Олимпиада СПбГУ
по информатике
2023/24 учебного года

24fin0388 – Радюк Адриан Андреевич

A	B	C	D	E	F	sum
100	100	40	100	20	89	449

Task A

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

using std::pair, std::vector, std::cin, std::cout, std::string;

using ll = long long;
using ld = long double;
using pi = pair<int, int>;
using pl = pair<ll, ll>;
using vi = vector<int>;
using vl = vector<ll>;
using vp = vector<pi>;
using vb = vector<char>;
int INF = 2e9;
ll llINF = 9e18;

ll count(int n, int a, int b) {
    if (n < 0) return 0;
    if (n == 0) return 1;
    vl v(n+1, 0);
    v[0] = 1;
    for (int i = 0; i <= n; i++) {
        if (i + a <= n)
            v[i+a] += v[i];
        if (i + b <= n && a != b)
            v[i+b] += v[i];
    }
    return v.back();
}
```

```
int main() {
    std::ios::sync_with_stdio(false); cin.tie(0);

    int a, b, n; cin >> a >> b >> n;
    ll ans = 0;
    ans += count(n, a, b);
    ans += count(n-a, a, b) * (a-1);
    ans += count(n-b, a, b) * (b-1);
    cout << ans;
}
```

Task B

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

using std::pair, std::vector, std::cin, std::cout, std::string;

using ll = long long;
using ld = long double;
using pi = pair<int, int>;
using pl = pair<ll, ll>;
using vi = vector<int>;
using vl = vector<ll>;
using vp = vector<pi>;
using vb = vector<char>;
int INF = 2e9;
ll llINF = 9e18;

struct dot {
    ll x, y, z;
    dot(ll x, ll y, ll z) : x(x), y(y), z(z) {}
    dot operator-(dot d) const {
        return {x - d.x, y - d.y, z - d.z};
    }
};
dot inp() {
    int a, b, c;
    cin >> a >> b >> c;
    return dot(a, b, c);
}

ll dist(dot d) {
    ll c = d.x;
    ll b = -d.y;
    if (c*b <= 0) return abs(c) + abs(b);
    return std::min(abs(c), abs(b)) + abs(c-b);
}

ll dist(dot d1, dot d2) {
    return dist(d2-d1);
}

int main() {
```

```
    std::ios::sync_with_stdio(false); cin.tie(0);

    ll n; cin >> n;
    dot d1 = inp(), d2 = inp();
    vector<dot> vd = {
            {n*2, -n, -n},
            {-n, n*2, -n},
            {-n, -n, n*2}};
    for (int i = 0; i < 3; i++)
        vd.push_back(dot(0, 0, 0) - vd[i]);
    vd.emplace_back(0, 0, 0);
    ll ans = llINF;
    for (auto d : vd) {
        ans = std::min(ans, dist(d1, d2 - d));
    }
    cout << ans;
}
```

Task C

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

using std::pair, std::vector, std::cin, std::cout, std::string;

using ll = long long;
using ld = long double;
using pi = pair<int, int>;
using pl = pair<ll, ll>;
using vi = vector<int>;
using vl = vector<ll>;
using vp = vector<pi>;
using vb = vector<char>;
int INF = 2e9;
ll llINF = 9e18;

int n;
const int N = 6;
char toch(int x) {
    return ' ' + x + 1;
}

string encode(string s) {
    string h;
    for (int i = 0; i < n; i += N) {
        int x = 0;
        for (int j = 0; j < N && i+j < n; j++) {
            x += (1 << j) * (s[i+j] - '0');
        }
//        cout << x << " ";
        h += toch(x);
    }
//    cout << "\n";
    return h;
```

```
}
string frch(int x) {
    string s;
    for (int i = 0; i < N; i++) {
        s += '0' + (x % 2);
        x /= 2;
    }
    return s;
}
string decode(string h) {
    string s;
    for (char c : h) {
        int x = c - ' ' - 1;
//        cout << x << " ";
        s += frch(x);
    }
//    cout << "\n";
    s.resize(n);
    return s;
}

void solve1() {
    string s; cin >> s;
    cout << encode(s) << std::endl;
}

void solve2() {
    string s1, h, s2;
    cin >> s1;
    cin.ignore();
    std::getline(cin, h);
    s2 = decode(h);
//    cout << "s2 = " << s2 << "\n";
    for (int j = 0; j < n; j++) {
        bool good = true;
        for (int i = 0; i < n; i++) {
            if (s1[i] != s2[(i+j)%n]) {
                good = false;
                break;
            }
        }
        if (good) {
            cout << "YES" << std::endl;
            return;
        }
    }
    cout << "NO" << std::endl;
}

int main() {
    std::ios::sync_with_stdio(false); cin.tie(0);

    string s; cin >> s >> n;
```

```
    if (s[0] == 'f') solve1();
    else solve2();
}
```

Task D

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

using std::pair, std::vector, std::cin, std::cout, std::string;

using ll = long long;
using ld = long double;
using pi = pair<int, int>;
using pl = pair<ll, ll>;
using vi = vector<int>;
using vl = vector<ll>;
using vp = vector<pi>;
using vb = vector<char>;
int INF = 2e9;
ll llINF = 9e18;

int n;
int delta = 0;

//vi v = {2, 5, 3, 4, 1};
//
//void print() {
//    for (int i = 0; i < n; i++)
//        cout << v[i] << " ";
//    cout << std::endl;
//}

int inp(int a, int b) {
    delta++;
    if (delta == n) delta = 0;

//    int x1 = v[0];
//    std::swap(v[a-1], v[b-1]);
//    v.push_back(v.front());
//    v.erase(v.begin());
//    int x2 = v[0];
//    if (x2 > x1) return 1;
//    if (x2 < x1) return -1;
//    return 0;

    cout << a << " " << b << std::endl;
    string s; cin >> s;
    char c = s[0];
    if (c == '!') exit(0);
    if (c == '<') return -1;
    if (c == '>') return 1;
    return 0;
}
```

```
void check() {
    int c = inp(1, 1);
    bool need = (c > 0) xor (delta == 0);
    if (need) inp(1, n);
//    print();
}

int main() {
//    std::ios::sync_with_stdio(false); cin.tie(0);

    cin >> n;
//    n = 5;
//    print();
    while (true) {
//    for (int i = 0; i < 100; i++) {
        check();
    }
}
```

Task E

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

using std::pair, std::vector, std::cin, std::cout, std::string;

using ll = long long;
using ld = long double;
using pi = pair<int, int>;
using pl = pair<ll, ll>;
using vi = vector<int>;
using vl = vector<ll>;
using vp = vector<pi>;
using vb = vector<char>;
int INF = 2e9;
ll llINF = 9e18;

int n;
vector<vi> g;
vi sz;

vi primes;
vector<vl> pgi;
void resheto() {
    int N = 2e5 + 5;
    vector<char> lp(N+1, 0);
    for (int i = 2; i <= N; ++i) {
        if (lp[i] == 0) {
            primes.emplace_back(i);
            if ((ll)i*i > N) continue;
            for (int j = i*i; j <= N; j += i)
                lp[j] = 1;
        }
```

```
    }
    primes.erase(primes.begin(), primes.begin()+10);

    pgi.resize(n*2);
    for (int i = 0; i < n*2; i++) {
        ll p = primes[i];
        ll pp = p*p*p*p;
        for (int j = 0; j < sz[i%n]; j++) {
            pgi[i].push_back(pp);
            pp *= p;
        }
    }
}

struct sss {
    int now = 0;
    pl hash = {0, 0};
    vi next;
    sss() {
        next.assign(n, 0);
    }
    void calcNext() {
        int nn = next[now];

        next[now] = (next[now] + 1) % sz[now];
        hash.first -= pgi[now][nn];
        hash.first += pgi[now][next[now]];
        hash.second -= pgi[now+n][nn];
        hash.second += pgi[now+n][next[now]];

        now = g[now][nn];
    }
};

int main() {
    std::ios::sync_with_stdio(false); cin.tie(0);

    int q;
    cin >> n >> q;
    g.assign(n, vi());
    for (int i = 0; i < n; i++) {
        int k; cin >> k;
        sz.push_back(k);
        for (int j = 0; j < k; j++) {
            int a; cin >> a; a--;
            g[i].push_back(a);
        }
    }
    vl qi(q);
    ll mx = 0;
    for (ll& i : qi) {
        cin >> i;
        mx = std::max(mx, i);
```

```
}
if (mx <= 100000) {
    vi next(n, 0);
    vi v;
    int now = 0;
    for (int i = 0; i < 1000100; i++) {
        v.push_back(now);
        int now1 = g[now][next[now] % g[now].size()];
        next[now]++;
        now = now1;
    }
    for (int i = 0; i < q; i++) {
        cout << v[qi[i]] + 1 << " ";
    }
    return 0;
}

resheto();
vi v;
sss fn;
vector<std::map<pl, char>> vm(n);
ll m1, m0;
pl hash0;
for (int i = 0;; i++) {
    v.push_back(fn.now+1);
    if (vm[fn.now].find(fn.hash) != vm[fn.now].end()) {
        hash0 = fn.hash;
        m1 = i;
        break;
    }
    vm[fn.now][fn.hash] = 1;
    fn.calcNext();
}
sss fn1;
for (int i = 0;; i++) {
    if (fn1.hash == hash0) {
        m0 = i;
        break;
    }
    fn1.calcNext();
}

auto count = [&](int t) {
    if (t < v.size()) {
        return v[t];
    } else {
        t -= m0+1;
        t %= m1 - m0;
        return v[m0+1 + t];
    }
};
for (int i = 0; i < q; i++) {
    cout << count(qi[i]) << " ";
```

```
    }
}
```

Task F

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

using std::pair, std::vector, std::cin, std::cout, std::string;

using ll = long long;
using ld = long double;
using pi = pair<int, int>;
using pl = pair<ll, ll>;
using vi = vector<int>;
using vl = vector<ll>;
using vp = vector<pi>;
using vb = vector<char>;
int INF = 2e9;
ll llINF = 9e18;

vector<vi> v;
int h, w;

int main() {
    std::ios::sync_with_stdio(false); cin.tie(0);

    cin >> h >> w;
    v.resize(h);
    for (vi &vv : v) {
        vv.resize(w);
        string s; cin >> s;
        for (int i = 0; i < w; i++)
            vv[i] = s[i] - '0';
    }

    vector<string> vs(h, string(w, '.'));
    int ans = 0;
    vector<pair<int, pair<pi, bool>>> ms;
    for (int yi = 0; yi < h; yi++) {
        for (int xi = 0; xi < w; xi++) {
            if (xi != w-1) {
                int c = v[yi][xi] * v[yi][xi+1];
                ms.emplace_back(c, pair(pair(xi, yi), true));
            }
            if (yi != h-1) {
                int c = v[yi][xi] * v[yi+1][xi];
                ms.emplace_back(c, pair(pair(xi, yi), false));
            }
        }
    }
    std::sort(ms.begin(), ms.end());
    std::reverse(ms.begin(), ms.end());
    for (auto[c, p] : ms) {
```

```
        auto[yx, b] = p;
        auto[x, y] = yx;
        int x1 = x, y1 = y;
        if (b) x1++; else y1++;

        if (vs[y][x] != '.' || vs[y1][x1] != '.') continue;
        ans += c;
        if (b) {
            vs[y][x] = 'L';
            vs[y][x+1] = 'R';
        } else {
            vs[y][x] = 'T';
            vs[y+1][x] = 'B';
        }
    }

    cout << ans << "\n";
    for (string &s : vs)
        cout << s << "\n";
}
```