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Utils (1)

```
headers
Description: Nagłówki używane w każdym kodzie. Działa na każdy kon-
tener i pary
Usage:      debug(a, b, c) << d << e; wypisze a, b, c:  a; b; c;
de
<bits/stdc++.h>                                cd38cb, 33 lines

using namespace std;
using LL = long long;
#define FOR(i, l, r) for(int i = (l); i <= (r); ++i)
#define REP(i, n) FOR(i, 0, (n) - 1)
template<class T> int size(T &&x) {
    return int(x.size());
}
template<class A, class B> ostream& operator<<(ostream &out,
    const pair<A, B> &p) {
    return out << '(' << p.first << ", " << p.second << ')';
}
template<class T> auto operator<<(ostream &out, T &&x) ->
    decltype(x.begin(), out) {
    out << '{';
    for(auto it = x.begin(); it != x.end(); ++it)
        out << *it << (it == prev(x.end()) ? " " : ", ");
    return out << '}';
}
void dump() {}
template<class T, class... Args> void dump(T &&x, Args... args)
{
    cerr << x << ";  ";
    dump(args...);
}
#ifdef DEBUG
    const int seed = 1;
    struct N1{~N1(){cerr << '\n';}};
    # define debug(x...) cerr << (#x != "" ? #x " ":  " : ""), dump(x
    ), N1(), cerr
#else
    const int seed = chrono::system_clock::now().time_since_epoch
        ().count();
    # define debug(...) 0 && cerr
#endif
mt19937_64 rng(seed);
int rd(int l, int r) {
    return uniform_int_distribution<int>(l, r) (rng);
}
```

```
headers/bazshrc.sh                                10 lines

c() {
    clang++ -O3 -std=c++11 -Wall -Wextra -Wshadow \
        -Wconversion -Wno-sign-conversion -Wfloat-equal \
        -D_GLIBCXX_DEBUG -fsanitize=address,undefined -ggdb3 \
        -DDEBUG $1.cpp -o $1
}

nc() {
    clang++ -O3 -std=c++11 -static $1.cpp -o $1 #-m32
}

headers/vimrc                                    3 lines

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filetype indent plugin on
syntax on

example-code
Description: jakiś tam opis, można walnąć latexa:  2 + 2 = 5.
           ęóąślźźćńĖŌĄŚLŹŹĆŃ
Time:  $\mathcal{O}(n\sqrt{n}\log^2 n)$ , gdzie  $n$  to jakaś fajna zmienna
Memory:  $\mathcal{O}(n\log n)$ 
Usage: int rd = getRandomValue(0, 5);
int rd01 = ExampleStruct().get();
           ęóąślźźćńĖŌĄŚLŹŹĆŃ                                bbd845, 24 lines

mt19937_64 rng(chrono::system_clock::now().time_since_epoch().
    count());

int getRandomValue(int l, int r) {
    return uniform_int_distribution<int>(l, r) (rng);
}

struct ExampleStruct {
    int random_variable;
    constexpr int left = 0, right = 1;

    ExampleStruct() {
        random_variable = getRandomValue(left, right);
        if(random_variable == 0) {
            // some random bulls**t to show the style
            ++random_variable;
        }
        else
            --random_variable;
    }

    int& get_value() {
        return random_variable;
    }
};
```

Math (2)

```
extended-gcd
Description: Dla danego (a, b) znajduje takie (gcd(a, b), x, y), że ax + by =
gcd(a, b)
Time:  $\mathcal{O}(\log(\max(a, b)))$ 
Usage: LL gcd, x, y; tie(gcd, x, y) = extendedGcd(a, b);
           402db5, 7 lines

tuple<LL, LL, LL> extendedGcd(LL a, LL b) {
    if(a == 0)
        return {b, 0, 1};
    LL x, y, nwd;
    tie(nwd, x, y) = extendedGcd(b % a, a);
    return {nwd, y - x * (b / a), x};
}
```

Data structures (3)

```
find-union
Description: mniejszy do wiekszego
Time:  $\mathcal{O}(\alpha(n))$                                 3a2363, 19 lines

struct FindUnion {
    vector<int> rep;
    bool sameSet(int a, int b) { return find(a) == find(b); }
    int size(int x) { return -rep[find(x)]; }
    int find(int x) {
        return rep[x] < 0 ? x : rep[x] = find(rep[x]);
    }
    bool join(int a, int b) {
        a = find(a), b = find(b);
        if(a == b)
            return false;
        if(-rep[a] < -rep[b])
            swap(a, b);
        rep[a] += rep[b];
        rep[b] = a;
        return true;
    }
    FindUnion(int n) : rep(n, -1) {}
};

lazy-segment-tree
Description: Michał popisz sie opisem
Usage: add(l, r, val) dodaje na przedziale
quert(l, r) bierze maxa z przedziału                                414b27, 57 lines

struct Node {
    int val, lazy;
    int size = 1;
};

struct Tree {
    vector<Node> nodes;
    int size = 1;

    Tree(int n) {
        while(size < n) size *= 2;
        nodes.resize(size * 2);
        for(int i = size - 1; i >= 1; i--)
            nodes[i].size = nodes[i * 2].size * 2;
    }

    void add_val(int v, int val) {
        nodes[v].val += val;
        nodes[v].lazy += val;
    }

    void propagate(int v) {
        REP(i, 2)
            add_val(v * 2 + i, nodes[v].lazy);
        nodes[v].lazy = 0;
    }

    int query(int l, int r, int v = 1) {
        if(l == 0 && r == nodes[v].size - 1)
            return nodes[v].val;
        propagate(v);
        int m = nodes[v].size / 2;
        if(r < m)
            return query(l, r, v * 2);
        else if(m <= l)
            return query(l, r, v * 2 + 1);
        else
            return max(query(l, r, v * 2), query(l, r, v * 2 + 1));
    }
};
```

```
        return query(l - m, r - m, v * 2 + 1);
    else
        return max(query(l, m - 1, v * 2), query(0, r - m, v * 2 + 1));
}

void add(int l, int r, int val, int v = 1) {
    if(l == 0 && r == nodes[v].size - 1) {
        add_val(v, val);
        return;
    }
    propagate(v);
    int m = nodes[v].size / 2;
    if(r < m)
        add(l, r, val, v * 2);
    else if(m <= l)
        add(l - m, r - m, val, v * 2 + 1);
    else
        add(l, m - 1, val, v * 2), add(0, r - m, val, v * 2 + 1);

    nodes[v].val = max(nodes[v * 2].val, nodes[v * 2 + 1].val);
}
};
```

segment-tree
Description: Michal popisz sie opisem
Usage: todo

541b9e, 29 lines

```
struct Tree {
    using T = int;
    T f(T a, T b) { return a + b; }
    vector<T> nodes;
    int size = 1;

    Tree(int n, T val = 0) {
        while(size < n) size *= 2;
        nodes.resize(size * 2, val);
    }

    void update(int pos, T val) {
        nodes[pos += size] = val;
        while(pos /= 2)
            nodes[pos] = f(nodes[pos * 2], nodes[pos * 2 + 1]);
    }

    T query(int l, int r) {
        l += size, r += size;
        T ret = (l != r ? f(nodes[l], nodes[r]) : nodes[l]);
        while(l + 1 < r) {
            if(l % 2 == 0)
                ret = f(ret, nodes[l + 1]);
            if(r % 2 == 1)
                ret = f(ret, nodes[r - 1]);
            l /= 2, r /= 2;
        }
    }
};
```

fenwick-tree
Description: indexowanie od 0
Usage: update(pos, val) dodaje val do elementu pos
query(pos) zwraca sumę pierwszych pos elementów
lower_bound(val) zwraca pos, że suma [0, pos] <= val

78e5fe, 26 lines

```
struct Fenwick {
    vector<LL> s;
    Fenwick(int n) : s(n) {}

    void update(int pos, LL val){
```

```
        for(; pos < size(s); pos |= pos + 1)
            s[pos] += val;
    }

    LL query(int pos) {
        LL ret = 0;
        for(; pos > 0; pos &= pos - 1)
            ret += s[pos - 1];
        return ret;
    }

    int lower_bound(LL val) {
        if(val <= 0) return -1;
        int pos = 0;
        for(int pw = 1 << 25; pw; pw /= 2) {
            if(pos + pw <= size(s) && s[pos + pw - 1] < sum)
                pos += pw, sum -= s[pos - 1];
        }
        return pos;
    }
};
```

ordered-set
Description: lepszy set. Jeśli chcemy multiset, to używamy par val, id.
Nie działa z -D.GLIBCXX_DEBUG
Usage: insert(x) dodaje element x
find_by_order(i) zwraca iterator do i-tego elementu
order_of_key(x) zwraca, ile jest mniejszych elementów,
x nie musi być w secie
<ext/pb_ds/assoc.container.hpp>, <ext/pb_ds/tree_policy.hpp>
using namespace __gnu_pbds;

0a779f, 9 lines

```
template<class T> using ordered_set = tree<
    T,
    null_type,
    less<T>,
    rb_tree_tag,
    tree_order_statistics_node_update
>;
```

lichao-tree
Description: Dla funkcji, których pary przecinaja sie co najwyżej raz, oblicza maximum w punkcie x. Podany kod jest dla funkcji liniowych

a7f04a, 50 lines

```
struct Function {
    int a, b;
    L operator()(int x) {
        return x * L(a) + b;
    }
    Function(int p = 0, int q = inf) : a(p), b(q) {}
};

ostream& operator<<(ostream &os, Function f) {
    return os << make_pair(f.a, f.b);
}

struct LiChaoTree {
    int size = 1;
    vector<Function> tree;

    LiChaoTree(int n) {
        while(size < n)
            size *= 2;
        tree.resize(size << 1);
    }

    L get_min(int x) {
        int v = x + size;
        L ans = inf;
```

```
        while(v) {
            ans = min(ans, tree[v](x));
            v >>= 1;
        }
        return ans;
    }

    void add_func(Function new_func, int v, int l, int r) {
        int m = (l + r) / 2;
        bool domin_l = tree[v](l) > new_func(l),
             domin_m = tree[v](m) > new_func(m);
        if(domin_m)
            swap(tree[v], new_func);

        if(l == r)
            return;
        else if(domin_l == domin_m)
            add_func(new_func, v << 1 | 1, m + 1, r);
        else
            add_func(new_func, v << 1, l, m);
    }

    void add_func(Function new_func) {
        add_func(new_func, 1, 0, size - 1);
    }
};
```

Graphs (4)

Geometry (5)

Strings (6)

Optimizations (7)

Random stuff (8)