

Олимпиада СПбГУ по информатике 2020/21 учебного года

A	B	C	D	E	F	Sum
100	100	100	100	20	25	445

Task A ()

```
#include <iostream>
#include <iomanip>
#include <vector>
#include <string>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <numeric>
#include <climits>
#include <cstdlib>
#include <cassert>
#include <cmath>

#define all(x) (x).begin(), (x).end()
#define sz(a) (int)(a).size()

using namespace std;

using ll = long long;
using ull = unsigned long long;
using ld = long double;

int main() {
#ifdef LOCAL
    freopen("input.txt", "r", stdin);
#endif
    ios_base::sync_with_stdio(false);
    cin.tie(nullptr);
    cout.tie(nullptr);

    int k;
    cin >> k;

    if (k <= 9) {
        cout << k;
    }
    else {
        if (k % 9 == 1) {
            cout << 0;
        }
        else if (k % 9 == 0) {
            cout << 9;
        }
        else {
            cout << k % 9;
        }
    }

    return 0;
}
```

Task B ()

```
#include <iostream>
#include <iomanip>
#include <vector>
#include <string>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <numeric>
#include <climits>
#include <cstdlib>
#include <cassert>
#include <cmath>

#define all(x) (x).begin(), (x).end()
#define sz(a) (int)(a).size()

using namespace std;

using ll = long long;
using ull = unsigned long long;
using ld = long double;

int main() {
#ifdef LOCAL
    freopen("input.txt", "r", stdin);
#endif
    ios_base::sync_with_stdio(false);
    cin.tie(nullptr);
    cout.tie(nullptr);

    int n, k;
    cin >> n >> k;
    string s;
    cin >> s;

    int ans = 0;
    for (int i = 0; i < n; i++) {
        ++ans;
        set<char> st;
        st.insert(s[i]);
        int j = i;
        while (j < min(i + k, n) && sz(st) <= 3) {
            ++j;
            st.insert(s[j]);
        }
        i = j;
    }

    cout << ans;

    return 0;
}
```

Task C ()

```
#include <iostream>
#include <iomanip>
#include <vector>
#include <string>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <numeric>
#include <climits>
#include <cstdlib>
#include <cassert>
#include <cmath>

#define all(x) (x).begin(), (x).end()

using namespace std;

using ll = long long;
using ull = unsigned long long;
using ld = long double;

int main() {
#ifdef LOCAL
    freopen("input.txt", "r", stdin);
#endif
    ios_base::sync_with_stdio(false);
    cin.tie(nullptr);
    cout.tie(nullptr);

    int n, x, y;
    cin >> n >> x >> y;
    vector<int> v(n + 1), w(n + 1);
    for (int i = 1; i <= n; ++i) {
        cin >> v[i];
    }
    for (int i = 1; i <= n; ++i) {
        cin >> w[i];
    }

    int sum_v = accumulate(all(v), 0);
    int delta = sum_v - x;

    vector<int> ans(n + 1, 0);

    if (delta > 0) {
        vector<vector<int>> dp(n + 1, vector<int>(y + 1, 0));
        for (int i = 1; i <= n; ++i) {
            for (int j = 1; j <= y; ++j) {
                dp[i][j] = dp[i - 1][j];
                if (j - w[i] >= 0) {
                    dp[i][j] = max(dp[i][j], dp[i - 1][j - w[i]] + v[i]);
                }
            }
        }
        int max_pos = max_element(all(dp[n])) - dp[n].begin();
        int max = dp[n][max_pos];
        if (max < delta) {
            cout << -1;
            return 0;
        }
        {
            int j = max_pos;
            for (int i = n; i > 0; --i) {
                if (dp[i][j] != dp[i - 1][j]) {
                    ans[i] = 1;
                    j -= w[i];
                }
            }
        }
    }
}
```

```
    for (int i = 1; i <= n; ++i) {  
        if (ans[i] == 0) {  
            cout << 'x';  
        }  
        else {  
            cout << 'y';  
        }  
    }  
  
    return 0;  
}
```

Task D ()

```
#include <iostream>
#include <iomanip>
#include <vector>
#include <string>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <numeric>
#include <climits>
#include <cstdlib>
#include <cassert>
#include <cmath>

#define all(x) (x).begin(), (x).end()
#define sz(a) (int)(a).size()

using namespace std;

using ll = long long;
using ull = unsigned long long;
using ld = long double;

int main() {
#ifdef LOCAL
    freopen("input.txt", "r", stdin);
#endif
    ios_base::sync_with_stdio(false);
    cin.tie(nullptr);
    cout.tie(nullptr);

    int n;
    cin >> n;
    string s;
    cin >> s;

    vector<char> stck;

    for (char c : s) {
        if (stck.empty()) {
            if (c == '(' || c == '[') {
                stck.push_back(c);
            }
            else if (c == ')') {
                stck.push_back('(');
            }
            else {
                stck.push_back('[');
            }
        }
        else {
            if (c == '(') {
                if (stck.back() == '(') {
                    stck.pop_back();
                }
                else {
                    stck.push_back('(');
                }
            }
            else if (c == '[') {
                if (stck.back() == '[') {
                    stck.pop_back();
                }
                else {
                    stck.push_back('[');
                }
            }
            else if (c == ')') {
                if (stck.back() == '(') {
                    stck.pop_back();
                }
            }
        }
    }
}
```

```

        else {
            stck.push_back('(');
        }
    }
    else if (c == ']') {
        if (stck.back() == '[') {
            stck.pop_back();
        }
        else {
            stck.push_back('[');
        }
    }
}

cout << sz(stck) / 2;

return 0;
}

```

Task E ()

```
#include <iostream>
#include <iomanip>
#include <vector>
#include <string>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <numeric>
#include <climits>
#include <cstdlib>
#include <cassert>
#include <cmath>
#include <random>

#define all(x) (x).begin(), (x).end()

using namespace std;

using ll = long long;
using ull = unsigned long long;
using ld = long double;

int rand_mod = 0;
mt19937 gen(228);

int randint() {
    return gen() % rand_mod;
}

vector<int> mt;

void gen_mt(int n) {
    mt.resize(n + 1);
    int msb = log2(n);
    rand_mod = (1 << (msb));
    for (int i = 0; i <= n; ++i) {
        mt[i] = randint();
    }
}

void add() {
    int n, k;
    cin >> n >> k;
    vector<int> a(k);
    for (int i = 0; i < k; ++i) {
        cin >> a[i];
    }
    sort(all(a));

    if (rand_mod == 0) {
        gen_mt(n);
    }

    int hash = 0;
    for (int i = 0; i < k; ++i) {
        hash ^= mt[a[i]];
    }
    assert(!binary_search(all(a), hash));
    cout << hash << "\n";
}

void clear() {
    int n, k;
    cin >> n >> k;
    vector<int> a(k + 1);
    for (int i = 0; i <= k; ++i) {
        cin >> a[i];
    }
    sort(all(a));
```

```

    if (rand_mod == 0) {
        gen_mt(n);
    }

    int hash = 0;
    for (int i = 0; i <= k; ++i) {
        hash ^= mt[a[i]];
    }

    for (int i = 0; i <= k; ++i) {
        if ((hash ^ mt[a[i]]) != a[i]) {
            cout << a[i] << "␣";
        }
    }
    cout << "\n";
}

int main() {
#ifdef LOCAL
    freopen("input.txt", "r", stdin);
#endif
    ios_base::sync_with_stdio(false);
    cin.tie(nullptr);
    cout.tie(nullptr);
    string mode;
    cin >> mode;

    int t;
    cin >> t;

    while (t--) {
        if (mode == "add") {
            add();
        }
        else {
            clear();
        }
    }

    return 0;
}

```


Task F ()

```
#include <iostream>
#include <iomanip>
#include <vector>
#include <string>
#include <set>
#include <unordered_set>
#include <map>
#include <unordered_map>
#include <algorithm>
#include <numeric>
#include <climits>
#include <cstdlib>
#include <cassert>
#include <cmath>

#define all(x) (x).begin(), (x).end()
#define sz(a) (int)(a).size()

using namespace std;

using ll = long long;
using ull = unsigned long long;
using ld = long double;

struct Pt {
    int x, y;
};

ostream& operator<<(ostream& out, Pt p) {
    out << p.x << " " << p.y;
    return out;
}

int main() {
#ifdef LOCAL
    freopen("input.txt", "r", stdin);
#endif
    ios_base::sync_with_stdio(false);
    cin.tie(nullptr);
    cout.tie(nullptr);

    int n;
    cin >> n;

    vector<Pt> p{ {0, 0}, {0, 1}, {1, 1}, {1, 0} };
    vector<Pt> v{ {0, 1}, {1, 1}, {1, 0}, {1, -1}, {0, -1}, {-1, -1}, {-1, 0}, {-1, 1} };

    cout << sz(p) << "\n";
    for (int i = 0; i < sz(p); ++i) {
        cout << p[i] << "\n";
    }

    for (int i = 0; i < n; ++i) {
        cout << v[i] << "\n";
    }

    return 0;
}
```