

Олимпиада СПбГУ по информатике 2021/22 учебного года

A	B	C	D	E	F	Sum
100	100	100	100	100	8	508

Task A ()

```
#include <iostream>
#include <random>
#include <vector>
#include <set>
#include <cmath>
#include <unordered_map>
#include <algorithm>
#include <queue>
#include <string>
#include <map>
#include <bits/stdc++.h>

// #define _CRT_SECURE_NO_WARNINGS
// #pragma GCC target("sse,sse2,sse3,ssse3,sse4,popcnt,abm,mmx,avx,avx2,tune=native") // Enable AVX
// #pragma GCC optimize("Ofast")
// #pragma GCC optimize("no-stack-protector")
// #pragma GCC optimize("unroll-loops")
// #pragma GCC optimize("unswitch-loops")
// #pragma GCC optimize("fast-math")
// #pragma GCC optimize("rename-registers") // Optimization flags

// #include <ext/pb_ds/assoc_container.hpp>
// #include <ext/pb_ds/tree_policy.hpp>

// using namespace __gnu_cxx;
// using namespace __gnu_pbds;
using namespace std;

template<class T>
void hash_combine(size_t &seed, const T &v) {
    hash<T> hasher;
    seed ^= hasher(v) + 0x9e3779b9 + (seed << 6) + (seed >> 2);
}

namespace std {
    template<typename S, typename T>
    struct hash<pair<S, T>> {
        size_t operator()(const pair<S, T> &v) const {
            size_t seed = 0;
            ::hash_combine(seed, v.first);
            ::hash_combine(seed, v.second);
            return seed;
        }
    };
}

// const int MAX_MEM = 1e8;
// int mpos = 0;
// char mem[MAX_MEM];
// inline void * operator new ( size_t n ) {
//     char *res = mem + mpos;
//     mpos += n;
//     assert(mpos <= MAX_MEM);
// }
```

```

//    return (void *)res;
//}
//inline void operator delete ( void * ) { }

#define int long long

int bin_pow(long long a, int p, int M) {
    if (p == 0LL) return 1LL;
    if (p % 2) return a * bin_pow(a, p - 1, M) % M;
    long long c = bin_pow(a, p / 2, M);
    return c * c % M;
}

bool is_prime(int n) {
    for (int i = 2; i * i <= n; ++i) {
        if (n % i == 0) return false;
    }
    return true;
}

int rev(int a, int m) {
    if (a == 1) return a;
    return (1 - rev(m % a, a) * m) / a + m;
}

//using ordered_set = tree<pair<int, int>, null_type, less<pair<int, int>>, rb_tree_tag,
//    tree_order_statistics_node_update>;

const int M = 1e9 + 9;
//const int M2 = 998244353;
const long long INF = 1e15 + 7;
const int p = 113;
//const int k = 18;
const int N = 400005;
//const int k = 60;

signed main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.precision(10);
    //    freopen("primeseq.in", "r", stdin);
    //    freopen("primeseq.out", "w", stdout);
    cout << fixed;
    int n;
    cin >> n;
    vector<pair<string, int>> vec;
    int minn = INF;
    map<int, int> ma;
    for (int i = 0; i < n; ++i) {
        string s;
        int a;
        cin >> s >> a;
        int ind = 0;
        reverse(s.begin(), s.end());
        for (auto c: s) {
            ma[a + ind] += c - '0';
            int now = a + ind;
            while (ma[now] >= 10) {
                int ost = ma[now] / 10;
                ma[now] %= 10;
                now++;
                ma[now] += ost;
            }
            ind++;
        }
    }
    for (auto c: ma) {
        if (c.second != 0) {
            cout << c.first;
            break;
        }
    }
}

```

}

Task B ()

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

using namespace std;

// #pragma GCC target("sse,sse2,sse3,ssse3,sse4,popcnt,abm,mmx,avx,avx2,tune=native") // Enable AVX
// #pragma GCC optimize("Ofast")
// #pragma GCC optimize("no-stack-protector")
// #pragma GCC optimize("unroll-loops")
// #pragma GCC optimize("unswitch-loops")
// #pragma GCC optimize("fast-math")
// #pragma GCC optimize("rename-registers") // Optimization flags
// #define int long long
const int k = 1000;
const int M = 998244353;
const int N = 2'000'005;

signed main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.precision(10);
    // freopen("primeseq.in", "r", stdin);
    // freopen("primeseq.out", "w", stdout);
    cout << fixed;
    int n;
    cin >> n;
    vector<int> vec(n);
    for (int i = 0; i < n; ++i) cin >> vec[i];
    while (true) {
        int ind = 0;
        for (int i = 0; i < n; ++i) {
            if (vec[i] > 0) ind = i;
        }
        if (vec[ind] == 0) {
            cout << "Stop" << endl;
            return 0;
        }
        cout << "Flip_and_wait" << endl;
        int now = 0;
        while (now <= ind) {
            string s;
            cin >> s;
            int cnt = 0;
            for (auto c: s) {
                if (c == 'e') cnt++;
            }
            cnt /= 2;
            now += cnt;
            if (now <= ind) {
                cout << "Wait" << endl;
            }
        }
        vec[ind]--;
    }
}
```

Task C ()

```
#include <iostream>
#include <random>
#include <vector>
#include <set>
#include <cmath>
#include <unordered_map>
#include <algorithm>
#include <queue>
#include <string>
#include <map>
#include <bits/stdc++.h>

// #define _CRT_SECURE_NO_WARNINGS
// #pragma GCC target("sse,sse2,sse3,ssse3,sse4,popcnt,abm,mmx,avx,avx2,tune=native") // Enable AVX
// #pragma GCC optimize("Ofast")
// #pragma GCC optimize("no-stack-protector")
// #pragma GCC optimize("unroll-loops")
// #pragma GCC optimize("unswitch-loops")
// #pragma GCC optimize("fast-math")
// #pragma GCC optimize("rename-registers") // Optimization flags

// #include <ext/pb_ds/assoc_container.hpp>
// #include <ext/pb_ds/tree_policy.hpp>

// using namespace __gnu_cxx;
// using namespace __gnu_pbds;
using namespace std;

template<class T>
void hash_combine(size_t &seed, const T &v) {
    hash<T> hasher;
    seed ^= hasher(v) + 0x9e3779b9 + (seed << 6) + (seed >> 2);
}

namespace std {
    template<typename S, typename T>
    struct hash<pair<S, T>> {
        size_t operator()(const pair<S, T> &v) const {
            size_t seed = 0;
            ::hash_combine(seed, v.first);
            ::hash_combine(seed, v.second);
            return seed;
        }
    };
}

// const int MAX_MEM = 1e8;
// int mpos = 0;
// char mem[MAX_MEM];
// inline void * operator new ( size_t n ) {
//     char *res = mem + mpos;
//     mpos += n;
//     assert(mpos <= MAX_MEM);
//     return (void *)res;
// }
// inline void operator delete ( void * ) { }

#define int long long

int bin_pow(long long a, int p, int M) {
    if (p == 0LL) return 1LL;
    if (p % 2) return a * bin_pow(a, p - 1, M) % M;
    long long c = bin_pow(a, p / 2, M);
    return c * c % M;
}

bool is_prime(int n) {
    for (int i = 2; i * i <= n; ++i) {
        if (n % i == 0) return false;
    }
}
```

```

    }
    return true;
}

int rev(int a, int m) {
    if (a == 1) return a;
    return (1 - rev(m % a, a) * m) / a + m;
}

//using ordered_set = tree<pair<int, int>, null_type, less<pair<int, int>>, rb_tree_tag,
//    tree_order_statistics_node_update>;

const int M = 1e9 + 9;
//const int M2 = 998244353;
const long long INF = 1e15 + 7;
const int p = 113;
//const int k = 18;
const int N = 400005;
//const int k = 60;

map<string, string> ma1, ma2;

set<string> used;

void f(string now) {
    if (now.size() > 10) return;
    for (int mask = 0; mask < (1 << now.size()); ++mask) {
        if (__builtin_popcount(mask) >= now.size() / 2) {
            string now_s = now;
            for (int i = 0; i < now.size(); ++i) {
                if ((mask >> i) & 1) {
                    now_s[i] = '?';
                }
            }
            if (used.find(now_s) == used.end()) {
                ma1[now] = now_s;
                ma2[now_s] = now;
                used.insert(now_s);
                break;
            }
        }
    }
    f(now + '1');
    f(now + '0');
}

signed main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.precision(10);
    //    freopen("primeseq.in", "r", stdin);
    //    freopen("primeseq.out", "w", stdout);
    cout << fixed;
    int t;
    cin >> t;
    f("0");
    f("1");
    while (t--) {
        string s;
        cin >> s;
        bool fl = false;
        for (auto c: s) {
            if (c == '?') {
                fl = true;
            }
        }
        if (s.size() <= 10) {
            if (fl) {
                cout << ma2[s] << "\n";
            } else {
                cout << ma1[s] << "\n";
            }
        }
    }
}

```

```

    }
} else {
    if (f1) {
        int cnt0 = 0, cnt1 = 0;
        for (auto c: s) {
            if (c == '0') cnt0++;
            else if (c == '1') cnt1++;
        }
        if (cnt0 <= 4 and cnt1 <= 4 and abs(cnt0 - cnt1) == 1) {
            if (cnt1 > cnt0) {
                for (auto c: s) {
                    if (c == '?') cout << 1;
                    else cout << c;
                }
                cout << "\n";
            } else {
                for (auto c: s) {
                    if (c == '?') cout << 0;
                    else cout << c;
                }
                cout << "\n";
            }
        }
    } else {
        if (cnt0 > cnt1) {
            for (auto c: s) {
                if (c == '?') cout << 1;
                else cout << c;
            }
            cout << "\n";
        } else {
            for (auto c: s) {
                if (c == '?') {
                    cout << 0;
                } else cout << c;
            }
            cout << "\n";
        }
    }
}

} else {
    int cnt0 = 0, cnt1 = 0;
    for (auto c: s) {
        if (c == '0') cnt0++;
        else cnt1++;
    }
    if (cnt0 > 3 and cnt1 > 3) {
        if (cnt0 > cnt1) {
            for (auto c: s) {
                if (c == '0') cout << "?";
                else cout << '1';
            }
            cout << "\n";
        } else {
            for (auto c: s) {
                if (c == '1') cout << "?";
                else cout << "0";
            }
            cout << "\n";
        }
    }
} else {
    if (cnt0 > cnt1) {
        int want_show = cnt1 + 1;
        for (auto c: s) {
            if (c == '0') {
                if (want_show > 0) {
                    cout << "0";
                    want_show--;
                } else {
                    cout << "?";
                }
            } else {
                cout << "1";
            }
        }
    }
}
}

```


Task D ()

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

using namespace std;

#define int long long
const int M = 998244353;
const int N = 2'000'005;

vector<pair<int, int>> vec = {{0, 1},
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```

```

int fac(long long n) {
    int ind = 0;
    for (int i = 1; i < vec.size(); ++i) {
        if (vec[i].first <= n) {
            ind = i;
        }
    }
    long long fact = vec[ind].second;
    for (int i = vec[ind].first + 1; i <= n; ++i) {
        fact *= i;
        fact %= M;
    }

    return fact;
}

```

```

long long factorial_power(long long n, int p) {

    long long power = 0;

    while (n > 0) {

        n /= p;

        power += n;

    }
    return power;
}

```

```

int mod_factorial(long long n, int p) {

    int factorial = 1;

    while (n > 0) {
        long long k = n / p;
        int b = n % p;
        if (k % 2 == 1) {
            factorial = factorial * (p - 1) % p;
        }
        factorial = factorial * fac(b) % p;
        n = k;
    }
    return factorial;
}

```

```

signed main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.precision(10);
    // freopen("primeseq.in", "r", stdin);
    // freopen("primeseq.out", "w", stdout);
    cout << fixed;
    // long long fact = 1;
    // cout << "{";
    // for (int i = 1; i < 1000000000; ++i) {

```

```

//      fact *= i;
//      fact %= M;
//      if (i % (300000) == 0) {
//          cout << "{" << i << ", " << fact << "};\n";
//      }
//  }
//  cout << "};";
int n;
cin >> n;
cout << factorial_power(n + 1, M) << "\u" << mod_factorial(n + 1, M);
}

```

Task E ()

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

using namespace std;

#define int long long
const int k = 1000;
const int N = 1'000'005;

int bl[k];

int fenw[N];

int sum (int r)
{
    int result = 0;
    for (; r >= 0; r = (r & (r+1)) - 1)
        result += fenw[r];
    return result;
}

void inc (int i, int delta)
{
    for (; i < N; i = (i | (i+1)))
        fenw[i] += delta;
}

signed main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.precision(10);
    // freopen("primeseq.in", "r", stdin);
    // freopen("primeseq.out", "w", stdout);
    cout << fixed;
    long long n;
    cin >> n;
    vector<long long> vec(n);
    for (int i = 0; i < n; ++i) cin >> vec[i];
    vector<vector<pair<int, int>>> quer(n + 1);
    long long m;
    cin >> m;
    vector<int> ans(m);
    for (int i = 0; i < m; ++i) {
        long long a, b, d;
        cin >> a >> b >> d;
        quer[a].push_back({d, -i - 1});
        quer[b].push_back({d, i + 1});
    }
    for (int i = 0; i <= n; ++i) {
        for (auto c: quer[i]) {
            int now = 0;
            for (int j = 1; j < k; ++j) {
                now += ((c.first + j - 1) / j) * bl[j];
            }
            now += sum(c.first);
            if (c.second < 0) ans[-c.second - 1] -= now;
            else ans[c.second - 1] += now;
        }
        if (i == n) break;
        if (vec[i] < k) bl[vec[i]]++;
        else {
            for (int j = 1; j < N; j += vec[i]) inc(j, 1);
        }
    }
    for (int i = 0; i < m; ++i) cout << (long long)ans[i] << "\n";
}
```


Task F ()

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

using namespace std;

// #pragma GCC target ("sse,sse2,sse3,ssse3,sse4,popcnt,abm,mmx,avx,avx2,tune=native") // Enable AVX
// AVX2
// #pragma GCC optimize ("Ofast")
// #pragma GCC optimize ("no-stack-protector")
// #pragma GCC optimize ("unroll-loops")
// #pragma GCC optimize ("unswitch-loops")
// #pragma GCC optimize ("fast-math")
// #pragma GCC optimize ("rename-registers") // Optimization flags
// #define int long long
// const int k = 1000;
const int M = 998244353;
const int N = 2'000;

signed_main() {
    ios_base::sync_with_stdio(0);
    cin.tie(0);
    cout.precision(10);
    // freopen("primeseq.in", "r", &stdin);
    // freopen("primeseq.out", "w", &stdout);
    cout <<< fixed;
    int n;
    cin >>> n;

    vector<pair<int, int>> vec(n);
    for (int i = 0; i < n; i++) {
        int l, r;
        cin >>> l >>> r;
        vec[i] = {l, r};
    }
    int maxx = 0;
    map<int, int> ma[21];
    ma[0][0] = 1;
    for (int i = 1; i <= n; i++) {
        for (int j = -100; j <= 100; j++) {
            for (int k = -100; k <= 100; k++) {
                if (j - k >= vec[i - 1].first & j - k <= vec[i - 1].second) {
                    int dob = 0;
                    if (j == 0) dob = 1;
                    // if (ma[i - 1][k] == 1 & dob == 1) {
                    // cout <<< izn <<< " " <<< i <<< " " <<< j <<< " " <<< k <<< endl;
                    // }
                    ma[i][j] = max(ma[i][j], ma[i - 1][k] + dob);
                }
            }
        }
    }
    for (auto c : ma[n]) {
        maxx = max(maxx, c.second);
    }

    cout <<< maxx;
}
```