Олимпиада СПбГУ по информатике 2021/22 учебного года

A	B	C	D	E	F	Sum
100	100	100	100	58	31	489

Task A ()

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

using ll = long long;
#define all(o) (o).begin(), (o).end()
#if LOCAL
#define dbg(o) ({cout << #o << " = " << (o) << "\n"; (o); })
#else
#define dbg(o) (o)
#endif

template<typename T>
ostream &operator<<(ostream &o, vector<T> v) {
    for (T e: v) {
        o << e << " ";
    }
    return o;
}

template<typename T1, typename T2>
ostream &operator<<(ostream &o, pair<T1, T2> v) {
    o << v.first << " " << v.second << " ";
    return o;
}

void solve() {
    int n; cin >> n;
    vector<pair<ll, ll>> a(n);
    for (int i = 0; i < n; ++i) {
        cin >> a[i].first >> a[i].second;
        while (a[i].first % 10 == 0) {
            a[i].first /= 10;
            a[i].second++;
        }
    }

    sort(all(a), [&](auto l, auto r) {
        return l.second < r.second;
    });

    ll p = 0, q = 0;
    for (int i = 0; i < n; ++i) {
        if (p == a[i].second) {
            q += a[i].first;
        } else {
            ll d = a[i].second - p;
            if (d < 15) {
                while (q % 10 == 0 && d > 0) {
                    q /= 10;
                    p++;
                    d--;
                }
                if (d > 0) {
                    cout << p << "\n";
                    return;
                }
```

```
            } else {
                if (q != 0) {
                    while (q % 10 == 0) {
                        p++;
                        q /= 10;
                    }
                    cout << p << "\n";
                    return;
                }
                p = a[i].second;
            }
            q += a[i].first;
        }
    }
    while (q % 10 == 0) {
        p++;
        q /= 10;
    }
    cout << p << "\n";
}

int main() {
#if LOCAL
    freopen("../input.txt", "r", stdin);
    int q; cin >> q;
    while (q--) {
        solve();
    }
#else
    solve();
#endif
}
```

Task B ()

```
#pragma GCC optimize("Ofast")

#include <bits/stdc++.h>

using namespace std;

using ll = long long;
#define all(o) (o).begin(), (o).end()
#if LOCAL
#define dbg(o) ({cout << #o << " = " << (o) << "\n"; (o); })
#else
#define dbg(o) (o)
#endif

template<typename T>
ostream &operator<<(ostream &o, vector<T> v) {
    for (T e: v) {
        o << e << " ";
    }
    return o;
}

template<typename T1, typename T2>
ostream &operator<<(ostream &o, pair<T1, T2> v) {
    o << v.first << " " << v.second << " ";
    return o;
}

int flip() {
    cout << "Flip and wait" << endl;
    string beep; cin >> beep;
    assert(beep != "Burn");
    return int(beep.size() - 3) / 2;
}

int wait() {
    cout << "Wait" << endl;
    string beep; cin >> beep;
    assert(beep != "Burn");
    return int(beep.size() - 3) / 2;
}

void wait_until(int start, int id) {
    int cnt = start;
    while (cnt <= id) {
        cnt += wait();
    }
}

void solve() {
    int n;
    cin >> n;

    vector<int> a(n);
    for (int i = 0; i < n; ++i) {
        cin >> a[i];
    }

    for (int i = 0; i < n; ++i) {
        while (a[i] > 1) {
            wait_until(flip(), i);
            wait_until(flip(), i);
            a[i] -= 2;
        }
    }

    for (int i = n - 1; i >= 0; --i) {
        if (a[i] == 1) {
            wait_until(flip(), i);
        }
    }
```

```
    cout << "Stop" << endl;
}

int main() {
    ios_base::sync_with_stdio(false);
    cin.tie(0);
#if LOCAL
    // freopen("../input.txt", "r", stdin);
    int q;
    cin >> q;
    while (q--) {
        solve();
    }

#else
    solve();
#endif
}
```

Task C ()

```
#pragma GCC optimize("Ofast")

#include <bits/stdc++.h>

using namespace std;

using ll = long long;
#define all(o) (o).begin(), (o).end()
#if LOCAL
#define dbg(o) ({cout << #o << " = " << (o) << "\n"; (o); })
#else
#define dbg(o) (o)
#endif

template<typename T>
ostream &operator<<(ostream &o, vector<T> v) {
    for (T e: v) {
        o << e << " ";
    }
    return o;
}

template<typename T1, typename T2>
ostream &operator<<(ostream &o, pair<T1, T2> v) {
    o << v.first << " " << v.second << " ";
    return o;
}

const ll MOD = 998244353;

ll pw(ll x, ll k) {
    if (k == 0) return 1;
    ll p = pw(x, k / 2);
    if (k % 2 == 0) {
        return p * p % MOD;
    } else {
        return p * p % MOD * x % MOD;
    }
}

void solve2(string s) {
    mt19937 rnd(42123);
    int l = (int)s.size();

    string pattern(l, '0');
    for (int i = 0; i < l; ++i) {
        if (rnd() & 1) {
            pattern[i] = '?';
        }
    }

    if (count(all(pattern), '?') < count(all(pattern), '0')) {
        replace(all(pattern), '?', '1');
        replace(all(pattern), '0', '?');
    }

    if (count(all(s), '?') == 0) {
        int zeros = int(count(all(s), '0')), ones = l - zeros;
        if (zeros == 0 || ones == 0) {
            for (int i = 0; i < l; ++i) {
                if (pattern[i] == '?') s[i] = '?';
            }
            cout << s << "\n";
        } else {
            if (zeros > ones) {
                replace(all(s), '0', '?');
            } else {
                replace(all(s), '1', '?');
            }
            cout << s << "\n";
        }
    } else {
```

```
        bool special = true;
        for (int i = 0; i < l; ++i) {
            if (pattern[i] == '?') {
                if (s[i] != '?') special = false;
            } else {
                if (s[i] == '?') special = false;
            }
        }

        if (special) {
            if (count(all(s), '1') == 0) {
                cout << string(l, '0') << "\n";
            } else {
                cout << string(l, '1') << "\n";
            }
        } else {
            if (count(all(s), '1') == 0) {
                replace(all(s), '?', '1');
                cout << s << "\n";
            } else {
                replace(all(s), '?', '0');
                cout << s << "\n";
            }
        }
    }
}

unordered_map<string, optional<string>> decode;
unordered_map<string, string> encode;

void warm_up() {
    for (int len = 2; len <= 10; ++len) {
        vector<string> strings;
        vector<bitset<32>> patterns;
        for (int s = 0; s < (1 << len); ++s) {
            bitset<32> bs(s);
            strings.push_back(bs.to_string().substr(32 - len));
            if (__builtin_popcount(s) >= len / 2) patterns.emplace_back(s);
        }

        // dbg(strings);
        // dbg(patterns);
        for (string s: strings) {
            for (auto p: patterns) {
                string c = s;
                for (int i = 0; i < len; ++i) {
                    if (p[i]) c[i] = '?';
                }
                if (decode[c].has_value()) continue;
                decode[c] = s;
                encode[s] = c;
                break;
            }
        }
    }
    // for (auto [k, v]: decode) {
    //     cout << k << " " << *v << "\n";
    // }
}

void solve1(string s) {
    if (count(all(s), '?') == 0) {
        cout << encode[s] << "\n";
    } else {
        cout << *decode[s] << "\n";
    }
}

void solve() {
    warm_up();
    int n;
    cin >> n;
    for (int _ = 0; _ < n; ++_) {
        string s;
```

```
        cin >> s;
        if (s.size() > 10) {
            solve2(s);
        } else {
            solve1(s);
        }
    }
}

int main() {
#if LOCAL
    freopen("../input.txt", "r", stdin);
    int q;
    cin >> q;
    while (q--) {
        solve();
    }
#else
    solve();
#endif
}
```

Task D ()

```cpp
#pragma GCC optimize("Ofast")
#include <bits/stdc++.h>

using namespace std;

using ll = long long;
#define all(o) (o).begin(), (o).end()
#if LOCAL
#define dbg(o) ({cout << #o << " = " << (o) << "\n"; (o); })
#else
#define dbg(o) (o)
#endif

template<typename T>
ostream &operator<<(ostream &o, vector<T> v) {
    for (T e: v) {
        o << e << " ";
    }
    return o;
}

template<typename T1, typename T2>
ostream &operator<<(ostream &o, pair<T1, T2> v) {
    o << v.first << " " << v.second << " ";
    return o;
}

const ll MOD = 998244353;

ll pw(ll x, ll k) {
    if (k == 0) return 1;
    ll p = pw(x, k / 2);
    if (k % 2 == 0) {
        return p * p % MOD;
    } else {
        return p * p % MOD * x % MOD;
    }
}

void solve() {
    ll n; cin >> n;
    n++;
    ll f = 1;
    if (n % MOD < MOD / 2) {
        for (int i = 1; i <= n % MOD; ++i) {
            f = (f * i) % MOD;
        }
    } else {
        f = 1;
        for (int i = n % MOD + 1; i < MOD; ++i) {
            f = (f * i) % MOD;
        }
        dbg(f);
        f = (MOD - 1) * dbg(pw(f, MOD - 2)) % MOD;
    }
    if (n / MOD % 2 == 1) {
        f = (MOD - f) % MOD;
    }
    cout << n / MOD + n / (MOD * MOD) << " " << f << "\n";

    // int n;
    // cin >> n;
    // vector<int> a(n);
    // for (int i = 0; i < n; ++i) {
    //     cin >> a[i];
    // }

}

int main() {
#if LOCAL
    // freopen("../input.txt", "r", stdin);
```

```
    int q;
    cin >> q;
    while (q--) {
        solve();
    }
#else
    solve();
#endif
}
```

Task E ()

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

using namespace std;

using ll = long long;
#define all(o) (o).begin(), (o).end()
#if LOCAL
#define dbg(o) ({cout << #o << " = " << (o) << "\n"; (o); })
#else
#define dbg(o) (o)
#endif

template<typename T>
ostream &operator<<(ostream &o, vector<T> v) {
    for (T e: v) {
        o << e << " ";
    }
    return o;
}

template<typename T1, typename T2>
ostream &operator<<(ostream &o, pair<T1, T2> v) {
    o << v.first << " " << v.second << " ";
    return o;
}

const int MN = 1 << 20;
struct SegmentTree {
    struct Node {
        ll sum = 0;
        vector<int> push;
    };

    vector<Node> data;
    SegmentTree() : data(MN * 2) {}

    void inc(int d) {
        data[1].push.push_back(d);
    }

    void push(int v, int l, int r) {
        if (v < MN) {
            for (int d: data[v].push) {
                int k = (r - 1 + d) / d - (l - 1 + d) / d;
                if (k == 0) continue;
                data[v].sum += k;
                data[v * 2].push.emplace_back(d);
                data[v * 2 + 1].push.emplace_back(d);
            }
        } else {
            for (int d: data[v].push) {
                data[v].sum += l % d == 0;
            }
        }
        data[v].push.clear();
    }

    ll get(int l, int r, int tl = 0, int tr = MN, int v = 1) { // NOLINT(misc-no-recursion)
        if (r - l < 1) return 0;
        push(v, tl, tr);
        if (l == tl && r == tr) return data[v].sum;
        int m = (tl + tr) / 2;
        return get(l, min(r, m), tl, m, v * 2) + get(max(l, m), r, m, tr, v * 2 + 1);
    }
};

void solve() {
    int n;
    cin >> n;

    vector<int> a(n);
    for (int i = 0; i < n; ++i) {
```

```
        cin >> a[i];
    }

    int q; cin >> q;
    for (int i = 0; i < q; ++i) {
        int l, r, d; cin >> l >> r >> d;
        ll res = 0;
        for (int j = l; j < r; ++j) {
            res += (d + a[j] - 1) / a[j];
        }
        cout << res << "\n";
    }
}

int main() {
#if LOCAL
    freopen("../input.txt", "r", stdin);
    int q;
    cin >> q;
    while (q--) {
        solve();
    }
#else
    solve();
#endif
}
```

Task F ()

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

using namespace std;

using ll = long long;
#define all(o) (o).begin(), (o).end()
#if LOCAL
#define dbg(o) ({cout << #o << " = " << (o) << "\n"; (o); })
#else
#define dbg(o) (o)
#endif

template<typename T>
ostream &operator<<(ostream &o, vector<T> v) {
    for (T e: v) {
        o << e << " ";
    }
    return o;
}

template<typename T1, typename T2>
ostream &operator<<(ostream &o, pair<T1, T2> v) {
    o << v.first << " " << v.second << " ";
    return o;
}

void solve() {
    int n;
    cin >> n;

    vector<ll> l(n), r(n);
    for (int i = 0; i < n; ++i) cin >> l[i] >> r[i];

    vector<int> dp(n + 1, 1);
    for (int i = n - 1; i >= 0; --i) {
        ll tl = 0, tr = 0;
        for (int j = i; j < n; j++) {
            tl += l[j], tr += r[j];
            if (tl <= 0 && 0 <= tr) {
                dp[i] = max(dp[j + 1] + 1, dp[i]);
            }
        }
    }

    cout << *max_element(all(dp)) << '\n';
}

int main() {
#if LOCAL
    freopen("../input.txt", "r", stdin);
    int q;
    cin >> q;
    while (q--) {
        solve();
    }

#else
    solve();
#endif
}
```