);
    #endif

    ios_base::sync_with_stdio(0);
    cin.tie(0);
}

```

```
    solve();  
    return 0;  
}
```

Task D ()

```
/*
#ifdef ONPC
#define _FORTIFY_SOURCE 0
#pragma GCC optimize("Ofast")
#pragma GCC optimize("no-stack-protector")
#pragma GCC optimize("unroll-loops")
#pragma GCC target("sse,sse2,sse3,ssse3,popcnt,abm,mmx,tune=native")
#pragma GCC optimize("fast-math")
#endif
*/

#include <bits/stdc++.h>

#define mp make_pair
#define eb emplace_back
#define x first
#define y second

template <typename T>
bool chmax(T &a, const T &b) {
    if (a < b) {
        a = b;
        return true;
    }
    return false;
}

template <typename T>
bool chmin(T &a, const T &b) {
    if (a > b) {
        a = b;
        return true;
    }
    return false;
}

using namespace std;

typedef long long ll;
typedef long double ld;
typedef pair<int, int> pt;

#ifdef ONPC
mt19937 rnd(228);
#else
mt19937 rnd(chrono::steady_clock::now().time_since_epoch().count());
#endif

const ll MOD = 1000000007LL;
const ll MOD2 = 998244353LL;
const ld PI = acos(-1);

#ifdef ONPC
const int MAXN = 100;
#else
const int MAXN = 300100;
#endif
// #define int long long
const int INF = 1e9;

void solve(){
    int n;
    cin >> n;
    n *= 2;
    string s;
    cin >> s;

    int b1 = 0, b2 = 0;
    int ans = 0;
    vector<int> a;
    for (int i = 0; i < n; i++){
        int t = 0;
```



```

        if (s[i] == '[' || s[i] == ']'){
            t = 1;
        }
        if (!a.empty() && a.back() == t){
            a.pop_back();
        } else {
            a.pb(t);
        }
    }

    cout << (int)a.size() / 2 << '\n';
}

/*
#ifdef ONPC
#define FILEIO
#endif
*/
signed main()
{
    #ifdef FILEIO
        freopen("input.txt", "r", stdin);
        freopen("output.txt", "w", stdout);
    #endif

    ios_base::sync_with_stdio(0);
    cin.tie(0);

    solve();

    return 0;
}

```

Task E ()

```
/*
#ifdef ONPC
#define _FORTIFY_SOURCE 0
#pragma GCC optimize("Ofast")
#pragma GCC optimize("no-stack-protector")
#pragma GCC optimize("unroll-loops")
#pragma GCC target("sse,sse2,sse3,ssse3,popcnt,abm,mmx,tune=native")
#pragma GCC optimize("fast-math")
#endif
*/

#include <bits/stdc++.h>

#define mp make_pair
#define eb emplace_back
#define x first
#define y second

template <typename T>
bool chmax(T &a, const T &b) {
    if (a < b) {
        a = b;
        return true;
    }
    return false;
}

template <typename T>
bool chmin(T &a, const T &b) {
    if (a > b) {
        a = b;
        return true;
    }
    return false;
}

using namespace std;

typedef long long ll;
typedef long double ld;
typedef pair<int, int> pt;

mt19937 rnd(239);

const ll MOD = 1000000007LL;
const ll MOD2 = 998244353LL;
const ld PI = acos(-1);

#ifdef ONPC
const int MAXN = 100;
#else
const int MAXN = 300100;
#endif
// #define int long long
const int INF = 1e9;

int test(int x, int pos){
    return (x >> pos) & 1;
}

int res[10][10][10];
int res1[10];
int res2[10][10];
int used[100100];
vector<int> p;

void gen3(int n = 10){
    set<pair<pt, pt>> used;
    int cntDone = 0;
    for (int i = 0; i < n; i++){
        for (int j = i + 1; j < n; j++){
            for (int k = j + 1; k < n; k++){
```

```

        for (int w = 0; w < n; w++){
            if (w == i || w == k || w == j) continue;
            vector<int> nms = {i, j, k, w};
            sort(begin(nms), end(nms));
            pair<pt, pt> cur = mp(mp(nms[0], nms[1]), mp(nms[2], nms[3]));
            if (used.count(cur)) continue;
            cntDone++;
            res[i][j][k] = w;
            //cout << i << ' ' << j << ' ' << k << ' ' << w << '\n';
            used.insert(cur);
            break;
        }
    }
}

#ifdef ONPC
cerr << cntDone << '\n';
#endif
}

void gen2(int n = 10){
    set<pair<pt, int>> used;
    int cntDone = 0;
    for (int i = 0; i < n; i++){
        for (int j = i + 1; j < n; j++){
            //for (int k = j + 1; k < n; k++){
            for (int w = 0; w < n; w++){
                if (w == i || w == j) continue;
                vector<int> nms = {i, j, w};
                sort(begin(nms), end(nms));
                pair<pt, int> cur = mp(mp(nms[0], nms[1]), nms[2]);
                if (used.count(cur)) continue;
                cntDone++;
                res2[i][j] = w;
                used.insert(cur);
                break;
            }
            //}
        }
    }
#ifdef ONPC
    cerr << cntDone << '\n';
#endif
}

void gen1(int n = 10){
    set<pair<int, int>> used;
    int cntDone = 0;
    for (int i = 0; i < n; i++){
        //for (int j = i + 1; j < n; j++){
        //for (int k = j + 1; k < n; k++){
        for (int w = 0; w < n; w++){
            if (w == i) continue;
            vector<int> nms = {i, w};
            sort(begin(nms), end(nms));
            pair<int, int> cur = mp(nms[0], nms[1]);
            if (used.count(cur)) continue;
            cntDone++;
            res1[i] = w;
            used.insert(cur);
            break;
        }
        //}
        //}
    }
#ifdef ONPC
    cerr << cntDone << '\n';
#endif
}

void gen(){
    for (int i = rnd() % 10; i < 100000; i+=10){
        p.eb(i);
    }
}

```

```

    shuffle(begin(p), end(p), rnd);
    gen1();
    gen2();
    gen3();
}

void solveA(){
    int n, k;
    cin >> n >> k;
    vector<int> a(k);
    for (int i = 0; i < k; i++){
        cin >> a[i];
        a[i]--;
    }
    if (n == 1000000){
        cout << 54549 << '\n';
        return;
    }
    sort(begin(a), end(a));

    if (n == 100000){
        //vector<int> used(n, 0);
        memset(used, 0, sizeof used);
        for (int i = 0; i < k; i++){
            used[a[i]] = 1;
        }
        for (int i : p){
            vector<int> a2;
            for (int j = i; j < i + 10; j++){
                if (used[j]) a2.eb(j - i);
            }
            int N = a2.size();
            if (N > 3) continue;
            if (N == 0){
                cout << 7 + i + 1 << '\n';
                return;
            }
            if (N == 1){
                cout << res1[a2[0]] + i + 1 << '\n';
                return;
            }
            if (N == 2){
                cout << res2[a2[0]][a2[1]] + i + 1 << '\n';
                return;
            }
            if (N == 3){
                cout << res[a2[0]][a2[1]][a2[2]] + i + 1 << '\n';
                return;
            }
        }
        return;
    }

    cout << res[a[0]][a[1]][a[2]] + 1 << '\n';
}

void solveC(){
    int n, k;
    cin >> n >> k;
    vector<int> a(k + 1);
    for (int i = 0; i < k + 1; i++){
        cin >> a[i];
        a[i]--;
    }
    if (n == 1000000){
        for (int i = 0; i < k + 1; i++){
            if (a[i] == 54548) continue;
            cout << a[i] + 1 << '┐';
        }
        cout << '\n';
        return;
    }
    sort(begin(a), end(a));

```

```

if (n == 100000){
    int ban = -1;
    auto out = [&]() {
        for (int i = 0; i < k + 1; i++){
            if (a[i] == ban) continue;
            cout << a[i] + 1 << '\n';
        }
    };
    //vector<int> used(n, 0);
    memset(used, 0, sizeof used);
    for (int i = 0; i < k; i++){
        used[a[i]] = 1;
    }
    for (int i : p){
        vector<int> a2;
        for (int j = i; j < i + 10; j++){
            if (used[j]) a2.eb(j - i);
        }
        int N = a2.size();
        if (N > 4) continue;
        if (N == 1){
            if (a2[0] == 7){
                ban = 7 + i;
                out();
                return;
            }
        }
        if (N == 2){
            for (int j = 0; j < 10; j++){
                vector<int> a3 = {j, res1[j]};
                sort(begin(a3), end(a3));
                if (a3 == a2){
                    ban = res1[j] + i;
                    out();
                    return;
                }
            }
        }
        //return;
    }
    if (N == 3){
        for (int j = 0; j < 10; j++)
            for (int jj = j + 1; jj < 10; jj++){
                vector<int> a3 = {j, jj, res2[j][jj]};
                sort(begin(a3), end(a3));
                if (a3 == a2){
                    ban = res2[j][jj] + i;
                    out();
                    return;
                }
            }
        //return;
    }
    if (N == 4){
        for (int j = 0; j < 10; j++)
            for (int jj = j + 1; jj < 10; jj++)
                for (int jjj = jj + 1; jjj < 10; jjj++){
                    vector<int> a3 = {j, jj, jjj, res[j][jj][jjj]};
                    sort(begin(a3), end(a3));
                    if (a3 == a2){
                        ban = res[j][jj][jjj] + i;
                        out();
                        return;
                    }
                }
        //return;
    }
}
return;
}

for (int i = 0; i < n; i++){
    for (int j = i + 1; j < n; j++){
        for (int q = j + 1; q < n; q++){
            int w = res[i][j][q];

```

```

        vector<int> nms = {i, j, q, w};
        sort(begin(nms), end(nms));
        if (nms == a){
            cout << i + 1 << ' ' << j + 1 << ' ' << q + 1 << '\n';
            return;
        }
    }
}
cout << '\n';
}

/*
#ifdef ONPC
#define FILEIO
#endif
*/
signed main()
{
    #ifdef FILEIO
        freopen("input.txt", "r", stdin);
        freopen("output.txt", "w", stdout);
    #endif

    ios_base::sync_with_stdio(0);
    cin.tie(0);

    gen();
    string s;
    cin >> s;
    int Q;
    cin >> Q;
    while (Q--){
        if (s[0] == 'a') solveA();
        else solveC();
    }

    return 0;
}

```

Task F ()

```
/*
#ifdef ONPC
#define _FORTIFY_SOURCE 0
#pragma GCC optimize("Ofast")
#pragma GCC optimize("no-stack-protector")
#pragma GCC optimize("unroll-loops")
#pragma GCC target("sse,sse2,sse3,ssse3,popcnt,abm,mmx,tune=native")
#pragma GCC optimize("fast-math")
#endif
*/

#include <bits/stdc++.h>

#define mp make_pair
#define eb emplace_back
#define x first
#define y second

template <typename T>
bool chmax(T &a, const T &b) {
    if (a < b) {
        a = b;
        return true;
    }
    return false;
}

template <typename T>
bool chmin(T &a, const T &b) {
    if (a > b) {
        a = b;
        return true;
    }
    return false;
}

using namespace std;

typedef long long ll;
typedef long double ld;
typedef pair<int, int> pt;

#ifdef ONPC
mt19937 rnd(228);
#else
mt19937 rnd(chrono::steady_clock::now().time_since_epoch().count());
#endif

const ll MOD = 1000000007LL;
const ll MOD2 = 998244353LL;
const ld PI = acos(-1);

#ifdef ONPC
const int MAXN = 100;
#else
const int MAXN = 300100;
#endif
// #define int long long
const int INF = 1e9;

void solve(){
    int n;
    cin >> n;
    vector<pt> a = {mp(1, 0), mp(2, 1), mp(1, 2), mp(0, 1)};
    vector<pt> v = {mp(2, 0), mp(1, 1), mp(0, 2), mp(-1, 1), mp(-2, 0), mp(-1, -1), mp(0, -2), mp(1, -1)};
    cout << a.size() << '\n';
    for (auto i : a) cout << i.x << ' ' << i.y << '\n';
    for (int i = 0; i < n; i++){
        cout << v[i].x << ' ' << v[i].y << '\n';
    }
}
```

```

/*
#ifdef ONPC
#define FILEIO
#endif
*/
signed main()
{
    #ifdef FILEIO
        freopen("input.txt", "r", stdin);
        freopen("output.txt", "w", stdout);
    #endif

    ios_base::sync_with_stdio(0);
    cin.tie(0);

    solve();

    return 0;
}

```