

Олимпиада СПбГУ по информатике 2022/23 учебного года

A	B	C	D	E	F	Sum
100	100	60	100	52	10	422

Task A ()

```
#define _CRT_SECURE_NO_WARNINGS
#include <iostream>
#include <algorithm>
#include <string>
#include <vector>
#include <set>
#include <map>
#include <queue>
#include <deque>
#include <bitset>
#include <cmath>
#include <random>

using namespace std;

#define all(v) v.begin(), v.end()
using ll = long long;
using ld = long double;
#define endl '\n'
mt19937 rnd(777);
#define int long long
#define unq(v) v.resize(unique(v.begin(), v.end()) - v.begin())

const int N = 1e6 + 9, M = 1e9 + 7, X = 1 << 20;
const ll INF = 1e18 + 9;

int a[N];
int ans[N];

signed main() {
#ifdef _DEBUG
    freopen("input.txt", "r", stdin);
#else
    cin.tie(0);
    ios_base::sync_with_stdio(0);
#endif

    int n = 6;
    vector<int> v;
    for (int i = 0; i < n; i++) {
        int pos;
        cin >> pos;
        pos--;
        vector<int> u;
        for (int i = 0; i < pos; i++)
            u.push_back(v[i]);
        u.push_back(i + 1);
        for (int i = pos; i < v.size(); i++)
            u.push_back(v[i]);
        v = u;
    }
    for (int i = 0; i < v.size(); i++) {
        ans[v[i]] = i + 1;
    }
    for (int i = 1; i <= n; i++)
        cout << ans[i] << " ";
}
```

}

Task B ()

```
#define _CRT_SECURE_NO_WARNINGS
#include<iostream>
#include<algorithm>
#include<string>
#include<vector>
#include<set>
#include<map>
#include<queue>
#include<deque>
#include<bitset>
#include<cmath>
#include<random>

using namespace std;

#define all(v) v.begin(), v.end()
using ll = long long;
using ld = long double;
#define endl '\n'
mt19937 rnd(777);
#define int long long
#define unq(v) v.resize(unique(v.begin(), v.end()) - v.begin())

const int N = 1e6 + 9, M = 1e9 + 7, X = 1 << 20;
const ll INF = 1e18 + 9;

int a[N];
int ans[N];

signed main() {
#ifdef _DEBUG
    freopen("input.txt", "r", stdin);
#else
    cin.tie(0);
    ios_base::sync_with_stdio(0);
#endif

    string s;
    int n;
    cin >> s >> n;
    for (int i = 0; i < n; i++) {
        cin >> a[i];
    }
    if (s == "first") {
        int sum = 0;
        for (int i = 0; i < n; i++)
            sum += a[i];
        cout << sum * M;
        return 0;
    }
    int sum = a[0] / M;
    for (int i = 0; i < n; i++) {
        sum += a[i] % M;
    }
    cout << sum;
}
```

Task C ()

```
#define _CRT_SECURE_NO_WARNINGS
#include<iostream>
#include<algorithm>
#include<string>
#include<vector>
#include<set>
#include<map>
#include<queue>
#include<deque>
#include<bitset>
#include<cmath>
#include<random>

using namespace std;

#define all(v) v.begin(), v.end()
using ll = long long;
using ld = long double;
#define endl '\n'
mt19937 rnd(777);
#define int long long
#define unq(v) v.resize(unique(v.begin(), v.end()) - v.begin())

const int N = 1e6 + 9, M = 1e9 + 7, X = 1 << 20;
const ll INF = 1e18 + 9;

int a[N];
vector<pair<int, int>> ans;

void get2(pair<int, int> a, pair<int, int> b) {
    int a1 = a.first, a2 = b.first, b1 = a.second, b2 = b.second;
    if (a1 == a2 && b1 > b2)
        ans.push_back({ a1, b1 - b2 });
    if (b1 == b2 && a1 > a2)
        ans.push_back({ a1 - a2, b1 });
}

pair<int, int> swapp(pair<int, int> a) {
    return { a.second, a.first };
}

int used[N];
pair<int, int> p0[3];
pair<int, int> p1[3];
pair<int, int> p[3];

int check(pair<int, int> a, pair<int, int> b) {
    return a.first <= b.first && a.second <= b.second;
}

void calc() {
    if (p[0] == pair<int, int>{3, 5} && p[1] == pair<int, int>{2, 2} && p[2] == pair<int, int>{1, 2})
        p[0] = p[0];
    get2(p[0], p[1]);

    if (!check(p[1], p[0]) || !check(p[2], p[0]))
        return;
    if (p[1].first + p[2].first == p[0].first && p[1].second == p[2].second)
        ans.push_back({ p[0].first, p[0].second - p[1].second });

    if (p[2].second == p[0].second && p[1].first + p[2].first <= p[0].first) {
        ans.push_back({ p[0].first - p[1].first - p[2].first, p[0].second });
    }
    if (p[1].first + p[2].first <= p[0].first && p[2].second > p[0].second - p[1].second)
        ans.push_back({ p[1].first, p[0].second - p[1].second });
}
```

```

void rec(vector<int> pos) {
    if (pos.size() == 3) {
        for (int i = 0; i < 3; i++)
            p[i] = p1[pos[i]];
        calc();
    }
    for (int i = 0; i < 3; i++) {
        if (!used[i]) {
            pos.push_back(i);
            used[i] = 1;
            rec(pos);
            pos.pop_back();
            used[i] = 0;
        }
    }
}

signed main() {
#ifdef _DEBUG
    freopen("input.txt", "r", stdin);
#else
    cin.tie(0);
    ios_base::sync_with_stdio(0);
#endif

    cin >> p0[0].first >> p0[0].second >> p0[1].first >> p0[1].second >> p0[2].first >> p0[2].second;
    for (int i = 0; i < 3; i++)
        ans.push_back(p0[i]);
    for (int m = 0; m < 8; m++) {
        for (int i = 0; i < 3; i++) {
            p1[i] = p0[i];
            if ((m >> i) & 1)
                p1[i] = swapp(p0[i]);
        }
        rec({});
    }
    vector<pair<int, int>> ans2;
    for (auto& el : ans) {
        if (el.first <= 0 || el.second <= 0)
            continue;
        if (el.first > el.second)
            el = swapp(el);
        ans2.push_back(el);
    }
    sort(all(ans2));
    ans2.resize(unique(all(ans2)) - ans2.begin());
    for (auto el : ans2)
        cout << el.first << " " << el.second << endl;
}

```

Task D ()

```
#define _CRT_SECURE_NO_WARNINGS
#include<iostream>
#include<algorithm>
#include<string>
#include<vector>
#include<set>
#include<map>
#include<queue>
#include<deque>
#include<bitset>
#include<cmath>
#include<random>

using namespace std;

#define all(v) v.begin(), v.end()
using ll = long long;
using ld = long double;
// #define endl '\n'
mt19937 rnd(777);
#define int long long
#define unq(v) v.resize(unique(v.begin(), v.end()) - v.begin())

const int N = 60, M = 1e9 + 7, X = 1 << 20;
const ll INF = 1e18 + 9;

int a[N];
int a0[N];
int t[N];

void f(int i, int x) {
    a[i] -= x;
    if (x == 0) {
        t[i] = 0;
        a[i] = a0[i];
    }

    cout << i << " " << x << endl;

    int j, y;
    cin >> j >> y;
    if (j == -1)
        exit(0);
    a[j] -= y;
    if (y == 0) {
        t[j] = 0;
        a[j] = a0[j];
    }
}

int dp[N][N][N][2][2][2];
pair<int, int> p[N][N][N][2][2][2];

int getdp() {
    return dp[a[1]][a[2]][a[3]][t[1]][t[2]][t[3]];
}

pair<int, int> getp() {
    return p[a[1]][a[2]][a[3]][t[1]][t[2]][t[3]];
}

int dp0[N][N][2][2];
int p0[N][N][2][2];

signed main() {
#ifdef _DEBUG
    // freopen("input.txt", "r", stdin);
#else
    cin.tie(0);
    ios_base::sync_with_stdio(0);
#endif
}
```

```
#endif
```

```
int n;
cin >> n;
for (int i = 1; i <= n; i++)
    t[i] = 1;
for (int i = 1; i <= n; i++) {
    cin >> a[i];
    a0[i] = a[i];
}
if (n == 1) {
    cout << "1_" << a[1] << endl;
    int i, x;
    cin >> i >> x;
    if (i == -1 && x == -1)
        return 0;
    cout << "1_" << a[1] << endl;

    cin >> i >> x;
    return 0;
}

if (n == 2) {
    for (int t1 = 0; t1 <= 1; t1++) {
        for (int t2 = 0; t2 <= 1; t2++) {
            for (int x = 0; x <= a[1]; x++) {
                for (int y = 0; y <= a[2]; y++) {

                    if (x == 0 && y == 0)
                        continue;
                    if (t1 && !dp0[a0[1]][y][0][t2]) {
                        dp0[x][y][t1][t2] = 1;
                        p0[x][y][t1][t2] = INF;
                        continue;
                    }
                    if (t2 && !dp0[x][a0[2]][t1][0]) {
                        dp0[x][y][t1][t2] = 1;
                        p0[x][y][t1][t2] = -INF;
                        continue;
                    }
                    for (int k = 0; k < x; k++) {
                        if (!dp0[k][y][t1][t2]) {
                            dp0[x][y][t1][t2] = 1;
                            p0[x][y][t1][t2] = x - k;
                            break;
                        }
                    }
                    if (dp0[x][y][t1][t2])
                        continue;
                    for (int k = 0; k < y; k++) {
                        if (!dp0[x][k][t1][t2]) {
                            dp0[x][y][t1][t2] = 1;
                            p0[x][y][t1][t2] = -(y - k);
                            break;
                        }
                    }
                }
            }
        }
    }
}

int x = a[1], y = a[2];
if (!dp0[x][y][t[1]][t[2]]) {
    cout << "-1_-1" << endl;
    return 0;
}

while (true) {
    int g = p0[x][y][t[1]][t[2]];
    if (g == INF) {
        f(1, 0);
    }
    else if (g == -INF) {
        f(2, 0);
    }
}
```

```

        else if (g > 0)
            f(1, g);
        else
            f(2, -g);
        x = a[1];
        y = a[2];
    }
    return 0;
}

for (int t1 = 0; t1 <= 1; t1++) {
    for (int t2 = 0; t2 <= 1; t2++) {
        for (int t3 = 0; t3 <= 1; t3++) {
            for (int x = 0; x <= a[1]; x++) {
                for (int y = 0; y <= a[2]; y++) {
                    for (int z = 0; z <= a[3]; z++) {
                        if (x + y + z == 0)
                            continue;
                        if (t1 && !dp[a0[1]][y][z][0][t2][t3]) {
                            dp[x][y][z][t1][t2][t3] = 1;
                            p[x][y][z][t1][t2][t3] = { 1, 0 };
                            continue;
                        }
                        if (t2 && !dp[x][a0[2]][z][t1][0][t3]) {
                            dp[x][y][z][t1][t2][t3] = 1;
                            p[x][y][z][t1][t2][t3] = { 2, 0 };
                            continue;
                        }
                        if (t3 && !dp[x][y][a0[3]][t1][t2][0]) {
                            dp[x][y][z][t1][t2][t3] = 1;
                            p[x][y][z][t1][t2][t3] = { 3, 0 };
                            continue;
                        }
                    }

                    for (int k = 0; k < x; k++) {
                        if (!dp[k][y][z][t1][t2][t3]) {
                            dp[x][y][z][t1][t2][t3] = 1;
                            p[x][y][z][t1][t2][t3] = { 1, x - k };
                            break;
                        }
                    }
                    if (dp[x][y][z][t1][t2][t3])
                        continue;

                    for (int k = 0; k < y; k++) {
                        if (!dp[x][k][z][t1][t2][t3]) {
                            dp[x][y][z][t1][t2][t3] = 1;
                            p[x][y][z][t1][t2][t3] = { 2, y - k };
                            break;
                        }
                    }
                    if (dp[x][y][z][t1][t2][t3])
                        continue;

                    for (int k = 0; k < z; k++) {
                        if (!dp[x][y][k][t1][t2][t3]) {
                            dp[x][y][z][t1][t2][t3] = 1;
                            p[x][y][z][t1][t2][t3] = { 3, z - k };
                            break;
                        }
                    }
                }
            }
        }
    }
}

if (!getdp()) {
    cout << "-1_-1" << endl;
    return 0;
}

```



```
while (true) {  
    f(getp().first , getp().second);  
}  
}
```

Task E ()

```
#define _CRT_SECURE_NO_WARNINGS
#include<iostream>
#include<algorithm>
#include<string>
#include<vector>
#include<set>
#include<map>
#include<queue>
#include<deque>
#include<bitset>
#include<cmath>
#include<random>

using namespace std;

#define all(v) v.begin(), v.end()
using ll = long long;
using ld = long double;
#define endl '\n'
mt19937 rnd(777);
#define int long long
#define unq(v) v.resize(unique(v.begin(), v.end()) - v.begin())

const int N = 60, M = 1e9 + 7, X = 1 << 20, MAX = 1e6;
const ll INF = 1e18 + 9;

string s[N];

vector<vector<int>>> v;

vector<int> vec;

void rec(int last) {
    if (vec.size() == 10) {
        v.push_back(vec);
        return;
    }
    for (int i = last; i <= 10; i++) {
        vec.push_back(i);
        rec(i);
        if (v.size() > MAX)
            return;
        vec.pop_back();
    }
}

int get() {
    vector<int> res;
    for (int i = 0; i < 10; i++) {
        int sum = 0;
        for (int j = 0; j < 10; j++) {
            sum += s[i][j] - '0';
        }
        res.push_back(sum);
    }
    sort(all(res));
    return lower_bound(all(v), res) - v.begin() + 1;
}

void print(int i) {
    vector<int> cnt = v[i - 1];

    for (int i = 0; i < 10; i++) {
        string s;
        for (int j = 0; j < cnt[i]; j++) {
            s.push_back('1');
        }
        for (int j = cnt[i]; j < 10; j++) {
            s.push_back('0');
        }
    }
}
```

```

        cout << s << endl;
    }

}

signed main() {
#ifdef _DEBUG
    freopen("input.txt", "r", stdin);
#else
    cin.tie(0);
    ios_base::sync_with_stdio(0);
#endif

    rec(0);
    sort(all(v));
    //cout << v.size();

    int t;
    string q;
    cin >> t >> q;
    while (t--) {
        if (q == "transmit") {
            int n;
            cin >> n;
            print(n);
            cout << endl;
        }
        else {
            for (int i = 0; i < 10; i++)
                cin >> s[i];
            cout << get() << endl;
        }
    }
}

```

Task F ()

```
#define _CRT_SECURE_NO_WARNINGS
#include<iostream>
#include<algorithm>
#include<string>
#include<vector>
#include<set>
#include<map>
#include<queue>
#include<deque>
#include<bitset>
#include<cmath>
#include<random>

using namespace std;

#define all(v) v.begin(), v.end()
using ll = long long;
using ld = long double;
#define endl '\n'
mt19937 rnd(777);
#define int long long
#define unq(v) v.resize(unique(v.begin(), v.end()) - v.begin())

const int N = 60, M = 1e9 + 7, X = 1 << 20, MAX = 1e6;
const ll INF = 1e18 + 9;

vector<pair<int, int>> ans;

void rec(vector<pair<int, int>> a, vector<pair<int, int>> b, int add) {
    if (!a.size() && !b.size()) {
        if (add)
            ans.push_back({ 1, 1 });
        return;
    }
    int x = a.back().first;
    int y = b.back().first;
    if (a.back().second == 1 || b.back().second == 1 || !add && x + y >= 10) {

        if (a.back().second > 1) {
            a.back().second--;
        }
        else
            a.pop_back();
        if (b.back().second > 1) {
            b.back().second--;
        }
        else
            b.pop_back();

        int add2 = (x + y + add) / 10;
        ans.push_back({ (x + y + add) % 10, 1 });
        rec(a, b, add2);
        return;
    }

    if (add) {
        if (x + y < 9) {
            a.back().second--;
            b.back().second--;
            ans.push_back({ x + y + add, 1 });
            rec(a, b, 0);
            return;
        }
    }
}

int len = min(a.back().second, b.back().second);
```

```

int z = (x + y) % 10;
int add2 = 0;
if (x + y >= 10 || x + y == 9 && add == 1) {
    z = (x + y + 1) % 10;
    add2 = 1;
}

ans.push_back({ z, len });

if (a.back().second == len)
    a.pop_back();
else
    a.back().second -= len;

if (b.back().second == len)
    b.pop_back();
else
    b.back().second -= len;
rec(a, b, add2);
}

int num(string s) {
    reverse(all(s));
    int b = 1, ans = 0;
    for (auto c : s) {
        ans += (c - '0') * b;
        b *= 10;
    }
    return ans;
}

vector<pair<int, int>> vec(string s) {
    vector<pair<int, int>> v;
    for (int i = 0; i < s.size(); i++) {
        if (s[i] != '(') {
            v.push_back({ s[i] - '0', 1 });
            continue;
        }

        int x = s[i + 1] - '0';
        i += 3;
        string t;
        while (s[i] != ')')
            t.push_back(s[i++]);
        v.push_back({ x, num(t) });
    }
    return v;
}

signed main() {
#ifdef _DEBUG
    freopen("input.txt", "r", stdin);
#else
    cin.tie(0);
    ios_base::sync_with_stdio(0);
#endif

    string s, t;
    cin >> s >> t;
    auto a = vec(s), b = vec(t);
    int sz1 = 0, sz2 = 0;

    for (auto el : a)
        sz1 += el.second;
    for (auto el : b)
        sz2 += el.second;
    reverse(all(a));
    reverse(all(b));
    if (sz1 < sz2)
        a.push_back({ 0, sz2 - sz1 });
    if (sz2 < sz1)

```

```

        b.push_back({ 0, sz1 - sz2 });

reverse(all(a));
reverse(all(b));

rec(a, b, 0);
reverse(all(ans));
for (int i = 0; i < ans.size(); i++) {
    if (ans[i].second == 1) {
        cout << ans[i].first;
        continue;
    }
    cout << "(" << ans[i].first << "|" << ans[i].second << ")";
}
}

```