

Олимпиада СПбГУ по информатике 2020/21 учебного года

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

Task A ()

```
//  
// Created by omega_alpha on 18.03.2021  
//  
  
#include <bits/stdc++.h>  
using namespace std;  
  
#define int long long  
#define FF first  
#define SS second  
#define ALL(a) a.begin(), a.end()  
#define RALL(a) a.rbegin(), a.rend()  
#define pb push_back  
#define pf push_front  
#define mp make_pair  
  
using ll = long long;  
using ld = long double;  
  
const int INFI = 1e9 + 228;  
const ll INFL = 1e18 + 228;  
const ld INFLD = 1e18 + 228;  
const ld PI = acos(-1);  
const int MAXN = 1e5 + 228;  
  
vector<pair<int, int>> DD = {{-1, 0}, {1, 0}, {0, 1}, {0, -1}};  
void run() {  
    int k;  
    cin >> k;  
    int per = 0;  
    int last = 0;  
    for (int i = 1; i <= k; ++i) {  
        last = (i + per) % 10;  
        per = (i + per) / 10;  
    }  
    cout << last << "\n";  
}  
  
signed main() {  
    ios_base::sync_with_stdio(false);  
    cin.tie(0);  
    cout.tie(0);  
    int t;  
    //cin >> t;  
    t = 1;  
    while (t--) run();  
    return 0;  
}
```

Task B ()

```
//  
// Created by omega_alpha on 18.03.2021  
//  
  
#include <bits/stdc++.h>  
using namespace std;  
  
#define int long long  
#define FF first  
#define SS second  
#define ALL(a) a.begin(), a.end()  
#define RALL(a) a.rbegin(), a.rend()  
#define pb push_back  
#define pf push_front  
#define mp make_pair  
  
using ll = long long;  
using ld = long double;  
  
const int INFI = 1e9 + 228;  
const ll INFL = 1e18 + 228;  
const ld INFLD = 1e18 + 228;  
const ld PI = acos(-1);  
const int MAXN = 1e5 + 228;  
  
vector<pair<int, int>> DD = {{-1, 0}, {1, 0}, {0, 1}, {0, -1}};  
  
void run() {  
    int n, k;  
    cin >> n >> k;  
    string s;  
    cin >> s;  
    int ans = 0;  
    int uk = 0;  
    while (uk < n) {  
        set<char> now;  
        int last = uk - 1;  
        for (int i = uk; i < n; ++i) {  
            now.insert(s[i]);  
            if (i - uk + 1 <= k && now.size() <= 3) {  
                last = i;  
            } else {  
                break;  
            }  
        }  
        //cout << uk << ' ' << last << endl;  
        ans++;  
        uk = last + 1;  
    }  
    cout << ans << "\n";  
}  
  
signed main() {  
    ios_base::sync_with_stdio(false);  
    cin.tie(0);  
    cout.tie(0);  
    int t;  
    //cin >> t;  
    t = 1;  
    while (t--) run();  
    return 0;  
}
```

Task C ()

```
//  
// Created by omega_alpha on 18.03.2021  
//  
  
#include <bits/stdc++.h>  
using namespace std;  
  
// #define int long long  
#define FF first  
#define SS second  
#define ALL(a) a.begin(), a.end()  
#define RALL(a) a.rbegin(), a.rend()  
#define pb push_back  
#define pf push_front  
#define mp make_pair  
  
using ll = long long;  
using ld = long double;  
  
const int INFI = 1e9 + 228;  
const ll INFL = 1e18 + 228;  
const ld INFLD = 1e18 + 228;  
const ld PI = acos(-1);  
const int MAXN = 2e5 + 50001;  
  
vector<pair<int, int>> DD = {{-1, 0}, {1, 0}, {0, 1}, {0, -1}};  
int dp[2][MAXN];  
bool pred[505][MAXN];  
void run() {  
    int n, x, y;  
    cin >> n >> x >> y;  
    vector<char> ans(n + 1, 'y');  
    vector<int> a1, a2;  
    for (int i = 0; i < n; ++i) {  
        int x;  
        cin >> x;  
        a1.pb(x);  
    }  
    for (int i = 0; i < n; ++i) {  
        int x;  
        cin >> x;  
        a2.pb(x);  
    }  
    vector<pair<int, int>> mass;  
    mass.pb({0, 0});  
    for (int i = 0; i < n; ++i) {  
        mass.pb({a1[i], a2[i]});  
    }  
    int sum_ves = 0;  
    for (auto u : mass) sum_ves += u.SS;  
    dp[0][0] = 0;  
    for (int i = 1; i <= n; ++i) {  
        for (int j = 1; j <= x; ++j) {  
            if (dp[1][j] < dp[0][j]) {  
                dp[1][j] = dp[0][j];  
                pred[i][j] = false;  
            }  
            if (j >= mass[i].FF && dp[1][j] < dp[0][j - mass[i].FF] + mass[i].SS) {  
                dp[1][j] = dp[0][j - mass[i].FF] + mass[i].SS;  
                pred[i][j] = true;  
            }  
        }  
        for (int j = 0; j <= x; ++j) {  
            dp[0][j] = dp[1][j];  
            dp[1][j] = 0;  
        }  
    }  
    for (int i = 0; i <= x; ++i) {  
        if (sum_ves - dp[0][i] <= y) {  
            // cout << i << ' ' << dp[i] << ' ' << sum_ves << endl;  
            int st = i;  
            int it = n;  
        }  
    }  
}
```

```

        while (st > 0) {
            if (pred[it][st]) {
                ans[it] = 'x';
                st -= mass[it].FF;
                it--;
            } else {
                it--;
            }
        }
        /*int now_x = 0, now_y = 0;
        for (int j = 0; j < n; ++j) {
            if (ans[j] == 'x') now_x += mass[j].FF;
            else now_y += mass[j].SS;
        }
        if (now_x > x || now_y > y) cout << 7 / 0;*/
        //cout << '1';
        for (int j = 1; j <= n; ++j) cout << ans[j];
        cout << "\n";
        return;
    }
}
cout << -1 << "\n";
}

signed main() {
    ios_base::sync_with_stdio(false);
    cin.tie(0);
    cout.tie(0);
    int t;
    //cin >> t;
    t = 1;
    while (t--) run();
    return 0;
}

```

Task D ()

```
//
// Created by omega_alpha on 18.03.2021
//

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

#define int long long
#define FF first
#define SS second
#define ALL(a) a.begin(), a.end()
#define RALL(a) a.rbegin(), a.rend()
#define pb push_back
#define pf push_front
#define mp make_pair

using ll = long long;
using ld = long double;

const int INFI = 1e9 + 228;
const ll INFL = 1e18 + 228;
const ld INFLD = 1e18 + 228;
const ld PI = acos(-1);
const int MAXN = 1e5 + 228;

vector<pair<int, int>> DD = {{-1, 0}, {1, 0}, {0, 1}, {0, -1}};
map<char, int> type;
void run() {
    type['('] = 1;
    type[')'] = 1;
    type['['] = 2;
    type[']'] = 2;
    int n;
    cin >> n;
    n *= 2;
    string s;
    cin >> s;
    s = '#' + s;
    stack<int> st;
    int ans = 0;
    for (int i = 1; i <= n; ++i) {
        if (st.size() == 0) {
            st.push(s[i]);
            continue;
        }
        if (type[st.top()] == type[s[i]]) {
            st.pop();
            continue;
        }
        st.push(s[i]);
    }
    cout << (st.size() / 2);
}

signed main() {
    ios_base::sync_with_stdio(false);
    cin.tie(0);
    cout.tie(0);
    int t;
    //cin >> t;
    t = 1;
    while (t--) run();
    return 0;
}
```

Task E ()

```
//  
// Created by omega_alpha on 18.03.2021  
//  
  
#include <bits/stdc++.h>  
using namespace std;  
  
#define int long long  
#define FF first  
#define SS second  
#define ALL(a) a.begin(), a.end()  
#define RALL(a) a.rbegin(), a.rend()  
#define pb push_back  
#define pf push_front  
#define mp make_pair  
  
using ll = long long;  
using ld = long double;  
  
const int INFI = 1e9 + 228;  
const ll INFL = 1e18 + 228;  
const ld INFLD = 1e18 + 228;  
const ld PI = acos(-1);  
const int MAXN = 1e5 + 228;  
  
vector<pair<int, int>> DD = {{-1, 0}, {1, 0}, {0, 1}, {0, -1}};  
  
set<int> mass;  
int it = 0;  
int ans_it = 0;  
void gen(int uk, int dl, set<int> now) {  
    if (uk == dl) {  
        it++;  
        if (now == mass) {  
            ans_it = it;  
        }  
        return;  
    }  
    int last = 0;  
    if (mass.size() == 0) last = 1;  
    else last = *(prev(mass.end())) + 1;  
    for (int i = last; i <= 11 + uk - dl; ++i) {  
        if (mass.find(i) != mass.end()) continue;  
        mass.insert(i);  
        gen(uk + 1, dl, now);  
        mass.erase(i);  
    }  
}  
int it2 = 0;  
set<int> ans_it2;  
void gen2(int uk, int dl, int now) {  
    if (uk == dl) {  
        it2++;  
        if (now == it2) {  
            ans_it2 = mass;  
        }  
        return;  
    }  
    int last = 0;  
    if (mass.size() == 0) last = 1;  
    else last = *(prev(mass.end())) + 1;  
    for (int i = last; i <= 11 + uk - dl; ++i) {  
        if (mass.find(i) != mass.end()) continue;  
        mass.insert(i);  
        gen2(uk + 1, dl, now);  
        mass.erase(i);  
    }  
}  
int ans[MAXN];  
set<int> obr_ans[MAXN];  
int get_ans(int n, set<int> was) {  
    for (int i = n; i >= 1; --i) {
```

```

        //if (i % 3 != 0) continue;
        if (was.find(i) != was.end()) continue;
        if (i == n) {
            if (was.find(n - 1) != was.end()) continue;
            return i;
        }
        if (was.find(i + 1) != was.end() && was.find(i - 1) != was.end()) continue;
        return i;
    }
}
vector<int> prost;
void run() {
    int n, k;
    cin >> n >> k;
    if (k == 3) {
        set<int> now;
        for (int i = 0; i < k; ++i) {
            int x;
            cin >> x;
            now.insert(x);
        }
        it = 0;
        ans_it = 0;
        gen(0, k, now);
        cout << ans[ans_it] << "\n";
    } else if (n == 1000000 && k <= 10) {
        set<int> was;
        for (int i = 0; i < k; ++i) {
            int x;
            cin >> x;
            was.insert(x);
        }
        cout << get_ans(n, was) << "\n";
        return;
    } else {
        vector<int> mass;
        set<int> was;
        for (int i = 0; i < k; ++i) {
            int x;
            cin >> x;
            mass.pb(x);
            was.insert(x);
        }
        for (int i = prost.size() - 1; i >= 0; --i) {
            if (prost[i] > n) continue;
            if (was.find(prost[i]) != was.end()) continue;
            if (i == prost.size() - 1) {
                if (was.find(prost[i - 1]) != was.end()) continue;
                cout << prost[i] << "\n";
                break;
            }
            if (was.find(prost[i + 1]) != was.end() && was.find(prost[i - 1]) != was.end())
                continue;
            cout << prost[i] << "\n";
            break;
        }
        return;
    }
}
}
void run2() {
    int n, k;
    cin >> n >> k;
    if (k == 3) {
        set<int> now;
        for (int i = 0; i < k + 1; ++i) {
            int x;
            cin >> x;
            now.insert(x);
        }
        it = 0;
        ans_it = 0;
        gen(0, k + 1, now);
        //cout << ans_it << endl;
        for (auto u : obr_ans[ans_it]) cout << u << ' ';
    }
}

```

```

        cout << "\n";
    } else if (n == 1000000 && k <= 10) {
        set<int> was;
        for (int i = 0; i < k + 1; ++i) {
            int x;
            cin >> x;
            was.insert(x);
        }
        /*for (auto u : was) {
            set<int> was2 = was;
            was2.erase(u);
            if (u == get_ans(n, was2)) {
                for (auto v : was2) cout << v << ' ';
                cout << "\n";
                return;
            }
        }*/
        for (int i = n; i >= 1; --i) {
            //if (i % 3 != 0) continue;
            if (was.find(i) == was.end()) continue;
            if (i == n) {

                if (was.find(n - 1) != was.end()) continue;
                for (auto v : was) {
                    if (v == i) continue;
                    cout << v << ' ';
                }
                cout << "\n";
                return;
            }
            if (was.find(i + 1) != was.end() && was.find(i - 1) == was.end()) {
                for (auto v : was) {
                    if (v == i) continue;
                    cout << v << ' ';
                }
                cout << "\n";
                return;
            }
        }
    } else {
        vector<int> mass;
        set<int> was;
        for (int i = 0; i < k + 1; ++i) {
            int x;
            cin >> x;
            was.insert(x);
            mass.pb(x);
        }
        for (int i = prost.size() - 1; i >= 0; --i) {
            if (prost[i] > n) continue;
            if (i == prost.size() - 1) {
                if (was.find(prost[i - 1]) != was.end()) continue;
                for (auto v : was) {
                    if (v == prost[i]) continue;
                    cout << v << ' ';
                }
                cout << "\n";
                return;
            }
            if (was.find(prost[i + 1]) != was.end() && was.find(prost[i - 1]) == was.end()) {
                for (auto v : was) {
                    if (v == prost[i]) continue;
                    cout << v << ' ';
                }
                cout << "\n";
                return;
            }
        }
    }
    return;
}

set<set<int>> used;
signed main() {

```



```

prost.pb(2);
for (int i = 3; i <= 30000; ++i) {
    bool prime = true;
    for (int j = 2; j * j <= i; ++j) {
        if (i % j == 0) {
            prime = false;
            break;
        }
    }
    if (prime) prost.pb(i);
}
reverse(ALL(prost));
for (int i = 1; i <= 120; ++i) {
    it2 = 0;
    ans_it2.clear();
    gen2(0, 3, i);
    for (int j = 1; j <= 10; ++j) {
        if (ans_it2.find(j) != ans_it2.end()) continue;
        ans_it2.insert(j);
        if (used.find(ans_it2) != used.end()) {
            ans_it2.erase(j);
            continue;
        }
        ans_it2.erase(j);
        ans[i] = j;
        it = 0;
        ans_it = 0;
        /*for (auto u : ans_it2) {
            cout << u << ' ';
        }
        cout << endl;*/
        ans_it2.insert(j);
        /*for (auto u : ans_it2) {
            cout << u << ' ';
        }
        cout << endl;*/
        used.insert(ans_it2);
        gen(0, 3 + 1, ans_it2);
        ans_it2.erase(j);
        //cout << ans_it << endl;
        obr_ans[ans_it] = ans_it2;
        break;
    }
}
ios_base::sync_with_stdio(false);
cin.tie(0);
cout.tie(0);
string s;
cin >> s;
int t;
cin >> t;
while (t--) {
    if (s == "add") run();
    else run2();
}
return 0;
}

```

Task F ()

```
//  
// Created by omega_alpha on 18.03.2021  
//  
  
#include <bits/stdc++.h>  
using namespace std;  
  
#define int long long  
#define FF first  
#define SS second  
#define ALL(a) a.begin(), a.end()  
#define RALL(a) a.rbegin(), a.rend()  
#define pb push_back  
#define pf push_front  
#define mp make_pair  
  
using ll = long long;  
using ld = long double;  
  
const int INFI = 1e9 + 228;  
const ll INFL = 1e18 + 228;  
const ld INFLD = 1e18 + 228;  
const ld PI = acos(-1);  
const int MAXN = 1e5 + 228;  
  
vector<pair<int, int>> DD = {{-1, 0}, {1, 0}, {0, 1}, {0, -1}};  
  
void run() {  
    int n;  
    cin >> n;  
    if (n <= 8) {  
        cout << 4 << endl;  
        cout << 0 << '␣' << 0 << endl;  
        cout << 1 << '␣' << 0 << endl;  
        cout << 1 << '␣' << 1 << endl;  
        cout << 0 << '␣' << 1 << endl;  
        vector<pair<int, int>> ans = {{-1, 1}, {0, 1}, {1, 1}, {1, 0}, {1, -1}, {0, -1}, {-1,  
            -1}, {-1, 0}};  
        for (int i = 0; i < n; ++i) cout << ans[i].FF << '␣' << ans[i].SS << endl;  
        return;  
    }  
}  
  
signed main() {  
    ios_base::sync_with_stdio(false);  
    cin.tie(0);  
    cout.tie(0);  
    int t;  
    //cin >> t;  
    t = 1;  
    while (t--) run();  
    return 0;  
}
```