Олимпиада СПбГУ по информатике 2020/21 учебного года

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

Task A ()

```cpp
#define _CRT_SECURE_NO_WARNINGS
#define _USE_MATH_DEFINES
//#define _GLIBCXX_DEBUG
#include <iostream>
#include <fstream>
#include <sstream>
#include <cstdio>
#include <cassert>
#include <climits>
#include <cstring>
#include <iomanip>
#include <vector>
#include <deque>
#include <stack>
#include <queue>
#include <string>
#include <cstdlib>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <cstdlib>
#include <cmath>
#include <bitset>
#include <random>
#include <numeric>
#include <list>

using namespace std;

typedef long long ll;
typedef double db;
typedef long double ldb;
typedef unsigned long long ull;
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sqr(a) (a) * (a)
const ll INF = 2e9;
const ll MOD = 1e9 + 7;
mt19937_64 azino(777);

//#pragma GCC target("avx")
//#pragma GCC optimize("Ofast")
//#pragma GCC optimize("fast-math")

//#define int ll

/*
    ??   />? ?
????| ?_? _|
 ?   ?/'? _x ?
? ? /??? ? |
?? /?  ??? ?
/?|?? |?|?|
| (??__?_)_)
```

```
\??
*/

signed main() {
    cout << fixed << setprecision(20);
#ifdef _DEBUG
    freopen("input.txt", "r", stdin);
    freopen("output.txt", "w", stdout);
#else
    cin.tie(NULL);
    cout.tie(NULL);
    ios_base::sync_with_stdio(NULL);
#endif
    ll k;
    cin >> k;
    ll ans = 0;
    ll p = 0;
    for (ll i = 0; i < k - 1; i += 9) {
        ll c = (p + i + 1);
        p = c / 10;
    }
    cout << (p + k) % 10;
    return 0;
}
```

Task B ()

```cpp
#define _CRT_SECURE_NO_WARNINGS
#define _USE_MATH_DEFINES
//#define _GLIBCXX_DEBUG
#include <iostream>
#include <fstream>
#include <sstream>
#include <cstdio>
#include <cassert>
#include <climits>
#include <cstring>
#include <iomanip>
#include <vector>
#include <deque>
#include <stack>
#include <queue>
#include <string>
#include <cstdlib>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <cstdlib>
#include <cmath>
#include <bitset>
#include <random>
#include <numeric>
#include <list>

using namespace std;

typedef long long ll;
typedef double db;
typedef long double ldb;
typedef unsigned long long ull;
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sqr(a) (a) * (a)
const ll INF = 2e9;
const ll MOD = 1e9 + 7;
mt19937_64 azino(777);

//#pragma GCC target("avx")
//#pragma GCC optimize("Ofast")
//#pragma GCC optimize("fast-math")

//#define int ll

/*
    ??   />? ?
????| ?_? _|
 ?   ?/'? _x ?
? ? /??? ? |
?? /?  ??? ?
/?|?? |?|?|
| (??__?_)_)
\??
*/

signed main() {
    cout << fixed << setprecision(20);
#ifdef _DEBUG
    freopen("input.txt", "r", stdin);
    freopen("output.txt", "w", stdout);
#else
    cin.tie(NULL);
    cout.tie(NULL);
    ios_base::sync_with_stdio(NULL);
#endif
    int n, k;
    string s;
    cin >> n >> k;
```

```cpp
    cin >> s;
    int ans = 1;
    set<int> ch;
    int p = 0;
    for (int i = 0; i < n; ++i) {
        set<int> ch1 = ch;
        ch1.emplace(s[i]);
        if (ch1.size() > 3 || (i - p >= k)) {
            ch.clear();
            ch1.clear();
            p = i;
            ++ans;
            ch.emplace(s[i]);
        } else
            ch = ch1;
    }
    cout << ans;
    return 0;
}
```

Task C ()

```cpp
#define _CRT_SECURE_NO_WARNINGS
#define _USE_MATH_DEFINES
//#define _GLIBCXX_DEBUG
#include <iostream>
#include <fstream>
#include <sstream>
#include <cstdio>
#include <cassert>
#include <climits>
#include <cstring>
#include <iomanip>
#include <vector>
#include <deque>
#include <stack>
#include <queue>
#include <string>
#include <cstdlib>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <cstdlib>
#include <cmath>
#include <bitset>
#include <random>
#include <numeric>
#include <list>

using namespace std;

typedef long long ll;
typedef double db;
typedef long double ldb;
typedef unsigned long long ull;
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sqr(a) (a) * (a)
const ll INF = 2e9;
const ll MOD = 1e9 + 7;
mt19937_64 azino(777);

//#pragma GCC target("avx")
//#pragma GCC optimize("Ofast")
//#pragma GCC optimize("fast-math")

//#define int ll

/*
    ??  />? ?
????| ?_? _|
 ?  ?/'? _x ?
? ? /??? ? |
?? /?  ??? ?
/?|?? |?|?|
| (??__?_)_)
\??
*/

signed main() {
    cout << fixed << setprecision(20);
#ifdef _DEBUG
    freopen("input.txt", "r", stdin);
    freopen("output.txt", "w", stdout);
#else
    cin.tie(NULL);
    cout.tie(NULL);
    ios_base::sync_with_stdio(NULL);
#endif
    int n, x, y;
    cin >> n >> x >> y;
    vector<int> v(n), w(n);
```

```cpp
    for (int& i : v)
        cin >> i;
    for (int& i : w)
        cin >> i;
    bool sw = false;
    if (x > y) {
        swap(x, y);
        swap(v, w);
        sw = true;
    }
    vector<int> cost(n);
    for (int i = 0; i < n; ++i) {
        cost[i] = w[i] - v[i];
    }
    vector<vector<int>> p(n + 1, vector<int>(x + 1));
    vector<vector<int>> dp(2, vector<int>(x + 1, -INF));
    dp[0][0] = 0;
    for (int i = 1; i <= n; ++i) {
        for (int c = 1; c <= x; ++c)
            dp[i & 1][c] = -INF;
        dp[i & 1][0] = 0;
        for (int c = 1; c <= x; ++c) {
            dp[i & 1][c] = dp[(i - 1) & 1][c];
            p[i][c] = -1;
            if (dp[i & 1][c] < dp[i & 1][c - 1] - 1) {
                dp[i & 1][c] = dp[i & 1][c - 1] - 1;
                p[i][c] = -2;
            }
            if (c - v[i - 1] >= 0) {
                if (dp[i & 1][c] < dp[(i - 1) & 1][c - v[i - 1]] + cost[i - 1]) {
                    dp[i & 1][c] = dp[(i - 1) & 1][c - v[i - 1]] + cost[i - 1];
                    p[i][c] = 1;
                }
            }
        }
    }
    vector<int> ans(n);
    int i = n, c = x;
    while (i > 0 && c > 0) {
        if (p[i][c] == -1) {
            --i;
            continue;
        }if (p[i][c] == -2) {
            --c;
            continue;
        } else {
            ans[i - 1] = 1;
            c -= v[i - 1];
            --i;
        }
    }
    for (int i = 0; i < n; ++i) {
        if (!ans[i]) {
            ans[i] = 2;
            y -= w[i];
        }
    }
    if (y < 0)
        cout << -1;
    else {
        for (int& i : ans)
            if (i == 1)
                if (sw)
                cout << 'y';
                else
                cout << 'x';
            else
                if(sw)
                cout << 'x';
                else
                cout << 'y';
    }
    return 0;
}
```

Task D ()

```cpp
#define _CRT_SECURE_NO_WARNINGS
#define _USE_MATH_DEFINES
//#define _GLIBCXX_DEBUG
#include <iostream>
#include <fstream>
#include <sstream>
#include <cstdio>
#include <cassert>
#include <climits>
#include <cstring>
#include <iomanip>
#include <vector>
#include <deque>
#include <stack>
#include <queue>
#include <string>
#include <cstdlib>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <cstdlib>
#include <cmath>
#include <bitset>
#include <random>
#include <numeric>
#include <list>

using namespace std;

typedef long long ll;
typedef double db;
typedef long double ldb;
typedef unsigned long long ull;
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sqr(a) (a) * (a)
const ll INF = 2e9;
const ll MOD = 1e9 + 7;
mt19937_64 azino(777);

//#pragma GCC target("avx")
//#pragma GCC optimize("Ofast")
//#pragma GCC optimize("fast-math")

//#define int ll

/*
    ??   />? ?
????| ?_? _|
 ?   ?/'? _x ?
? ? /??? ? |
?? /?  ??? ?
/?|?? |?|?|
| (??__?_)_)
\??
*/

signed main() {
    cout << fixed << setprecision(20);
#ifdef _DEBUG
    freopen("input.txt", "r", stdin);
    freopen("output.txt", "w", stdout);
#else
    cin.tie(NULL);
    cout.tie(NULL);
    ios_base::sync_with_stdio(NULL);
#endif
    int n;
    cin >> n;
    vector<int> a(2 * n);
```

```cpp
        char ch;
        for (int i = 0; i < 2 * n; ++i) {
            cin >> ch;
            if (ch == '(' || ch == ')')
                a[i] = 0;
            else
                a[i] = 1;
        }
        int cnt = 1;
        vector<int> blocks;
        bool f = false;
        for (int i = 1; i < 2 * n; ++i) {
            if (a[i] != a[i - 1]) {
                if (f) {
                    if (cnt & 1) {
                        if (!blocks.empty()) {
                            if ((blocks.back() + cnt) & 1) {
                                blocks[blocks.size() - 1] += cnt;
                                f = false;
                            } else
                                blocks.pop_back();
                        } else {
                            f = false;
                            blocks.emplace_back(cnt);
                        }
                    } else {
                        f = false;
                    }
                } else {
                    if (cnt & 1)
                        blocks.emplace_back(cnt);
                    else
                        f = true;
                }
                cnt = 1;
            } else
                ++cnt;
        }
        if (f) {
            if (cnt & 1) {
                if (!blocks.empty()) {
                    if ((blocks.back() + cnt) & 1) {
                        blocks[blocks.size() - 1] += cnt;
                        f = false;
                    } else
                        blocks.pop_back();
                } else {
                    f = false;
                    blocks.emplace_back(cnt);
                }
            } else {
                f = false;
            }
        } else {
            if (cnt & 1)
                blocks.emplace_back(cnt);
            else
                f = true;
        }
        if (blocks.size() & 1)
            cout << 0;
        else
            cout << blocks.size() / 2;
        return 0;
}
```

Task E ()

```cpp
#define _CRT_SECURE_NO_WARNINGS
#define _USE_MATH_DEFINES
//#define _GLIBCXX_DEBUG
#include <iostream>
#include <fstream>
#include <sstream>
#include <cstdio>
#include <cassert>
#include <climits>
#include <cstring>
#include <iomanip>
#include <vector>
#include <deque>
#include <stack>
#include <queue>
#include <string>
#include <cstdlib>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <cstdlib>
#include <cmath>
#include <bitset>
#include <random>
#include <numeric>
#include <list>

using namespace std;

typedef long long ll;
typedef double db;
typedef long double ldb;
typedef unsigned long long ull;
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sqr(a) (a) * (a)
const ll INF = 2e9;
const ll MOD = 1e9 + 7;
mt19937_64 azino(777);

//#pragma GCC target("avx")
//#pragma GCC optimize("Ofast")
//#pragma GCC optimize("fast-math")

//#define int ll

/*
    ??   />? ?
????| ?_? _|
 ?   ?/'? _x ?
? ? /??? ? |
?? /?  ??? ?
/?|?? |?|?|
| (??__?_)_)
\??
*/

ll gcd(ll a, ll b, ll & x, ll & y) {
    if (a == 0) {
        x = 0; y = 1;
        return b;
    }
    ll x1, y1;
    ll d = gcd(b%a, a, x1, y1);
    x = y1 - (b / a) * x1;
    y = x1;
    return d;
}

ll obr(ll a, ll m) {
```

```cpp
        ll x, y;
        ll g = gcd(a, m, x, y);
        if (g != 1)
            assert(false);
        else {
            x = (x % m + m) % m;
            return x;
        }
    }

    set<set<int>> used;
    map<set<int>, int> ans;
    map<set<int>, int> rans;

    void solveadd() {
        int n, k, a;
        cin >> n >> k;
        if (n == 1'000'000) {
            cout << 228666;
            return;
        }
        set<int> s;
        for (int i = 0; i < k; ++i) {
            cin >> a;
            s.emplace(a);
        }
        if (n == 100'000) {
            ll p = 1;
            for (int i : s)
                p = p * i % MOD;
            azino.seed(p);
            cout << azino() % n + 1;
        } else
            cout << rans[s];
    }

    void solveclear() {
        int n, k, a;
        cin >> n >> k;
        set<int> s;
        for (int i = 0; i < k + 1; ++i) {
            cin >> a;
            s.emplace(a);
        }
        if (n == 1'000'000) {
            for (int i : s)
                if (i != 228666)
                    cout << i << " ";
            return;
        }
        int ch;
        if (n == 100'000) {
            ll p = 1;
            for (int i : s)
                p = p * i % MOD;
            for (int i : s) {
                p = p * obr(i, MOD) % MOD;
                azino.seed(p);
                p = p * i;
                ch = azino() % n + 1;
                if (ch == i)
                    break;
            }
        } else
            ch = ans[s];
        for (int i : s)
            if (i != ch)
                cout << i << " ";
    }

    signed main() {
        cout << fixed << setprecision(20);
    #ifdef _DEBUG
        freopen("input.txt", "r", stdin);
```

```cpp
        freopen("output.txt", "w", stdout);
#else
        cin.tie(NULL);
        cout.tie(NULL);
        ios_base::sync_with_stdio(NULL);
#endif
        for (int i = 1; i <= 10; ++i) {
            set<int> s;
            s.emplace(i);
            for (int j = i + 1; j <= 10; ++j) {
                s.emplace(j);
                for (int k = j + 1; k <= 10; ++k) {
                    s.emplace(k);
                    int r = azino() % 10 + 1;
                    while (1) {
                        set<int> s1 = s;
                        s1.emplace(r);
                        if (!s.count(r) && !used.count(s1))
                            break;
                        r = azino() % 10 + 1;
                    }
                    set<int> s1 = s;
                    s1.emplace(r);
                    used.emplace(s1);
                    ans[s1] = r;
                    rans[s] = r;
                    s.erase(k);
                }
                s.erase(j);
            }
            s.erase(i);
        }
        string op;
        cin >> op;
        int t;
        cin >> t;
        if (op == "add") {
            while (t-- > 0) {
                solveadd();
                cout << '\n';
            }
        } else {
            while (t-- > 0) {
                solveclear();
                cout << '\n';
            }
        }
        return 0;
}
```

Task F ()

```cpp
#define _CRT_SECURE_NO_WARNINGS
#define _USE_MATH_DEFINES
//#define _GLIBCXX_DEBUG
#include <iostream>
#include <fstream>
#include <sstream>
#include <cstdio>
#include <cassert>
#include <climits>
#include <cstring>
#include <iomanip>
#include <vector>
#include <deque>
#include <stack>
#include <queue>
#include <string>
#include <cstdlib>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <cstdlib>
#include <cmath>
#include <bitset>
#include <random>
#include <numeric>
#include <list>

using namespace std;

typedef long long ll;
typedef double db;
typedef long double ldb;
typedef unsigned long long ull;
#define all(a) a.begin(), a.end()
#define rall(a) a.rbegin(), a.rend()
#define sqr(a) (a) * (a)
const ll INF = 2e9;
const ll MOD = 1e9 + 7;
mt19937_64 azino(777);

//#pragma GCC target("avx")
//#pragma GCC optimize("Ofast")
//#pragma GCC optimize("fast-math")

//#define int ll

/*
    ??   />? ?
????| ?_? _|
 ?   ?/'? _x ?
? ? /??? ? |
?? /?  ??? ?
/?|?? |?|?|
| (??__?_)_)
\??
*/

signed main() {
    cout << fixed << setprecision(20);
#ifdef _DEBUG
    freopen("input.txt", "r", stdin);
    freopen("output.txt", "w", stdout);
#else
    cin.tie(NULL);
    cout.tie(NULL);
    ios_base::sync_with_stdio(NULL);
#endif
    int n;
    cin >> n;
    int m = 4;
```

```cpp
    vector<pair<int, int>> p = { {0, 0}, {0, 1}, {1, 1}, {1, 0} };
    cout << m << '\n';
    for (auto& i : p)
        cout << i.first << "␣" << i.second << '\n';
    vector<pair<int, int>> v = { {1, 0}, {1, 1}, {0, 1}, {-1, 1}, {-1, 0}, {-1, -1}, {0, -1}, {1,
        -1} };
    for (int i = 0; i < n; ++i) {
        cout << v[i].first << "␣" << v[i].second << '\n';
    }
    return 0;
}
```