

Олимпиада СПбГУ по информатике 2020/21 учебного года

A	B	C	D	E	F	Sum
100	100	100	100	55	15	470

Task A ()

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

#define ll long long
#define ld long double

using namespace std;

const long long LINF = LLONG_MAX - 100;
const int INF = INT_MAX - 100;
const ll MOD = 1000000007;

const ld PI = 3.14159265358979323;

const int N = 1e3 + 111;

mt19937 rnd(432412);

ll k;
int a[] = {0, 2, 3, 4, 5, 6, 7, 8, 9};

int main() {
#ifdef Vova
    freopen("input", "r", stdin);
#else
    ios::sync_with_stdio(false);
    cin.tie(0);
#endif
    srand(time(NULL));
    cin >> k;
    if (k <= 9) {
        cout << k;
    }
    else {
        cout << (a[(k-10) % 9]);
    }
}
```

Task B ()

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

#define ll long long
#define ld long double

using namespace std;

const long long LINF = LLONG_MAX - 100;
const int INF = INT_MAX - 100;
const ll MOD = 1000000007;

const ld PI = 3.14159265358979323;

const int N = 1e5 + 111;

mt19937 rnd(432412);

int n, k, dp[N];
vector<vector<int>>> pos;
string s;

int unique_on_seg(int l, int r){
    int ans = 0;
    for (int i = 0; i < 26; ++i) {
        auto p = lower_bound(pos[i].begin(), pos[i].end(), 1);
        if (p != pos[i].end() && *p <= r)
            ++ans;
    }
    return ans;
}

int solve_fast(){
    pos.resize(26);
    for (int i = 0; i < n; ++i){
        pos[s[i] - 'a'].push_back(i);
        dp[i] = INF;
    }
    dp[0] = 1;
    for (int i = 1; i < n; ++i){
        int l = max(0, i-k+1), r = i;
        if (unique_on_seg(l, i) <= 3){
            dp[i] = 1 ? dp[l-1] + 1 : 1;
            continue;
        }
        while (l + 1 < r){
            int m = (l + r) / 2;
            if (unique_on_seg(m, i) <= 3)
                r = m;
            else
                l = m;
        }
        dp[i] = r ? dp[r-1] + 1 : 1;
    }
    return dp[n-1];
}

int solve_slow(){
    pos.resize(26);
    for (int i = 0; i < n; ++i){
        pos[s[i] - 'a'].push_back(i);
        dp[i] = INF;
    }
    dp[0] = 1;
    for (int i = 1; i < n; ++i){
        set<char> st;
        for (int j = i; i - j < k && j >= 0; --j){
            if (unique_on_seg(j, i) > 3)
                break;
            dp[i] = min(dp[i], j ? dp[j-1] + 1 : 1);
        }
    }
    return dp[n-1];
}
```

```

}

int main() {
#ifdef Vova
    freopen("input", "r", stdin);
#else
    ios::sync_with_stdio(false);
    cin.tie(0);
#endif
    srand(time(NULL));
    cin >> n >> k >> s;
    cout << solve_fast();
}

```

Task C ()

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

#define ll long long
#define ld long double

using namespace std;

const long long LINF = LLONG_MAX - 100;
const int INF = INT_MAX - 100;
const ll MOD = 1000000007;

const ld PI = 3.14159265358979323;

const int N = 550, W = 3e5 + 111;

mt19937 rnd(432412);

ll n, dp[2][W], x, y;
int i1 = 0, i2 = 1;
bool p[N][W];
pair<int, int> a[N];

int main() {
#ifdef Vova
    freopen("input", "r", stdin);
#else
    ios::sync_with_stdio(false);
    cin.tie(0);
#endif
    srand(time(NULL));
    cin >> n >> x >> y;
    for (int i = 0; i < n; ++i) cin >> a[i].first;
    for (int i = 0; i < n; ++i) cin >> a[i].second;
    for (int i = 0; i < 2; ++i) {
        for (int j = 0; j <= W; ++j) {
            dp[i][j] = INF;
        }
    }
    dp[i1][a[0].first] = 0;
    p[i1][a[0].first] = 1;
    dp[i1][0] = a[0].second;
    p[i1][0] = 0;
    for (int i = 1; i < n; ++i) {
        for (int j = 0; j < W; ++j) {
            dp[i2][j] = INF;
        }
        for (int j = a[i].first; j < W; ++j) {
            if (dp[i1][j - a[i].first] != INF) {
                dp[i2][j] = dp[i1][j - a[i].first];
                p[i][j] = 1;
            }
        }
        for (int j = 0; j < W; ++j) {
            if (dp[i2][j] > dp[i1][j] + a[i].second) {
                dp[i2][j] = dp[i1][j] + a[i].second;
                p[i][j] = 0;
            }
        }
        swap(i1, i2);
    }
    int curj = -1;
    for (int j = 0; j <= x; ++j) {
        if (dp[i1][j] <= y) {
            curj = j;
            break;
        }
    }
    if (curj == -1) {
        cout << -1;
        return 0;
    }
}
```

```

string ans;
for (int i = n-1; i >= 0; --i){
    if (p[i][curj]){
        ans += 'x';
        curj -= a[i].first;
    }
    else {
        ans += 'y';
    }
}
reverse(ans.begin(), ans.end());
cout << ans;
}

```

Task D ()

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

#define ll long long
#define ld long double

using namespace std;

const long long LINF = LLONG_MAX - 100;
const int INF = INT_MAX - 100;
const ll MOD = 1000000007;

const ld PI = 3.14159265358979323;

const int N = 2e5, W = 3e5 + 111;

mt19937 rnd(432412);

int n;
bool a[N];
int st = 0;

int main() {
#ifdef Vova
    freopen("input", "r", stdin);
#else
    ios::sync_with_stdio(false);
    cin.tie(0);
#endif
    srand(time(NULL));
    cin >> n;
    n <= 1;
    for (int i = 0; i < n; ++i) {
        char c;
        cin >> c;
        a[i] = c == '(' || c == ')';
    }
    int ans = 0;
    stack<int> s;
    for (int i = 0; i < n; ++i) {
        if (!s.empty() && s.top() == a[i])
            s.pop();
        else
            s.push(a[i]);
    }
    ans += ((int)s.size() + 1) / 2;
    cout << ans;
}
```

Task E ()

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

#define ll long long
#define ld long double

using namespace std;

const long long LINF = LLONG_MAX - 100;
const int INF = INT_MAX - 100;
const ll MOD = 1000000007;

const ld PI = 3.14159265358979323;

const int N = 15, W = 3e5 + 111, X = 1e6 + 111;

mt19937 rnd(432412);

int n, k, a[(int)1e6+111], pr[1 << N], MY_ANS = 100000;
pair<int, int> used[1 << N];

void print_mask(int mask){
    for (int i = 0; i < n; ++i){
        if (mask & (1 << i)){
            cout << i + 1 << ' ';
        }
    }
}

void add_2(){
    int mask = 0;
    for (int i = 0; i < k; ++i){
        cin >> a[i];
        --a[i];
        mask |= (1 << a[i]);
    }
    print_mask(pr[mask] ^ mask);
    cout << '\n';
}

void add_1(){
    for (int i = 0; i < k; ++i){
        cin >> a[i];
    }
    cout << MY_ANS << '\n';
}

void add(){
    int t;
    cin >> t;
    while (t--){
        cin >> n >> k;
        if (n >= 100000){
            add_1();
        }
        else{
            add_2();
        }
    }
}

void clear_2(){
    int mask = 0;
    for (int i = 0; i < k + 1; ++i) {
        cin >> a[i];
        --a[i];
        mask |= (1 << a[i]);
    }
    if (used[mask].second == -1) {
        print_mask(used[mask].first);
        cout << '\n';
    } else {
```

```

        print_mask(rand() % 2 ? used[mask].first : used[mask].second);
        cout << '\n';
    }
}

void clear_1(){
    for (int i = 0; i < k + 1; ++i) {
        cin >> a[i];
    }
    for (int i = 0; i < k + 1; ++i){
        if (a[i] != MY_ANS){
            cout << a[i] << '␣';
        }
    }
    cout << '␣';
}

void clear(){
    int t;
    cin >> t;
    while (t--){
        cin >> n >> k;
        if (n >= 100000) {
            clear_1();
        }
        else {
            clear_2();
        }
    }
}

int main() {
#ifdef Vova
    freopen("input", "r", stdin);
#else
    ios::sync_with_stdio(false);
    cin.tie(0);
#endif
    srand(time(NULL));
    string s;
    cin >> s;
    for (int mask = 0; mask < (1 << N); ++mask){
        used[mask] = {-1, -1};
    }
    for (int mask = 0; mask < (1 << N); ++mask){
        bool ok = false;
        for (int i = 0; i < N; ++i){
            if (mask & (1 << i))
                continue;
            if (used[mask | (1 << i)].first == -1){
                used[mask | (1 << i)].first = mask;
                ok = true;
                pr[mask] = mask | (1 << i);
                break;
            }
        }
        if (ok) continue;
        for (int i = 0; i < N; ++i){
            if (mask & (1 << i))
                continue;
            if (used[mask | (1 << i)].second == -1){
                used[mask | (1 << i)].second = mask;
                pr[mask] = mask | (1 << i);
                break;
            }
        }
    }
    if (s == "add"){
        add();
    }
    else {
        clear();
    }
}

```


Task F ()

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

#define ll long long
#define ld long double

using namespace std;

const long long LINF = LLONG_MAX - 100;
const int INF = INT_MAX - 100;
const ll MOD = 1000000007;

const ld PI = 3.14159265358979323;

const int N = 15, W = 3e5 + 111, X = 1e6 + 111;

mt19937 rnd(432412);

int n;
vector<pair<int, int>> ans = {{-1, 3}, {2, 3}, {3, 0}, {2, -3}, {-1, -3}, {-3, 0}};

int main() {
#ifdef Vova
    freopen("input", "r", stdin);
#else
    ios::sync_with_stdio(false);
    cin.tie(0);
#endif
    srand(time(NULL));
    cin >> n;
    cout << "4\n0_0\n0_3\n3_3\n3_0\n";
    for (int i = 0; i < n; ++i){
        cout << ans[i].first << '_' << ans[i].second << '\n';
    }
}
```